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# Plato, the brain, and the soul: Further research into neural correlates for plato's tripartite soul

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# Plato, the Brain, and the Soul: Further Research into Neural Correlates for Plato's Tripartite Soul

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Abstract

This paper explores neuropsychological evidence for Plato's philosophical theory of the tripartite soul as explained in Plato's *Republic.* Plato contends that an express relationship of the three elements that make-up the soul (reason, appetitive, and spirit) interact to promote just behavior, and that just behavior is optimal for individual and societal well-being. Specifically, just behavior is considered to arise from reason's oversight of the other two elements. Apparent in this theory is the proximity Plato's analysis has with the current psychological understanding of cognitions that activate behaviors. Strack and Deutsch's (2004) 2-system model of reflective and impulsive processing, with the addition of Wiers and Stacy's (2006) supplementary moderators of emotion and motivation, display evidence that Plato's theory has footing in psychological theory.

# Plato, the Brain, and the Soul: Further Research into Neural Correlates for Plato's Tripartite Soul

Scientific inquiry has roots in philosophical and spiritual deliberation, as exemplified by the classical thinkers of 4th-century Greece. The soul, widely considered a component of human psychology, was often featured in the works of Greek philosophers (Turley, 2014). In contrast to other classical theories, Plato bridged celestial and psychological thought with structures of governance and society, and devised a theory based on micro and macro models of organization to promote human flourishing (Turley, 2014). Plato's *Republic* (trans. 2004) represents those models in both the polis (macro) and human soul (micro), specifically that virtue and justice stem from reason, and that tyranny derives from indulging in the seduction of appetites. Plato writes that morality is "practicing justice with wisdom every way we can" (*Republic X*, 621c5-6), thus laying out a theory of the tripartite soul, composed of reason, the appetitive, and spirit, all of which interact to form individual characteristics that drive behavior. Fast-forward to over 2,000 years later, scientists are still interested in understanding the underlying cognitions and brain functions that stimulate particular prosocial behaviors, though today they may be overlooking classical theories considered outside scientific investigation. Among a few who haven't, Ridder and Vanneste (2013) conceptualized associational neurobiological evidence for Plato's description of Beauty, a component of the Greek cosmic ternary along with Goodness and Truth. Ridder and Vanneste (2013) used philosophical analyses, or patterns of reason as their methodological approach to illustrate how cognitions widely associated with subjective experiences of beauty and attraction can be sourced back to basic reward neural circuitry in the brain, reflected in elemental stimulus/response behavior. The authors deduced that innate functions of human behavior may be evolutionarily responsible for our most progressive cognitions (notions of Beauty, Goodness, and Truth), those associated with Plato's tripartite soul

ruled by virtue. The premises of Ridder and Vanneste's (2013) argument are as follows: 1. Reward circuitry is activated when people look at attractive faces (sexual selection) 2. Reward circuitry is activated when people look at aesthetically pleasing art (higher cognition) 3. Because the reward system is activated when individuals look at attractive faces and subjectively pleasing art, higher cognitions, such as art appreciation, may reside within basic neural networks, suggesting a domain-general mechanism for perceptions that evoke attraction, such as Beauty, Goodness, and Truth. Ridder and Vanneste (2013) conclude that virtue, the highest aim of moral thought, and thus the endower of things that are beautiful, good, and truthful, may therefore have legitimacy in the scientific study of neurobiology and human behavior (Ridder & Vanneste, 2013). While these authors only infer an association between basic human drives as reflected in brain activation and more complex cognitions such as Beauty, Goodness, and Truth, experiences that Plato believes are *awakened* by a reasoned and virtuous soul (Turley, 2014), this paper attempts to exceed inference and establish Plato's theory of a tripartite soul within current psychological application. Beginning this line of exploration will aid in marrying scientific models of behavior and neurobiology with analyses of human character as explained by our most influential thinkers.

The tripartite soul is first laid out as a theory for an imagined civil society, Kallipolis. Plato explains that a civil system, ruled by Philosopher-Kings, brings about a just and virtuous nation (Plato, trans. 2004). Similar to this system, Man must also regulate and reason within himself to promote just and virtuous behavior (Plato, trans. 2004). Plato's (trans. 2004) analysis of a tripartite soul is a complex system of various desires that motivates individual behavior and consequently contributes to individual happiness and the overall well-being of society. Specifically, Plato (trans. 2004) argues for an express balance of the three elements, where

reason rules the appetitive and the spirit acts as auxiliary to reason, so as to promote virtuous behavior. At first glance, Plato's theory resembles Freud's psychoanalytic theory, mainly in that innate and unconscious desires, in the form of the id, need taming by higher order cognitions (the ego) that act according to social norms (the super ego). Specific differences between Freud and Plato's theories reside in the interactive relationship the three components have with each other. Whereas Freud saw the id, ego, and super ego as hierarchical, Plato argues that reason, the appetitive, and spirit are interactive and characteristic.

In order to formulate whether the tripartite soul has interactive neurobiological associations that can be applied to models of behavior, operationalizations for Plato's three elements must first be sought as a way of lending this hypothesis to scientific discussion. The procedure for operationalizing Plato's three elements will be conducted as an investigation and close analysis of the elements described in Plato's *Republic* (trans. 2004), followed by the application of these elements to theories bounded in psychological science. Due to this large task, this paper will focus primarily on Plato's element, reason, and its application to just behavior. As mentioned, Plato theorized that reason, as the charioteer that oversees both spirit and appetites, determines virtue in individual conduct (Plato, trans. 2004). If the stated hypothesis has support through this investigation, corresponding scientific models and interactions among the operationalized terms to Plato's tripartite soul should be revealed. In conclusion, further suggestions for the continuation of this research hypothesis will be discussed, along with the limitations in the current investigation.

## Operationalizations of Plato's Tripartite Theory

### Appetitive

Plato (trans. 2004) describes the appetitive as multiform, consisting of necessary,

unnecessary, and lawless appetites. This description can be illustrated as a needs-to-wants spectrum, where dangerous impulses, to the extent of psychopathology, lay on the far side of lawless appetites, while basic needs lay on the necessary side. Basic needs, hard-wired to trigger the reward system in the brain when satisfied, have the ability to foster impulsive behavior driven primarily by hedonic arousal stored within long-term memory (Strack & Deutsch, 2004). This is supported in the *Republic* by Plato's (trans. 2004) observational evidence of 4th century Greek society, where he describes gradual increases of impulsive behavior by the citizenry as a product of their rewarding experiences.

To illustrate the complex and multiform composition of the appetitive as developed by Plato (trans. 2004), he states, "…we call it the appetitive element because of the intensity of its appetites for food, drink, sex, and all the things that go along with them" (*Republic IX*, 580e1-2). Consequentially, when an individual is guided predominantly by unregulated appetites, the soul begins to lose virtue (Plato, trans. 2004). Herman, Critchley, and Duka (2018) define impulsivity similarly: "a set of behaviors characterized by relative dominance of spontaneity over consideration." The authors contend that the intense gratification from immediate rewards often sways individuals to act impulsively rather than reflectively and with due evaluation (Herman et al., 2018). Moreover, Reynolds, Basso, Miller, Whiteside, and Combs (2019) suggest that impulsivity is an over-responsiveness to rewarding stimuli, indicating that people who display greater impulsivity are perhaps also more pervious to their surroundings and outside influences, enacting behavior that can result in negative outcomes. This is displayed in findings where impulsivity measures predicted individual risk-taking behavior, a trait closely associated with sensation seeking, and related to substance abuse, violence, and risky sexual encounters (Derefinko, Peters, Eisenlohr-Moul, Walsh, Adams, & Lynam, 2014). The negative outcomes

associated with risk-taking have the possibility of extending adverse repercussions beyond the acting individual (Derefinko et al., 2014) and into society, displaying how Plato's theory functions on a micro/macro scale. Due to the associational process that impulsive behavior has with Plato's notion of the appetitive, namely behaviors driven by instant gratification that can induce damage on individuals and society alike, the appetitive will be broadly operationalized as impulsive processing.

Strack and Deutsch (2004) conceived a dual-systems model for social behavior as a tandem function of reflective and impulsive processing. Impulsive behavior, defined by Strack and Deutsch (2004), is the process of indulging in basic needs beyond utility and hastening gratification. It works by creating associative bonds with hedonic experiences to motivate behavior. In other words, positive and negative judgements about experiences become habituated in behavior, thus leading to stronger neural associations between stimuli and their emotional responses. In support of this theory, Hofmann, Friese, and Wiers (2008) describe how "positive hedonic values" are attributed to a stimulus bolstering a "corresponding behavioral schema" to approach that stimulus, thus creating an automatic processing system. To balance, and perhaps regulate impulsive processing, the 2-systems model (Strack & Deutsch, 2004) also contains a reflective process, which follows a different operating pattern: "the two systems interact at various stages of processing, [where] outputs may determine behavior in a synergistic or antagonistic fashion" (p. 220). Likewise, Plato concisely states that there exist "two elements different from one another" (*Republic IV*, 439d4), namely the appetitive and reason.

**Reason**

Strack and Deutsch's (2004) 2-systems model explains the interaction between impulsive and reflective processing, and is employed in this paper as a systematic representation of Plato's

appetitive and reason. Plato (trans. 2004) contends that whereas the appetitive works quickly, based on an impulsive reaction to some desire, reason arises "from rational calculation" (*Republic IV*, 439c10). There are three characteristics of this interaction that should be considered for analysis: (a) reason functions in opposition to the appetitive, (b) in a virtuous individual, reason regulates the appetitive, and (c) behavior is contingent upon the employment of either one process or the other (Plato, trans. 2004). Consistent with this line of thought, reflective and impulsive processing in Strack and Deutsch's (2004) 2-systems model function differently, employing different neurological mechanisms, however tapping into the same associative networks stored in long-term memory. Whereas impulsive processing is an automatic response to an associative network strengthened by habituation or experience, reflective processing involves restraint, and a slower calculating mechanism that weighs long-term goals (Strack & Deutsch, 2004). Specifically, Strack and Deutsch (2004) propose that impulsive and reflective processes function laterally, and in essence, compete for control of behavioral action, reflecting Plato's (trans. 2004) notion that behavior is linked to either appetitive drives *or* reasoned cognition.

Strack and Deutsch (2004) further contend that a "mechanism of intending" in the 2-systems model helps to explain environmental factors that weight the dual processes of impulse and reflection that are used in social behavior. Perhaps better explained by Paternoster and Pogarsky (2009), they suggest that, "there is likely to be variation across persons (as well as over time and across situations) in how carefully, thoroughly, or thoughtfully choices and decisions are made" (p. 104). The Theory of Planned Behavior (Ajzen & Fishbein, 1980, as cited in Ajzen, 2012) also states that "beliefs" affect intention for individual behavior, mainly behavioral beliefs (those composed of subjective attitudes toward the behavior), normative beliefs (those composed

of social attitudes towards the behavior), and perceived behavioral control (or subjective mastery). Laying outside the individual's cognition is actual control, or whether or not various factors allow for the intended behavior (Ajzen, 2012). Taken collectively, no single tract for acting in accord with reason seems to exist, suggesting that reason has a broad application dependent on individual experiences, contexts, and cultures. What seems to be unanimous is that reflective decision-making utilizes careful deliberation and examination for weighing the consistency of various options with an individual's goals (Paternoster & Pogarsky, 2009). This process may grant individuals greater agency by allowing them to act according to their preferences, assuming that in healthy populations preferences are prosocial. Prosocial behavior, as an outcome of reflective processing, also supports Plato's (trans. 2004) belief that virtue proceeds from the rule of reason, given the same assumption. In sum, reflective decision-making not only follows Plato's description of reason by its definitional characteristic of slow and deliberate thinking, but interacts appropriately with the appetitive when it becomes overridden by impulsive tendencies.

As with any behavioral model, moderators and mediators influence behavior based on individual and environmental factors. In a study applying Strack and Deutsch's (2004) 2-systems model within the framework of addiction, emotion and motivation were found to moderate the strength of automaticity that generates impulsive behavior (Wiers & Stacy, 2006). In the next section, emotion and motivation, within the 2-systems model, will be examined as the third element for the tripartite soul: spirit.

**Spirit**

"One element, we say, is that with which a person learns; another, that with which he feels anger" (Plato, trans. 2004, *Republic IX*, 580d11-12). Anger is the primary emotion that

drives the spirited element within the tripartite soul theory (Plato, trans. 2004). The aim is "mastery, victory, and high repute" (Plato, trans. 2004, *Republic IX*, 581a10). This element, when left unregulated to rule the soul, becomes ruthless and barbarous, however when it is paired with reason, the ability to reflectively make decisions, the spirited element is tamed and becomes conducive to acting on one's reasons. (Plato, trans. 2004).

In the 2-systems model (Strack & Deutsch, 2004), expanded on by Wiers and Stacy (2006), negative affect and motivations, that inhibit or change a behavior, moderate impulsive responses to stimuli. For example, if acting on a desire produces a negative experience, adverse emotions will likely become tagged to that experience, motivating an individual to inhibit or change that behavior in the future. Apropos, Plato writes, "when appetite forces someone contrary to his rational calculation, he reproaches himself and feels anger at the thing in him that is doing the forcing" (Plato, trans. 2004, *Republic IV*, 440a8-b2).

Research on anger maintains that individuals act and feel according to their environments, or what they perceive is an appropriate response to "socially defined rules for [a] particular circumstance" (Berkowitz, 1989, p. 6). Restraint is an attempt to conform to the accepted norms of a given society, and attributes aid in informing an individual as to whether or not certain situations comply with those social norms (Berkowitz, 1989). In this regard, hostile or aggressive reactions, that are not warranted by a certain situation, promote chaos and discord with social expectations (Anderson & Dunning, 2014). During social conflicts, Wyckoff (2016) contends that anger arises as a reaction to personal devaluation. In these situations, the conduct of one acting individual is not compatible with another individual's perceived level of regard; there is a discord between action and expectation. When the affront and level of regard are at a greater disproportion, anger leads to aggression (Wyckoff, 2016). These interactions can result in

a hierarchical recalibration of social orders in groups depending on the cost inflicted on, or the benefit withheld from the offending party (Wyckoff, 2016). Future interactions based on anger are then either reinforced or restrained due to a strengthened connection between experience and behavior during reflective processing (Wiers & Stacy, 2006). As mentioned above, reflective decision-making employs processes that weigh options for the consistency of preferred goals, with the emotion of anger facilitating whether or not those goals will be met in the future. Thus, adverse emotions, specifically anger, and their consequential behavioral responses likely motivate individuals to utilize reflection (Fig 1). Consistent with Plato's (trans. 2004) theory, both anger and motivation have the ability to moderate impulsive processes and supplement reflective ones.

**Virtuous Behavior**

"Cosmic piety" is the notion that individuals are responsible for contributing to a divine nature, a widely accepted conviction throughout the Greco-Roman age (Turley, 2014). According to Turley (2014), Plato's tripartite theory contends that an optimal interaction of the three elements, with reason as overseer, promotes virtuous behavior within this divine nature. Virtue, as defined by Plato (trans. 2004), is composed of wisdom, courage, temperance, and justice, and is considered Good when it is replete with these assets. In line with Plato's view, Helwig and Turiel (2002) state that moral judgements develop as individuals acquire knowledge about rights, justice, and welfare through social interactions. This process begins early in life, with studies revealing that young children distinguish between moral wrongdoings and established cultural codes, suggesting that domains of morality reside within social learning and are not solely a product of a particular culture's established rules and authority (Helwig & Turiel, 2002). Consequentially, individuals enact behaviors based on the moral judgements they form, a

process exemplified in activism; “people’s judgements influence how they approach situations calling for actions, and … actions, in turn, influence the development of their judgements” (Helwig & Turiel, 2002, p. 481). Once again, the process of building moral judgements requires experience so that an individual can better align their behavior with desired consequences. This relationship connotes a course of reflection, where behavior is based on the prediction of possible outcomes, and contextual information of the environment helps individuals gauge whether or not the outcomes will be beneficial or harmful (Paternoster & Pogarsky, 2009). Slightly different from reflective decision-making, Helwig and Turiel (2002) contend that building moral judgements through moral reasoning requires an even greater cognition in weighing outcomes in order for behaviors to be consistent with the preferences of the acting individual and society (Turiel, 2017). Thus, as Plato argues that a reasoned soul promotes virtue (Plato, trans. 2004), so too does reflective decision-making promote moral decisions. Therefore, virtuous behavior is operationalized as moral reasoning, the ability to conceptualize about what is harmful, fair, and right within a society (Hedwig & Turiel, 2002). This last point is key in truly placing moral reasoning within Plato’s conception of a Just civilization on account that moral reasoning reflects an individual’s role in participating in the larger society, and that moral judgements aid in the construction for these societies to be Just and Good (Turiel, 2017). Turiel (2017), in short, proposes that through processes of deliberation and reflection, one maintains a sense of justice:

> It is the power of reason that allows us to consider our obligation and ideals as well as our interests and advantages. To deny this freedom of thought would amount to severe constraint on the reach of rationality (Sen, 1999 p. 23 as cited in

Turiel, 2017).

In conclusion, reflective processes (specifically in the form of reflective decision-making), and broadly impulsive processing, and emotion/motivation, interact to promote individual moral reasoning. These terms are proposed as operationalizations for Plato's tripartite elements: reason, the appetitive, and spirit, respectively, all of which interact to form a virtuous soul.

## Reason as Reflective Decision-Making: Explained and Expanded

The purpose of this section is to extract scientific meaning from Plato's philosophical analysis of reason, and compare that to the process of reflective decision-making. The scientific study of decision-making has actuated a variety of behavioral and neurological models. Distinguishing among these, while uncovering consistencies, will contribute to a more thorough investigation of reason, operationalized as reflective decision-making, and its overall role in moral reasoning.

### Models for Behavioral Control in Decision-Making

According to evolutionary theory**,** humans have relied on mechanisms in the brain to evaluate the environment (e.g., finding ideal locations for food, mate selection, risk assessment) and provide information for reproduction and survival. O'Doherty, Cockburn, and Pauli (2017) distinguish between two broad systems for these behaviors: stimulus-driven control and goal-directed control, a dual system similar to Strack and Deutsch's (2004) 2-systems model for social behavior. Specifically, O'Doherty et al. (2017) propose that both models are interdependent, and rely on reinforcement learning mechanisms either to facilitate quick responses to stimuli or reasoned calculations derived from the evaluation of a given environment. The two control systems are also believed to act as auxiliaries to one another: primal mechanisms in the stimulus-

driven control model help construct more complex control functions through experience, and the goal-directed model facilitates in the flexibility of choice outcomes and efficiency of their retrieval for stimulus-driven responses (O'Doherty et al., 2017). O'Doherty et al. (2017) hypothesize that the evolutionary function of an interactive impulsive-driven model, co-existing with a later developed goal-directed model, is a consequence of complex social structures in human development, suggesting that cognitive control is necessary in human social contexts. Decision-making is one such cognitive process that uses reflection and prospection to guide behavior in the direction of an agent's desired goals (Paternoster & Pogarsky, 2009). Decisions can be impulsive and swift (e.g., the fight-or-flight response), however they can also be deliberative, where multiple factors are weighed given their differing contexts. O'Doherty et al. (2017) suggest that both systems are necessary and that their employment is dependent on context and situation, implying that decision-making, whether impulsively or reflectively, is a domain-general process. Just like Plato contends that the three components in the soul share governance given contexts and situations, this model of stimulus-driven control and goal-directed control displays the evolutionary benefit of how impulses can promote behavioral control through learning. Current research using brain-imaging to measure activation during decision-making tasks is providing clearer answers for why impulsive processes in decision-making are beneficial for the acquisition of a more reflective processing system (O'Doherty et al., 2017). Findings suggest that a dual-systems model for behavioral control, where primal reflexes set the foundation for controlled learning, and advanced learning aids in expedited stimulus-driven responses, is reflected in similar interactions in the human brain (O'Doherty et al., 2017). As social systems have evolved into complex structures, based on social-norms and laws, the brain has evolved as well, making use of executive functions that can host and store an

array of information, augmenting impulsive drives.

## Neural Mechanisms for Reflective Decision-Making

### Decision-Making and Neuroeconomics

One line of interdisciplinary study in decision-making is in the field of neuroeconomics and game theory that examines decision-making processes particularly in social contexts. Social decision-making involves competency in social exchange, where decisions are made in concert with the choices of others (Sanfey, 2007). One important social component is to track the intentions of others, or "intention-detection" (Sanfey, 2007), where inferences relating to the behaviors of others can aid in promoting the goals of the deciding agent. Other components involve the operations of appraisal and emotional processing, where reward outcomes are measured and assessed. In the next section, these networks: (a) the reward circuitry, (b) theory of mind, and (c) emotional processing will be investigated to uncover specific and interactive neural mechanisms responsible for reflective decision-making in social contexts.

In decision-making, the brain uses a central reward system that weighs possible, alternative gains with the cost of their varying actions (Sanfey, 2007). A reward prediction error, created by the phasic firing of dopamine neurons in the brain, helps encode these predictions, and is a fundamental process for reinforcement learning (O'Doherty et al., 2017). Specifically, thick waves of dopamine, emitted from the striatum, activate according to perceived positive gains in social exchange (Sanfey, 2007), generating a mechanism that can be updated according to whether perceptions match actual results. Aversive experiences have also been linked to activity in the ventral striatum (Tom, Fox, Trepel, & Poldrack, 2007, as cited in Ramsøy & Skov, 2010), indicating that the ventral striatum plays a role in approach/avoidance behavior, or whether outcomes are desirable or aversive (O'Doherty et al., 2017). In fact, Kirk, Skov, Hulme,

Christensen, and Zeki (2009) distinguish between expectant and actual rewards, implicating the ventral striatum primarily in reward expectancy. These authors propose that a stimulus's contextual information, specifically within aesthetic evaluation, is registered primarily in the striatum, contributing to its role in the *expectation* of positive rewards, a finding directly in-line with Ridder and Vanneste's (2013) hypothesis stating that advanced cognitions register in basic, domain-general networks. This research demonstrates the importance of contextual information for the process of decision-making, highlighting that reflective decisions are swayed by the environments in which we live. Furthermore, Van Den Bos, Rodriguez, Schweitzer, and McClure (2014) state that the strength of amygdala and ventral striatum connectivity is associated with individual differences in impulse behavior, mainly that stronger connectivity between these sites increases behavioral motivation for quick rewards. Conversely, weaker connectivity between these sites is associated with cognitive control in the face of cravings or appetitive cues in healthy populations (Van Den Bos et al., 2014; see Neural Processes for Weighing Values in Decision-Making).

Activation in the striatum has also been seen in studies looking at rewards such as social status and altruism. Plato conveys the importance of social status in his conceptualized Kallipolis, expressing how behaviors can be swayed by an individual's goal of glory and high repute (Plato, trans. 2004). Kishida and Montague (2012) explain that the nucleus accumbens, a component of the ventral striatum, responds to perceived changes in social status within small group settings. The striatum is involved in tracking reciprocity in social exchange, where high activation in the striatum is correlated with higher perceived partner reciprocity, and less activation is correlated with lower perceived partner reciprocity (Sanfey, 2007). Studies have shown that signals in the striatum, guided by reciprocity, can also shift in time, so that

predictions about the intentions of a social partner happen sooner (Sanfey, 2007). In other words, consequential experiences in social contexts aids in the facilitation of faster and better outcomes. Thus, reinforcement learning, guided by reward processing, a system highly dependent on the striatum, is flexible in its ability to adapt to varying social contexts and situations, allowing the acquisition of information to guide behavior.

Tied into reward is the notion that positive emotions lead to approach behavior, involving similar neural processes in the midbrain and frontal lobe (Ramsøy & Skov, 2010). Zaki and Mitchell (2011) demonstrate that activation in the anterior insula (AI), an area associated with perceived emotion (Craig, 2009) extends prosocial behavior beyond reward incentives, and may also be a consequence of emotionally laden reactions. Specifically, they established a clear relationship between AI activity and inequity, and suggested that in certain situations, inequity is not only aversive to those on the receiving end, but to those on the distributing end as well (Zaki & Mitchell, 2011). Sanfey (2007) suggests that the association between aversive experiences and inequity can lead to distrust in social interactions, highlighting the importance experience has on an individual's decision-making in social contexts. A positive association between levels of serotonin and aversive emotional processing was found to negatively impact decision-making (Ramsøy & Skov, 2010), a finding reflected in a clinical population with major depression disorder, where features include disruptions in social behavior and decision-making (Alarcón & Forbes, 2017). Thus, emotional responses to environmental cues, as reflected in particular activation sites in the brain, provide information about the particular aspects of social contexts that promote or inhibit optimal decision-making.

These findings provide insight into the neural mechanisms that generally underlie hedonism and anhedonism, but offer little understanding as to what emotions would guide

someone to act in opposition to some subjective pleasures for others. Concerning Plato's theory, we are interested in what drives an individual to override instant or personal rewards, and behave for the benefit of others, a psychological concept in the realm of eudaimonic well-being, the idea that pleasure is derived from aspects like "life-meaning, authenticity, and purposefulness" (Di Fabio & Palazzeschi, 2015). In an interesting fMRI study, researchers were able to link generous behavior with subjective happiness as a functional neural process involving the orbito-frontal cortex (OFC), the temporal parietal junction (TPJ), and the ventral striatum (Park, Kahnt, Dogan, Strang, Fehr, & Tobler, 2017). Specifically, TPJ activity was associated with generous behavior (charity pledging), while the OFC computed the value of different options, including reward options for others, and the ventral striatum was involved in the subjective happiness that corresponded with generous behavior (Park et al., 2017). As mentioned above, activation of the ventral striatum is linked to situational factors, and further findings highlight the ventral striatum's role as an important activation cite for weighing options involving the self and others, suggesting that generous behavior is rewarding in itself.

Social exchange, and the decisions that guide an individual's behavior in social contexts, are contingent upon cognitions that require social processing, also known as Theory of Mind (ToM), or the process of interpreting the intentions of others. ToM mechanisms are closely intertwined with reward and emotional processing, in that the behaviors mentioned above (e.g. generosity) also involve understanding social partners. The medial prefrontal cortex (mPFC) was found to activate during person-impression formation in a study that discriminated between social and object cognition (Mitchell, Neil Macrae, & Banaji, 2005). In fact, the mPFC and anterior cingulate cortex are primarily involved in ToM, and are activated in a variety of social exercises including strategy tasks (Sanfey, 2007). Filkowski, Cochran, and Haas (2016) found

that this area activated during reputation processing and altruistic behavior, perhaps linking ToM with altruistic motives, and tying in how social partners develop perceptions based on each other's behavior. Again, these findings broadly suggest that perceptions of the self are an important component for acting pro-socially. Whereas altruistic behavior has been related to theories of rational self-interest, new reports are finding that intrinsic value, associated with both reward and emotional neural processes, actually guides prosocial behavior (Zaki & Mitchell, 2011). In other words, these three systems, where reward, emotion, and empathic censoring interact, modify and guide social decision-making, all-in-all displaying the importance of deliberation in social exchanges of reflective processing.

The neural underpinnings of altruistic behavior are worth investigating a little further, on the grounds that Plato's theory of reason involves the notion that a reason-ruling individual will behave according to what's best for society and not just personal gain. Plato's philosophy is embedded in religious and political context, where the soul's composition determines whether or not an individual comes in contact with "cosmic piety," or the True, the Good, and the Beautiful (Turley, 2014). Behavior that serves the polis (also inhabited by the Gods), was considered by Plato to be the socially desired behavior that would lead an individual towards those virtues mentioned above.

The interesting aspect about altruism that psychologists and biologists seek to understand, is the evolutionarily disadvantageous position altruistic behavior engenders. In other words, why would an individual act to promote the survival of another and not their own? Filkowski et al. (2016) suggest that ToM aids in increasing an individual's motivation to act altruistically, due to the involvement of interpersonal perceptional awareness. These authors explain that the rewards themselves in acts of altruism, primarily induce these behaviors, revealing the salience that

positive feelings have on social decision-making (Filkowski et al., 2016), and according to Plato, how reflective processes can lead to individual and societal happiness. As Park et al. (2017) were able to demonstrate, generous behavior promotes happiness, thereby linking the neural mechanisms involved in reward processing, ToM, and emotional states. Apropos, Plato contends:

> Practicing justice with wisdom every way we can, so that we will be friends to ourselves and to the gods, both while we remain here on Earth and when we receive the rewards of justice, and go around like victors in the games collecting prizes; and so both in this life and on the thousand-year journey we have described, we will fare well (*Republic X*, 621c5-9).

**Neural Processes for Weighing Values in Decision-Making**

Reflective decision-making involves various obscure and overt cognitive processes including reward appraisal, emotional awareness, and an understanding of the environment around us, such as the thoughts and intentions of others. Whereas social decision-making implies an interactive exchange in behavior among individuals, reflective processes for making decisions sometimes takes place without the social component. In every-day situations, individuals must decide what to eat, given the multitudinous choices, both healthy and unhealthy. They must also decide how to dress, how to spend money, and larger life goals such as what career to choose. Weighted on these choices are the values that individuals place given their biological compositions and environmental experiences. To that point, Plato doesn't limit his analysis of reason by categorizing it purely as a social or personal construct, rather, he demonstrates that it is engaged in a variety of situations in order to promote virtuous behavior. Given Plato's philosophical understanding of reasoned behavior, we can assume that reflective decision-

making would motivate an individual to make reasoned choices based on the principled values of various options. Similar to reward processing, in value based decision-making individuals engage in mental calculations that appraise payoffs in various options, however whereas reward processes are more concerned with the hedonic profit in outcome, valuation provides insight into mechanisms that can override hedonic rewards based on individual attitudes and goals.

Domenech, Redouté, Koechlin, and Dreher (2018) break down value based decision-making into a two-stage process. In the first stage, values are placed on available options in decision-making, and in the second stage, the best option is selected. A study that used an algorithmic model, named the Drift-Diffusion Model, for categorizing "continuous subjective value signals" in value based decision-making, determined that a network of spatially separated areas, carrying out specialized functions, was responsible for value based decisions (Domenech et al., 2018). Results from the study showed that the ventromedial prefrontal cortex (vmPFC) was associated with the valuation of options, the dorsolateral prefrontal cortex (dlPFC) integrated that information by encoding signals during selection, and the posterior parietal cortex (PPC) yielded an outcome, all-of-which comprise the prefrontal-parietal network (PPN; Domenech et al., 2018).

The PPN has been implicated as a broad mechanism for consciousness, as well as cognitive functions including attention, working memory, and chunking, or grouping smaller pieces of information into larger wholes (Bor & Seth, 2012). Furthermore, the PPN's role in consciousness has been linked to a cognitive theory: Bernard Baar's "Global Workspace Theory" (as cited in Bor & Seth, 2012), which posits that (a) local unconscious operations compete for a functional area in the brain where (b) these operations become broadly available to other neural processing networks. Similar to the notion of a functional *stage* for conscious deliberation,

Koechlin and Hyafil (2007) demonstrated that certain neural structures perform domain-general functions for selecting attentional content in a process called, “cognitive branching,” the process of weighing two similarly rewarding, or penalizing, alternatives, where abandoning a single option without due deliberation would elevate an individual’s decision-making risk. Koechlin and Hyafil (2007) specifically name the frontal polar cortex (FPC), in Broadmann’s area 10, as a critical structure for this sustained attention of deliberation when distractions wait in a pending state. The FPC works in concordance with the anterior lateral prefrontal region for activating tasks that guide current behavior, while medial/orbital prefrontal regions code for reward payoffs in pending states (Koechlin & Hyafil, 2007). Interestingly, the FPC cannot exceed the execution of one task at any given time (Koechlin & Hyafil, 2007), suggesting that valuation requires a precise choreography of neural processes located specifically in this most anterior region of the brain. Current research supports this hypothesis, namely that the PPN works as a “behavioral selection hub,” consisting of specific neural structures that integrate and then read out decision value signals (Domenech et al., 2018).

The question thus remains as to what processes exist for overriding certain impulsive tendencies in reflective decision-making. We can assume that weighing options based on an appetitive reward with those that perhaps expend larger rewards later, or adhere to social norms, would be a difficult, conflict-laden decision. Strategic control allows individuals to “simplify complex decision problems, evaluate outcomes against a variety of contexts, and flexibly match behavior to changes in the environment” (Venkatraman & Huettel, 2012, p.1075). Decision-making that involves cognitive control is thought to develop in a linear fashion after the reward system is established in early adolescence (Van Den Bos et al., 2014), supporting the evolutionary notion, as presented by Ridder and Vanneste (2013) in the introduction, that

behaviors incited by reward precede those incited by more reflective processes.

One form of complex decision-making that involves cognitive control concerns weighing immediate with later rewards. Temporal discounting (TD) in decision-making refers to a decrease in the subjective value of a reward when the delay of the reward increases in value (Scheres, Water, & Mies, 2013). Though TD is often used in studies with populations that exhibit impulse control deficiencies, researchers believe that TD may be more appropriately assigned as a personality trait because of its variability within individuals, across contexts, and its domain dependence (Scheres et al., 2013). In fact, Van Den Bos et al. (2014) site Broadmann's area 9 as a specific striatal tract that accounts for individual differences in TD. These authors suggest that increased input from the amygdala, a neural structure associated with impulsivity (Hofmann et al., 2008), to the ventral striatum increases the incentives of impulsive outcomes, thus generating greater TD (Van Den Bos et al., 2014).

Individuals also employ strategies to simplify conflict-laden decision-making (Venkatraman & Huettel, 2012). The larger dorsomedial prefrontal cortex (dmPFC) region was found to serve a three-system process for cognitive control in strategic decision-making (selection, optimization, and hierarchy), leading to more reasoned choices that can possibly override appetitive desires by regulating the automatic activation of the emotional system (Venkatraman & Huettel, 2012). Three separate areas in the dmPFC activate according to decision complexity in a respective posterior-to-anterior stratified fashion, indicating that neural structures respond separately, and hierarchically, depending on motivational demands (Venkatraman & Huettel, 2012). Hare, Hakimi, and Erangel (2014) note that interactions between the dlPFC and vmPFC are critical in self-control, specifically when abstract rewards are being valued. When connectivity between the dlPFC and vmPFC is not effective, values are

assigned to options that are inconsistent with an individual's preferred goals (Hare et al., 2014). This reflects the notion that prospection of future outcomes and control in present contexts interact to guide individual value-based behavior. Hill, Yi, Spreng, and Diana (2017) hypothesize that the default network, a system important in prospection, and frontal parietal regions responsible for evaluation, cooperate in foreseeing anticipated outcomes, suggesting that valuation of choices involves the integration of control and prospection, along with reward processes, that can override instant appetitive desires for greater objectives.

Like TD, social discounting (SD) refers to altruistic behavior that prioritizes a beneficial outcome for someone else over a beneficial outcome for the self (Hill et al., 2017). Similar to ToM, SD involves weighing options for the self and someone else, however unlike ToM, SD is less concerned with detecting the intentions of others, and more concerned with balancing interpersonal options and values. Findings in behavioral research indicate that individuals will more often act altruistically when a delay is added to both the outcome for the self and another (Yi, Charlton, Porter, Carter, & Bickel, 2011), suggesting that instant gratification can inhibit altruistic behavior. Hill et al. (2017) reveal that both TD (intertemporal self-control) and SD (interpersonal self-control) operate using related neural circuitry, mainly the frontal parietal, default, and mesolimbic (reward) networks.

Other studies have posited that difficult decision-making, like valuation and cognitive control, requires the assistance of neural structures related to memory (Jimura, Chushak, Westbrook, & Braver, 2018). In fact, the behavioral models that are being used for this study (Strack & Deutsch, 2004; Wiers & Stacy, 2006; O'Doherty et al., 2017) suggest just that, mainly that memory aids in the process of reflecting on past experiences to help guide prosocial behavior. In the next section, various forms of memory will be closely examined as they relate to

reflective decision-making.

**Memory and Reflective Decision-Making**

Reinforcement learning requires the ability to remember associations and reflect back on them, and the overt engagement to take action, thus linking memory and decision-making in the process of gaining knowledge. Plato emphasizes the importance of experience in the acquisition of wisdom. He differentiates between a maker of a piece of furniture and a user of a piece of furniture, stating that the maker has an opinion, and perhaps information on the piece through the user, but it is only the user who has direct knowledge of how the piece functions and feels (Plato, trans. 2004). In other words, the experience of a thing provides direct knowledge of that thing, and thus allows one to make rational decisions based on that thing, all-of-which requiring that an individual be able to record experiences and recall those experiences through certain mechanisms in the brain. Memory has not only been touched upon in terms of reinforcement learning (see section on Appetitive), but also in the 2-systems model, displaying how impulsive and reflective processes tap into the same memory systems where associations are made stronger through experience (Strack & Deutsch, 2004).

In behavior research, Del Missier, Mäntylä, Hansson, Bruine de Bruin, Parker, and Nilsson (2013) found positive associations between working memory and cognitively demanding tasks, namely resistance to framing (context-laden information), applying decision rules, and over/under confidence. The authors posited that increased cognitive demand in decision-making requires increased valuation (see Neural Processes for Weighing Values in Decision-Making) which leads to the ability to "articulate a preference or judgement based on a more thoughtful consideration of the options and associated information" (Del Missier et al., 2013, p. 1345). Studies using fMRI to track neural circuitry for working memory have implicated working

memory as an executive function taking place generally within frontal-parietal subunits of the brain (Owens, Duda, Sweet, & MacKillop, 2018). Specific neural activity in the right aPFC and dlPFC were found to be modulated by decision difficulty within working memory brain areas (Jimura et al., 2018). These areas aid in the valuation of smaller/sooner and larger/later rewards (TD) in a balance between maintenance and integration of abstract goals within working memory (Jimura et al., 2018). Working memory is also employed in conflict conditions, where conflict-history is maintained in the dlPFC (Funahashi, 2017). The experience attained through conflict-history is a reinforcement learning process that strengthens the link between choice and outcome (Funahashi, 2017).

Further behavioral associations between memory and decision-making include positive associations between episodic memory and experience-based judgments (understanding and recognizing social norms), and semantic memory and consistency in risk evaluation and resistance to sunk costs (costs that cannot be reversed; Del Missier et al., 2013). More demanding decision-making tasks require a more reflective decision-making process, involving working memory, whereas less cognitive demanding tasks rely more on acquired experience and emotionally related processes. In other words, though experience and knowledge are generally important for decision-making, quick and effortless judgement tasks rely on their employment more often. This further emphasizes the necessity primal, stimulus-driven behaviors have on behaviors based on deliberation, where the process of reflective decision-making becomes faster for individuals that learn from aversive experiences. These findings provide neuro-scientific support for Plato's (trans. 2004) theory that individual characteristics and attributes, mainly those

employed in just behavior, develop as a learning process.

### Conclusions for the Neural Substrates of Reflective Decision-Making

The size and capacity of the prefrontal cortex is unique to humans, and is the location for an array of executive functions, including decision-making (O'Doherty et al., 2017). One process particular to decision-making is cognitive control, a top-down operation taking place specifically in PFC regions (Funahashi, 2017). The above analysis of brain regions and functions that make up reflective decision-making, all-of-which operate at sophisticated levels that exceed basic reinforcement learning, demonstrates the human propensity for complex and reasoned judgement. As Plato (trans. 2004) theorizes, humans have a responsibility to themselves and the environment they live in, and the research presented here reflects that theory in the advanced make-up of the human brain.

## Reflective Decision-Making and Moral Reasoning

In Plato's examination of a just individual, he rationalizes that justice is derived by the "harmony" of the appetitive, spirit, and reason, "to establish the elements in the soul in a natural relation of mastering and being mastered by one another" (*Republic IV*, 444 d7-d9). According to Plato, the attempt to balance the soul in this way brings maximal happiness, and "if maximal justice and maximal happiness go together, then it pays, in terms of happiness, to be just rather than unjust" (*Republic*, p. xv).

Current research in the area of moral reasoning is compatible with Plato's notion, mainly that moral reasoning is not domain specific, but rather a function of various integrative components (Garrigan, Adlam, & Langdon, 2018). Cognitive, affective, and social processes, as well as individual differences in temperament and brain development, contribute to moral reasoning, or the process that can guide reflective decision-making composed of "moral rules,

knowledge, and understanding stored in memory as moral schemas" (Garrigan et al., 2018, p. 81). Early theories of moral reasoning developed by Piaget (1934, as cited in Garrigan et al., 2018) and Kohlberg (1976, 1981, 1984a, as cited in Garrigan et al., 2018) concentrated on developmental stages whereby an individual gradually progresses from egocentrism in childhood to gaining a more abstract understanding of the world through perspective taking. Later theorists focused on the importance of affective states, and how emotions such as empathy tie into morality, while those interested in the neural components of moral reasoning combined developmental aspects (maturation of the brain) with neuro-imaging studies that could pinpoint brain region activation during moral reasoning tasks (Garrigan et al., 2018). Comprehensive research, looking at past theories, as well as utilizing current research methods, displays the integrative way the various components of moral reasoning interact and develop. Plato (trans. 2004), as well, saw virtue as an integrative process, that doesn't solely consist of moral reasoning, but rather functions through the collective influences of instinct and emotion. Reflective decision-making, impulse, and emotion/motivation interact similarly in moral reasoning as Plato (trans. 2004) posits in his theory of a tripartite soul. Reflective reasoning, belonging to what Garrigan et al. (2018) consider to be the cognitive component of moral reasoning, can be summoned or overridden during various steps in moral decision-making (Garrigan et al., 2018). For instance, working memory and ToM mechanisms provide information for interpreting environmental cues that guide behavior, however individual characteristics may inhibit prosocial behavior (e.g., cheating in a game because an individual doesn't want to lose), thus displaying how at any given moment the brain weighs and integrates multiple factors that ultimately generate behavior. Examples of these factors include individual levels of emotional detection and regulation, "affect-event links", genetics, and parenting that

either promote greater cognition in moral decision-making or automatization of behavior (Garrigan et al., 2018). The process of reflective decision-making allows individuals a greater chance of aligning their behaviors with prosocial goals, however an integrative dance between all the components is necessary in order to strengthen neural connections that expedite information needed in the employment of that process. In line with this, Gibbs (2013, as cited in Garrigan et al., 2018) states that past experiences lead to "adaptive refinement and reorganiz[tion] of schemas enabl[ing] moral development to take place" (p. 83). Whereas, according to Plato (trans. 2004), the rule of impulsive behavior stimulated by appetitive cues is detrimental to a society or individual, current research agrees that reflective processes in decision-making require impulse, either as a form of aversive experience that can inform future behavior, or as a mechanism that can transform reflective processes into reflective ones. It follows that reflective decision-making therefore develops empirically as individuals participate within the moral margins of any given society.

## Limitations and Scope

The objective of this paper is to build upon inquiry, linking Plato's theory of a tripartite soul with behavioral research, and structural activity and functioning in the brain. One limitation for this investigation is Plato's exclusive consideration of the male gender in the tripartite soul theory. A broader picture of how Plato's theory applies to both genders is beneficial for considering a larger perspective on human morality. Further research would benefit from assuming that Plato's theorizing exclusively on the male sex was a consequence of the time, and continue unbiased analysis into whether gender differences exist in brain function for the suggested operationalized elements. For example, gender differences were found in emotional processing for individuals using a statistical strategy of reasoning in decision-making, where

outcomes were weighed given an option's specific premise (Markovits, Trémolière, & Blanchette, 2018). This finding suggests that gender may impact framing, or the contextual load of options, differently, displaying the need for a broader perspective on the overall interaction of impulse, reason, and emotion in morality.

Secondly, the scope of research presented here concentrates mostly on the neural functioning of healthy individuals, however a conceded fine line exists between normalcy and pathology in human behavior. Hoffman et al. (2008) note that impulsive processing in the 2-systems model is the same processing system employed in the beginning stages of addiction. Pathology is an important factor in applying Plato's tripartite theory to scientific analysis, considering that pathology lives in the brain and effects behavior, therefore contributing to interactive differences among the suggested operationalized elements. For instance, depression, specifically major depressive disorder, is hypothesized to moderate prosocial behavior (Alarcón & Forbes, 2017). Further analysis on how certain pathologies impact reflective/impulsive processing and emotion will contribute to placing the philosophical definition of human virtue in scientific study.

Lastly, the overall objective of this paper is broad, and thus, the scope was limited to the analyzation of only one element in Plato's tripartite theory, namely reason. To examine whether or not reflective processing truly behaves the way Plato (trans. 2004) theorizes — as overseer of both impulsive processing and emotion/motivation, further analysis is needed on the other two components (appetitive and spirit), and their interactions in overall moral reasoning.

## Conclusion

This paper presents operationalizations for Plato's tripartite soul, namely reflective processing for reason, impulsive processing for the appetitive, emotion and motivation for spirit,

and moral reasoning for just behavior. These operationalizations were established using a subjective analysis of Plato's theory, and linking it to current psychological theories found in peer reviewed scientific articles. Strack and Deutsch's (2004) 2-systems model for reflective and impulsive processing accurately displays the interaction between Plato's Appetite and Reason elements. The component, emotion/motivation, added by Wiers and Stacy (2006) to the 2-systems model, acts as auxiliary to reflection that can deter impulses, a process befitting Plato's description of Spirit (Fig. 1). This updated 3-systems model is supported by mechanisms in the brain that interact equivalently, suggesting that Plato's theory of a tripartite soul has scientific support within psychological science.

Research in the area of moral reasoning is just as meaningful now as it was in 4th century Greece. Across the globe moral values within political structures are being evaluated as societies contemplate equality, and globalization blurs cultural and national borders. Even as the world presently battles the Coronavirus pandemic, individuals are faced with the day-to-day decisions of buying up products on a whim, or sacrificing their perceived security for the sake of the community; holding onto perceived personal freedoms, or wearing a mask for the safety of society. Whereas Plato (trans. 2004) uses philosophical debate to argue that justice and just behavior are beneficial for the overall wellbeing of societies, this notion is in need of scientific attention today. Investigation into the behavioral and neural processes that either hinder or facilitate moral behavior is therefore critical, not only in political domains, but for educational purposes as well, as we raise and teach our future generations. Further scientific research in this area will greatly advance our understanding of a long-established philosophical theory on justice and morality, and test the merits of the argument advanced by Plato's *Republic*.

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# Appendix

Fig (1). An adaptation of (Wiers & Stacy, 2006) illustrative overview of the 2-Systems Model (Strack & Deutsch, 2004), with Plato's Tripartite Theory superimposed: (a) the appetitive element primarily makes up impulsive processing, where associated stimuli evoke approach behaviors, (b) reason employs executive mechanisms in the form of reflective decision-making known to aid in emotion regulation (Greene, Nystrom, Engell, Darley, & Cohen, 2004) (c) spirit modulates behavior through anger-induced adverse experience and motivation to inhibit or change the behavior.