Examining Phronesis Models with Evidence from the Neuroscience of Morality Focusing on Brain Networks

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Abstract

In this paper, I examined whether evidence from the neuroscience of morality supports the standard models of *phronesis*, i.e., Jubilee and Aretai Centre Models. The standard models explain *phronesis* as a multifaceted construct based on interaction and coordination among functional components. I reviewed recent neuroscience studies focusing on brain networks associated with morality and their connectivity to examine the validity of the models. Simultaneously, I discussed whether the evidence helps the models address challenges, particularly those from the *phronesis* eliminativism. Neuroscientific evidence supported the importance of brain networks, i.e., the default mode, salience, and central executive functioning networks, in moral functioning in general. The findings favorably supported the multifaceted and integrative nature of *phronesis* proposed by the standard models. Finally, I considered how the two models could explain the mechanisms of *phronesis* more integratively based on neuroscientific findings. At the end of this paper, with the evidence, I proposed several practical ideas to promote the cultivation of *phronesis*, e.g., the consideration of coordination among components for moral functioning and the use of moral exemplars.

Keywords: Practical wisdom, Phronesis, Neuroscience, Moral psychology, Brain networks, Moral functioning

Moral philosophers and psychologists have recently shown keen interest in practical wisdom, i.e., *phronesis*, to explain the mechanism of moral motivation and behavior (Kristjánsson 2014; Han 2023). Generally, *phronesis* means the capacity to render

the most appropriate ethical decision in a given situation (Vaccarezza et al. 2023). It contributes to optimal decision-making and generates emotional, motivational, and behavioral responses for problem-solving (Kristjánsson et al. 2021). *Phronesis* also helps us identify what we are supposed to pursue as human beings to flourish (Kristjánsson 2017). The proponents of *phronesis* argue that it is a prime virtue addressing conflicts between various moral values to produce optimal decisions and behavioral outcomes (Vaccarezza et al. 2023).

Researchers have proposed *phronesis* as a construct predicting motivational and behavioral outcomes in moral domains to address the "gappiness" issue in the field (Darnell et al. 2019). It is about the gap between moral judgment, motivation, and behavior. In the past, the mainstream theoretical framework in moral psychology, such as the classical Kohlbergian model, primarily focused on moral reasoning (Kohlberg 1975). However, studies have reported that sophisticated moral judgment does not sufficiently promote moral motivation and eventual behavior (Darnell et al. 2019). Consequently, researchers have explored integrative theoretical models, which embrace emotional and motivational constructs, to fill the gap. For instance, the Neo-Kohlbergian model includes moral sensitivity, motivation, and character strengths as its components in addition to moral judgment (Bebeau 2002).

Based on the efforts to develop a more inclusive and accurate model explaining moral motivation and behavior, recent *phronesis* researchers have proposed an integrative model of *phronesis* (Darnell et al. 2019; Kristjánsson et al. 2021). In this model, i.e., the Jubilee Centre Model of practical wisdom, multiple psychological components play roles in decision-making and the pursuit of flourishing (Darnell et al. 2022; Vaccarezza et al. 2023).

The model consists of functionalities for a blueprint of flourishing, moral sensitivity, reason-infused emotion, and moral adjudication. The model developers argue that the inclusive model of *phronesis* will better explain the mechanism of moral functioning and flourishing by addressing the gappiness issue with the various functionalities (Kristjánsson et al. 2021). A recent empirical study based on the model corroborates that the integrative model can predict behavior with enhanced accuracy (Darnell et al. 2022).

Another group of moral philosophers addressed a different aspect of *phronesis*. While the Jubilee Model is primarily concerned with the functional components constituting *phronesis*, the Aretai Centre Model explains the cultivation of *phronesis* in terms of mastering ethical expertise (De Caro et al. 2021; Vaccarezza et al. 2023). According to the model, *phronesis* is a unified expertise based on habituated and deliberative virtues. It enables us to render the best decisions across different domains in human lives. Moral psychologists have also suggested that developing ethical expertise is essential for optimal moral behavior (Narvaez and Lapsley 2005).

Although these models have provided substantial insights into how to understand and explain *phronesis* more accurately, they are facing several challenges. First, there is a challenge from the "*phronesis* eliminativism (Miller 2021)." Miller (2021) argued that if the current models of *phronesis* cannot successfully address three concerns, i.e., the subsumption, arbitrariness, and unity concerns, it would be more plausible to abandon the concept of *phronesis*. He instead suggests that a set of intellectual capacities, e.g., conflict resolution, goal-setting, reasoning capacities, etc., should substitute *phronesis*. Second, it is still unclear how to explain the relationship between the two different models of *phronesis* (Vaccarezza et al. 2023). Although the proponents of the two models agree that *phronesis* is

a multifaceted prime virtue required for optimal moral functioning and flourishing, they have not made a clear conclusion about their relationship. Until we address these concerns, the current frameworks describing *phronesis* might not be completely free of limitations.

Hence, I will discuss how to address the challenges to the recent models of *phronesis* based on evidence in neuroscience and psychology. First, I plan to review the *phronesis* models and criticisms of *phronesis* eliminativism. Second, I will examine recent neuroscience research to obtain insights to address the concerns. While reviewing relevant neuroscientific studies, I will discuss why and how the studies can contribute to our discussions on *phronesis*, which are assumed to be conducted by philosophers. During the process, I will specifically delve into studies on brain circuitries and networks instead of mere localization of psychological functions. Given the current models of *phronesis* underscore the multifaceted nature of *phronesis* and cooperation among functional components, network neuroscience, which also focuses on interaction and connectivity between brain regions and circuitries, will be particularly informative in my inquiry. Then, I will propose how the empirical evidence can improve the current *phronesis* models. Third and finally, I will discuss several practical points about cultivating *phronesis*.

Recent works have developed and examined the models of phronesis with findings in moral psychology

The Jubilee Centre Model proposed the multidimensional model of *phronesis* consisting of multiple psychological functions assisting ideal moral decision-making and eventual human flourishing (Kristjánsson 2017; Darnell et al. 2022; Vaccarezza et al. 2023). Their main point is that it is insufficient to explain the mechanism of moral motivation and behavior with a single component, such as moral reasoning previously proposed in

conventional moral psychology. Previous models likely fail to deal with the gappinness issue concerning the gap between judgment and behavior (Blasi 1980). Instead, they argue that we need to consider various aspects, i.e., a blueprint of flourishing, moral sensitivity, reason-infused emotion, and ethical adjudication, for a better and more accurate explanation of morality. The Model developers argue that appropriate moral judgment and eventual flourishing require the functioning of the individual components and their coordination (Kristjánsson 2017).

The inventors of the Jubilee Model referred to findings from moral psychology that explored various factors predicting moral motivation and behavior. For instance, as cited in Darnell et al. (2019), they employed ideas from Neo-Kohlbergians and psychological researchers studying empathy and identity (Bebeau 2002; Han 2022). The functional components proposed in the empirical investigation constituted the basis of the integrative *phronesis* model (Darnell et al. 2019, 2022). The model developers explained the blueprinting functionality based on the theory of moral identity, which addresses the centrality of moral values in oneself (Aquino and Reed 2002). In the case of moral sensitivity, they employed ideas to support the component from the moral sensitivity component proposed by Neo-Kohlbergians. The reason-infused emotion is consistent with emotional regulation guided by empathic concern and perspective-taking proposed by empathy researchers (Decety et al. 2012). Finally, the model developers supported the basis of moral adjudication with moral and wise reasoning in psychology (Bebeau 2002). A follow-up empirical study demonstrated that the integrative *phronesis* model significantly predicted public and personal prosocial behavior (Darnell et al. 2022). Hence, it would be

possible to assume that the Jubilee Centre Model possesses conceptual and empirical credibility to some extent.

The Aretai Centre Model delves into a different aspect of *phronesis* (Vaccarezza et al. 2023). Unlike the Jubilee Model focusing on functional constituents of *phronesis*, the Aretai model is more interested in the qualitative facet of *phronesis* in moral development. This model defines *phronesis* as a virtue that involves being an expert in deliberative, affective, and motivational skills in moral domains (De Caro et al. 2021). Unlike the traditional virtue theory, which was primarily interested in individual virtues, this model emphasizes the role of *phronesis* as a domain-general virtue that manifests various domains. From this perspective, exercising a specific virtue other than *phronesis* means the manifestation of *phronesis* in a realm that the virtue addresses. As a result, the model developers propose that we should perceive *phronesis* as a prime and unitary virtue governing all aspects of moral life in general.

Research in moral psychology focusing on ethical expertise development supports the points of the Aretai Model empirically. Narvaez and Lapsley (2005) explored the nature of ethical expertise and how it develops over time. They argued that moral experts demonstrate three distinctive features compared with ordinary people: first, diverse sets of representations guiding the application of knowledge; second, context-sensitive perception; and third, more sophisticated skill sets, e.g., developed heuristics and decision-making capacities. *Phronesis* defined in the Aretai Model's perspective requires developed meta-cognition and critical consideration of contextual factors consistent with the relevant psychological works, including the ethical expertise study (Kristjánsson et al. 2021;

Vaccarezza et al. 2023). Thus, research in moral psychology also inspired the Aretai Model, similar to the Jubilee Centre Model.

Despite the abovementioned similarities between the philosophical model by Vaccarezza et al. (2023) and the psychological model by Narvaez and Lapsley (2005), we should consider several noticeable differences between them as well. First, those two models were originated from different assumptions, perhaps moralized psychology versus psychologized morality (Jeong & Han 2013; Kristjánsson 2009). The Aretai model was initially proposed by a group of philosophers, so its structure and constituents were proposed based on the moralized psychology; on the other hand, the ethical expertise model was founded on the idea of the psychologized morality. Because those two models were based on different conceptual assumptions, their primary focus and interest were also likely to differ. Vaccarezza et al. (2023) were seemingly more interested in creating a model of expertise phronesis with normative assumptions in moral philosophy. On the other hand, Narvaez and Lapsley (2005) seemed to focus on building an empirical model of ethical expertise based on data and observation. Hence, even if those two models refer to a similar construct or concept, that does not necessarily mean that the ways how they describe the construct or concept are identical. Second, Lapsley (2021) argues that *phronesis* based on ethical expertise can be completely explained by related psychological constructs, such as perceptual sensitivity and dis- criminative facility. However, Vaccarezza et al. (2023) do not intend to argue the superfluousness of *phronesis,* and it can be successfully substituted by a set of relevant psychological constructs.

Although these recent models propose evidence-based descriptions of phronesis, Miller (2021) raised several concerns regarding their credibility. The main three points of

his critiques are subsumption, arbitrariness, and unity concerns. First, the subsumption concern is about what is left of a moral virtue once all fundamental roles in moral functioning are attributable to *phronesis*. Second, he argued that selecting functional components constituting *phronesis* in the models might be done arbitrarily or ad-hoc (arbitrariness concern). Third, the uniqueness concern raises an issue about why we should assume that a single trait, i.e., *phronesis,* carries out all functionalities if multiple components ascribe it. As a result, he argued that it would be possible to eliminate the concept of *phronesis* and replace the functionality with a set of intellectual capacities (e.g., conflict resolution, goal-setting, reasoning, justification, etc.) if we fail to address the three concerns. Lapsley's (2021) argument on the superfluousness of *phronesis* might also be in line with Miller's (2021).

The inventors of both models developed counterarguments to address the three concerns raised by Miller (2021). For instance, the Jubilee Model developers employed the metaphor of a decathlon to support the unique necessity of *phronesis* in moral functioning (Kristjánsson and Fowers 2022). According to the decathlon paper, developed skills to be successful in individual sports could not be sufficient conditions for success in a decathlon. Likewise, *phronesis* plays a central role in optimal moral functioning and flourishing that individual intellectual capacities cannot do as proposed by *phronesis* eliminativism (Kristjánsson 2017). The Aretai model inventors argue that phronesis consists of multiple components of ethical expertise supported by psychological research, so the raised concerns could not be an issue (De Caro et al. 2021; Vaccarezza et al. 2023). Although it might still be unsettled whether they have sufficiently addressed the concerns raised by

phronesis eliminativism, they have significantly elaborated their arguments to support the validity of their models.

In addition, I am still curious about how to treat the two existing models in describing *phronesis*. Should we say that only one is valid while the other is not? If the two models are compatible, not mutually exclusive, what would be a possible way to integrate them to explain *phronesis*? Of course, I acknowledge that they published a paper to compare the two models and search for mutually agreed points (Vaccarezza et al. 2023). Eventually, they concluded that despite differences in details, both models attempt to explain different sides of *phronesis*. However, they could discuss more how the two models cooperate upon a uniform goal, i.e., a more accurate explanation of *phronesis*, more concretely, from my perspective.

In the rest of this paper, I plan to consider how the current models of *phronesis* can better deal with the challenges of *phronesis* eliminativism with evidence from empirical science, including neuroscience. Moreover, I will examine such evidence to explore the possibility of integrating the two models.

How Can Neuroscience Support the Concept of *Phronesis* in Virtue Ethics?

Before exploring evidence in neuroscience, I will discuss why and how neuroscience can inform our intellectual endeavor in virtue ethics. Generally, in moral philosophy, empirical findings from psychology and neuroscience have helped philosophers develop and improve their theoretical frameworks (Han 2016, 2023a). For example, experiments employing ethical dilemmas have informed consideration of the relationship between reasoning and emotion in moral judgment, an important topic in moral psychology (Greene et al. 2001; May et al. 2021). Furthermore, neurological studies examining the association

between brain lesions and suboptimal moral functioning have provided insights into how ethical decision-making occurs based on cognitive and affective processes (Saver and Damasio 1991; May 2023).

In virtue ethics, some works have proposed that evidence from neuroscience, besides traditional psychology, can provide insights into philosophical inquiries (Han 2016; Navarini 2020; Han 2023). Virtue ethicists interested in *phronesis* have referred to non-neuroscientific psychological studies, e.g., the Neo-Kohlbergian model of moral functioning and ethical expert model, to support the validity of their phronesis models as overviewed above (Kristjánsson 2013; De Caro et al. 2021; Darnell et al. 2022). In addition to such psychological studies, neuroscientific works can provide additional supporting evidence. For instance, Han (2023) referred to findings from large-scale neuroimaging analyses and the Bayesian learning model to propose the purposes of moral education based on virtue ethics, i.e., habituation of virtues and cultivation of *phronesis*. Although this work did not address *phronesis* exclusively, it may suggest that neuroscience can be a tool to examine topics in virtue ethics.

Why can neuroscience be informative in our examination of *phronesis*? First, I want to underscore that neuroscience can provide information about the ontologies of cognitive and psychological processes associated with moral functioning (Poldrack and Yarkoni 2016). If we are interested in exploring functional components constituting *phronesis*, findings in neuroscience, which delve into the ontologies of cognitive and psychological processes, can be informative (Knutson and Srirangarajan 2023). Of course, as Darnell et al. (2022) did in their empirical study, non-neuroscientific psychological studies can also illuminate the functional components of *phronesis* through psychological measures and

tests. However, neuroscientific approaches, such as fMRI analysis with large-scale datasets, enable us to explore neural-level mechanisms of moral functioning, which constitute the basis for psychological processes at the neural level (Poldrack 2006; Han et al. 2019). Given the current *phronesis* models are based on and require empirical evidence regarding its functional components, neuroscientific evidence, which can provide us with more detailed pictures of psychological constituents, will be additional support.

Second, we also need to consider that the state-of-art techniques in neuroscience allow us to explore the connectivity between psychological functionalities of our interest via network analysis (Barabási et al. 2023). In the past, neuroscientists were primarily interested in associating a specific brain region and a psychological functionality of interest (McCaffrey 2023). However, recent research has shown that mere localization could not be a valid method to understand the neural-level mechanism of psychology (McCaffrey 2023; Barabási et al. 2023). Instead, the networks and circuitries of brain functioning better explain psychological processes. The network-centered approach to brain functions associated with morality might be particularly informative in examining the mechanism of *phronesis*. For instance, we can consider the metaphor of the decathlon employed by Kristjánsson and Fowers (2022) to argue the multifaceted nature of *phronesis*. With the decathlon metaphor, they underscored that *phronesis* consists of multiple functionalities, and mastering the individual components does not sufficiently explain possession of *phronesis*. Instead, appropriate cooperation and coordination among them are fundamental. In neuroscience, examining brain networks focuses on the connectivity and interaction among individual brain regions or circuitries (Gerchen et al. 2014). Hence,

neuroscientific evidence related to the brain networks associated with moral functioning might provide insights into understanding the interactive aspect of *phronesis*.

Along with the abovementioned evidence in neuroscience, psychological evidence can also additionally support the accounts on *phronesis*. One point to note is that several virtue ethicists, particularly those proposed the standard model of *phronesis*, argued that optimal moral functioning can only be well understood by examining its nature with empirical evidence, psychological evidence (Fowers 2017). They argued that properly understanding the nature of virtues and character and how to promote their optimal development can be achieved via acquiring related psychological evidence with reliable and valid measures (Kristjánsson 2013).

In the following section, I will discuss how neuroscience can inform our examination of *phronesis* with concrete evidence. I will specifically focus on neuroscientific research about brain networks and those related to moral functioning because such research would be more informative for better understanding *phronesis*, which is multifaceted and interactive, than previous neuroimaging research focusing on localization.

Neuroscientific Evidence Related to Moral Functioning

In recent studies, neuroscientists started underscoring that we should examine dynamic brain networks rather than specific brain regions to understand psychological processes at the neural level (Pessoa 2023a). For instance, one brain region (e.g., R(A)) does not deal with one unique psychological functioning (e.g., f(A)) or vice versa. Instead, a brain network n(A), which consists of R(A), R(B), R(C), and so on, serves for functioning f(A) (Pessoa 2023b). In the same manner, R(A) might constitute various brain networks other than n(A), e.g., n(B), n(C), and so on, associated with f(B), f(C), and so on. Thus, we

should delve into the "entangled" brain founded on dynamic brain networks (Bassett and Gazzaniga 2011) while examining the neural-level substrates of moral functioning to understand neural-level mechanisms of morality accurately. Accordingly, my review of previous studies in the neuroscience of morality and discussion on how they can inform virtue ethics will also focus on brain networks related to moral functioning rather than individual regions.

Although there is room for further investigation, we may identify three main brain networks associated with psychological processes in moral domains, i.e., the default mode network (DMN), salience network (SN), and central executive network (CEN), from recent research (Greene 2015; Dotterer et al. 2020). First, the DMN includes the medial prefrontal cortex (MPFC), posterior cingulate cortex (PCC), and temporoparietal junction (Reniers et al. 2012). The DMN plays fundamental roles in self-related processes (e.g., self-referencing, reflection, autobiographical memory) and social cognition (e.g., mentalizing, intention reasoning) (Bzdok et al. 2012; Reniers et al. 2012). Various previous fMRI experiments and large-scale analyses have reported that task conditions in moral domains are significantly associated with activity in the DMN regions (Bzdok et al. 2012; Sevinc and Spreng 2014; Han 2017; Eres et al. 2017). Second, the SN also plays a central role in morality-related functions. Research has reported that the SN is associated with attention-switching, salience attribution, and integration of internal and external responses (e.g., interoceptive response) within social behavior (Menon and Uddin 2010). Studies in the neuroscience of morality have shown that the SN regions are closely associated with conflict resolution (Greene et al. 2004); and emotional and motivational processes in moral domains (Han et al. 2016). This network includes the anterior cingulate cortex (ACC), anterior insula, and

amygdala (Menon and Uddin 2010). Third, the CEN is associated with cognitive functioning, including information processing and working memory for problem-solving and goal-directed behavior (Ryan et al. 2021). It includes the dorsolateral prefrontal and posterior parietal cortex (Chen et al. 2019). In the previous studies, these regions reported significant activity when participants engaged in cognitive control and calculation in morality-related task conditions (Greene et al. 2001; Cushman 2015).

In addition to activity in regions in individual networks during moral task conditions, we can observe significant interactions between them. For instance, Han et al. (2016) reported interactions between core DMN regions, i.e., the MPFC and PCC, and SN regions, such as the anterior insula, during moral dilemma solving. One interesting finding was that they found stronger interactions when participants encountered the in-person ethical dilemma, which was more complicated and emotionally provoking. The same trend, the more robust connectivity between the networks in a more complex versus simple moral dilemma condition, was found in an electroencephalography study (Xue et al. 2013). Moreover, another fMRI study reported a similar pattern of the interaction between the DMN and SN areas when participants were evaluating moral intent and harm, which involves moral cognition and emotion (Decety et al. 2012). Even beyond the moral domains, in social cognitive processes in general, research has demonstrated the interaction between the DMN and SN as a common phenomenon (Ribeiro Da Costa et al. 2022).

We can also refer to several clinical studies suggesting the importance of the networks in moral functioning with causal evidence. For instance, frontotemporal dementia, which affects the core of the DMN, i.e., the prefrontal cortex, was found to impair

theory-of-mind and moral sensitivity during moral dilemma-solving (Mendez et al. 2005; Gleichgerrcht et al. 2011). In addition to studies focusing on individual regions, several studies have also demonstrated the causal relationships between issues in brain networks and moral functioning. Parkinson's disease research has reported that it causes damage in the DMN and SN, including the PCC, ACC, insula, and amygdala (Santens et al. 2018). Furthermore, such patients reported abnormal structural connectivity across the networks associated with significant cognitive decline (Chen et al. 2019). The impairment in the DMN and SN in the patients harms their moral functioning, such as moral reasoning and eventual moral behavior (Chen et al. 2015; Santens et al. 2018). Patients with schizophrenia with aberrant connectivity between the DMN, SN, and CEN (Manoliu et al. 2014) show issues in being sensitive to others' extenuating motives for moral transgressions (McGuire et al. 2017). In summary, these studies suggest both region-wise and network-wise impairments in the brain circuitries cause issues in various moral functioning, such as moral sensitivity, moral reasoning, and behavioral motivation.

As reviewed, recent neuroscience research suggests that we should consider network-natured brain functioning instead of mere localization while studying the neural-level mechanisms of cognitive and psychological processes (McCaffrey 2023; Pessoa 2023b; Barabási et al. 2023). Previous experiments conducted with ordinary and clinical populations have revealed that regions in the three core networks associated with moral functioning, i.e., the DMN, SN, and CEN, play fundamental roles in moral domains. In addition to the functioning within each network, we should examine inter-network interaction and connectivity to understand morality properly at the neural level. Furthermore, given activity in a specific brain region could not accurately explain a

psychological process without consideration of networks, such neural-level evidence is consistent with models of moral functioning based on multiple functional components.

In the next section, I will discuss how we can better explore the nature of *phronesis* and address concerns regarding its concept based on the overviewed evidence from neuroscience. While working on the discussion, I will introduce additional neuroscientific studies that are directly relevant to my exploration of *phronesis*.

Addressing Concerns on *Phronesis* Based on Neuroscientific Evidence

The reviewed evidence in neuroscience suggests that we should regard moral functioning as complex mental functioning, which can only be possible through interaction and cooperation between various brain networks dealing with different psychological processes. Treating each functional component independently from the other could not be a way to understand the nature of morality, and thus *phronesis*. This point raised from neuroscientific evidence is consistent with what has been proposed by the standard models of *phronesis*, i.e., the Jubilee and Aretai Centre Models.

First, the fact that multiple circuitries participate in and interact with each other during moral task conditions may support the core tenets of the Jubilee Centre Model. As reviewed above, the core concept of the model is that *phronesis* consists of multiple psychological processes, so one specific functional component could not sufficiently explain it. Previous neuroscience research has shown that all three brain networks, i.e., the DMN, SN, and CEN, which deal with different psychological processes, cooperatively participate in task processing during various moral task conditions (Greene 2015; Chen et al. 2019). Any deficit in one component or problem in inter-network coordination cause impaired moral functioning in different dimensions.

The findings can help the models address the arbitrariness concern by Miller (2021). Although there is room for additional investigation, large-scale neuroimaging analyses have explained psychological processes supported by individual networks (Poldrack 2006; Poldrack and Yarkoni 2016). Interestingly, we can find the consistency between the psychological processes associated with the networks and functional components in the Jubilee Centre Model. Activity in the SN is inseparable from the constitutive function that enables one to be sensitive toward the morally salient aspects of a given situation (Menon and Uddin 2010). Self-related processes associated with the DMN are central to the blueprint function, which requires one to deliberate and reflect upon their identity, values, and beliefs (Han 2017). The executive functioning based on the CEN is central to the emotional regulative function to regulate one's emotional status to pursue a long-term purpose (Alexander et al. 2021). Finally, the interaction and coordination between the three networks implement the integrative function component. The integrative function requires psychological processes associated with the SN, i.e., understanding salient features and potential conflicts (Menon and Uddin 2010). It is also inseparable from deliberation upon various values and possibilities correlated with the DMN (Han 2017). Finally, enabling goal-directed best decision-making is the psychological function of the CEN (Ryan et al. 2021).

As shown in both non-clinical and clinical neuroimaging studies, the successful functioning of this integrative function component requires non-abnormal connectivity and interaction between the three networks (Chen et al. 2019; Ribeiro Da Costa et al. 2022). Evidence also supports the constructive validity of the psychological processes and functional components constituting *phronesis* as an integrative concept (Darnell et al. 2022;

Han 2024). Hence, neuroscience research provides additional evidence to address the arbitrariness concern with the existing psychological evidence at the behavioral level.

Similarly, evidence from non-neuroscientific psychological studies also support the point that the arbitrariness concern can be successfully addressed. First, self-referencing and other self-related functions, which are associated with the DMN at the neural level (Han 2017), are found to constitute the basis for motivation and behavior. For instance, moral identity, which is related to referencing to one's own identity and belief in the moral domain (Han 2017), predicts moral motivation and behavior according to a large-scale meta-analysis study (Hardy 2006; Hertz & Krettenauer 2016). Second, psychological functionalities associated with sensitivity to situational factors, such as empathy in the prosocial domain, which are correlated with the SN activity (Toller et al. 2018), are also fundamental in generating prosocial motivation and behavior (Hardy 2006; Nasello & Triffaux 2023). Third, the executive functioning, which is based on the CEN at the neural level (Alexander et al. 2021), is commonly involved in various cognitive processes, including general social cognition (Stucke & Doebel 2023). Finally, conceptual papers proposed that all these three psychological functionalities are central in collectively regulating moral and prosocial functioning (Hardy 2006; Romera et al. 2019). These previous studies suggest that psychological processes associated with the three brain networks constitute the foundations for moral functioning. Thus, the evidence at the psychological level supporting the necessity of the abovementioned functional components may additionally alleviate the arbitrariness concern, which argues that the functional components of *phronesis* were selected arbitrarily.

Neuroscience research can also help address the unity concern. If the work of each component is sufficient for moral functioning, the issue raised by the unity concern becomes valid. Then, we may need to abandon the concept of *phronesis* as a unity. Also, moral functioning should be explained by individual psychological processes, e.g., ethical sensitivity, reasoning, motivation, etc., without considering *phronesis* as an integrative whole (Lapsley 2021; Miller 2021). However, evidence from the investigation of brain networking involving morality may provide insights to address the concern. For instance, fMRI experiments demonstrated significant interaction and connectivity across regions in different brain networks in various moral task conditions (Decety et al. 2012; Han et al. 2016; Jung et al. 2016). We may also refer to neurological studies that reported the association between abnormal inter-network connectivity and a wide range of impairments in moral and social cognition (Dotterer et al. 2020). Studies of white-collar criminals also provide novel ideas. In those studies, the white-collar criminal subjects reported cognitive superiorities, e.g., executive functioning and attention processing, to non-criminals (Raine 2019). Accordingly, brain regions in the DMN, SN, and CEN related to cognitive functions show significantly higher gray matter thickness among criminals than among non-criminals (Raine et al. 2012).

The evidence suggests that we cannot fully explain optimal moral functioning in terms of the superior functioning of individual functional components, so the unity concern is not supported. Instead, as the concept of *phronesis* proposes, we should pay attention to how they interact and cooperate to understand morality. As shown in the case of white-collar criminals, one's capacities in individual components do not sufficiently explain appropriate moral behavior. Hence, we need to consider the higher-level network

constituted by the inter-connected functional networks, i.e., the DMN, SN, and CEN, and the psychological functions associated with them, as a whole in our exploration of the mechanism of morality, not that of anti-morality based on high cognitive functioning.

The presence of the inter-connected meta-network may suggest phronesis should be explained in terms of unity, not a mere enumeration of independent individual components. Such a point is consistent with what the metaphor of decathlon proposes. Kristjánsson and Fowers (2022) argued that *phronesis* could not be achieved merely by mastering strengths or virtues like the decathlon; a successful decathlon player is not a master of individual sports but can coordinate the mastery for eventual winning. A previous study of players of the triathlon, a sport similar to the decathlon, also reported that robust connectivity between skills in individual sports was more important in predicting success than mastering all sports (Calsbeek and Careau 2019). Likewise, a recent study in moral psychology also demonstrated that the network node strength across moral reasoning, moral identity, empathy, and purpose significantly predicted prosocial behavior (Han 2024). In short, all these suggest that *phronesis* for optimal moral functioning cannot be reduced to individual components but should be considered a network-natured integrated unity.

Some might still be able to argue that we cannot fully address the unity concern by simply emphasizing the network-natured aspect of *phronesis*. From their perspective, a meta-network consisting of individual functional networks can be understood as a set of such functions without putting a brand-new name, i.e., *phronesis*. However, recent neuroscience research on consciousness may suggest that such a view does not explain reality accurately (Seth and Bayne 2022). According to the Integrative Information Theory,

which explains the emergence of consciousness from brain networks, the higher-order concept of consciousness emerges when a network can present irreducible integrative information (Tononi et al. 2016). A brain network can produce integrative information that cannot be merely generated by a set of independent nodes in such a case**.** According to the network theory, a network with edges connecting nodes can generate significantly more information than the sum of the nodes without connectivity (Klein and Hoel 2020). Hence, we should treat the meta-network of moral functioning associated with *phronesis* as a unique functional network like the network of consciousness. The connectivity feature in the meta-network makes itself distinguishable from a mere sum of its components. Due to the higher complexity of the meta-network making it irreducible, we should also consider *phronesis* as a qualitatively complex unity.

Furthermore, we can see the unique feature of a meta-network of moral functioning consisting of the three networks compared with networks associated with other psychological processes. As discussed, each network constituting the meta-network, the DMN, SN, and CEN, address its psychological function independently from morality. For instance, out of the moral domains, the DMN is associated with self-related processes (Han 2017), SN plays attention and conflict monitoring (Greene 2015), and the CEN is related to general executive functioning (Raine et al. 2012). However, previous research has reported that the inter-network connectivity between the networks was significantly more robust in moral domains than in non-moral psychological function domains (Li et al. 2014). For instance, when one considered others' welfare, the inter-network connectivity was higher than when one performed self-oriented thoughts or was resting (Ribeiro Da Costa et al. 2022). This evidence may suggest that the meta-network corresponding to *phronesis* at the

neural level shows unique robustness in the inter-network connectivity compared with other psychological functions. Hence, we may conclude that neural-level evidence does not favorably support the unity concern since a robust meta-network consisting of networks, i.e., a meta-network distinctive from brain networks for general psychological functions, is associated with moral functioning.

Finally, we need to examine issues raised by the subsumption concern (Miller 2021). According to this concern, if we possess *phronesis* as a prime virtue responsible for optimal moral functioning, all other virtues would be factored out. The developers of both models could not provide clear answers about how to address this concern. For instance, the Aretai Model inventors bite the bullet and argue that the subsumption concern should not be an issue; according to them, *phronesis* is necessary and sufficient for optimal moral functioning (Vaccarezza et al. 2023). Although I am also confident about whether evidence from neuroscience can address the subsumption concern completely, I will explore the evidence to examine what neuroscience says about individual virtues.

We may review the cases of two virtues, i.e., compassion and honesty, with neural-level evidence. First, fMRI studies have demonstrated that considering and deliberating upon the virtue of compassion was significantly associated with activity in mirror neuron regions (Kim et al. 2021; Rodríguez-Nieto et al. 2022). The meta-network of moral functioning consisting of the DMN, SN, and CEN showed significant interaction and connectivity with the mirror neuron regions. Second, we can also examine the experiments focusing on honesty. Neuroimaging studies have shown that one's level of honesty was significantly associated with activity in the reward system, which includes the caudate (Yin

et al. 2021; Speer et al. 2022). The constituents of the meta-network also showed significant interaction and connection with the reward system in the studies.

These studies may suggest one point: although there is a meta-network implementing the core of moral functioning, i.e., the meta-network consisting of the DMN, SN, and CEN, the meta-network interacts and cooperates with different brain networks in individual virtue domains. Let us revisit the concept of the entangled brain. According to this view, dynamic networks, not static networks, explain different cognitive processes (Pessoa 2023b). The same brain region or network might be reused across various functional domains. Thus, we can consider numerous qualitatively different brain networks across diverse psychological processes.

Although further philosophical considerations are out of the scope of my paper, it would be possible to say that the exercise of individual virtues is associated with different dynamic brain networks embracing the core meta-network as a foundation. Of course, it might be premature to conclude that there are dedicated networks for various virtues (e.g., a network of honesty, compassion, etc.). However, at the least, I might be able to propose that significantly different networks are activated while addressing various virtues similar to temporary task forces. The core meta-network of moral functioning works as an executive board, while other peripheral networks (e.g., the mirror neurons in compassion's case, the reward system in honesty's case). Even if the core executive board, the core meta-network, is required as a command center in all instances, we cannot argue that nothing remains without reservation. Likewise, in moral domains, although phronesis plays a fundamental role in exercising virtues, we still need to consider the possibility of the existence and contribution of other aspects in exercising individual moral virtues. As a

result, I shall propose that evidence from neuroscience does not seemingly favorably support the subsumption concern at the least.

In this section, I have examined the three major concerns raised against the standard models of *phronesis* with evidence from neuroscience. The evidence might help the model developers address the former two concerns, i.e., the arbitrariness and the unity concern. Although further philosophical considerations seem necessary, evidence from neuroscience can provide an opportunity to address the subsumption concern. In the next section, based on the discussion so far, I will briefly explore how the two standard *phronesis* models, i.e., the Jubilee and Aretai Centre Models, can cooperate in explaining the mechanism of phronesis based on neuroscientific evidence.

Cooperation of the Two Standard *Phronesis* Models

In this section, I will discuss how evidence from neuroscience and provide insights into examining the relationship between the Jubilee and Aretai Centre Models. To achieve this goal, I will first discuss how neural-level evidence can support each model. Then, I will explore how the two models can better describe the nature and mechanism of *phronesis* and how empirical evidence can support such a point. One point to note is that my primary purpose of this paper is not to evaluate which specific model is superior to the other given psychological and neuroscientific evidence. Instead, as will be discussed later, I intend to argue that evidence supports aspects proposed by both models, and we should consider the integrative cooperation between the two models to describe the nature of *phronesis* more accurately.

First, regarding the Jubilee Model, the implications of neuroscientific evidence are perhaps obvious. The previous research that reported the core networks involving moral

functioning, i.e., the DMN, SN, and CEN, provides empirical support for the multicomponent *phronesis* model (Greene 2015; Han 2017; May et al. 2021). By demonstrating that moral functioning could not function without the psychological processes associated with the networks, the multifaceted nature of phronesis proposed by the Jubilee Model now seems more credible. Furthermore, the functional components constituting *phronesis* mentioned by the Jubilee Model have acquired empirical evidence supporting their existence and functionality.

Furthermore, the evidence can support the conceptual validity of the Aretai Model, which emphasizes *phronesis* as ethical expertise. According to the virtue molecularism constituting the basis for the Aretai Model, cultivation of *phronesis* requires becoming sensitive towards moral features of current situations with sophisticated cognitive and affective skills (De Caro et al. 2021). As demonstrated by the core networks involving moral functioning, these features proposed by the Aretai Model correspond to the psychological processes addressed by the three networks, i.e., the DMN, SR, and CEN. Such evidence might support the point that the functional components proposed in the model are not arbitrarily selected but based on the empirical ground.

Another point that the neuroscientific evidence can address regarding the Aretai Model is how to define and explain the psychological nature of the expertise. Although the model developers suggested that ethical expertise can be defined in terms of the cultivated set of the abovementioned psychological functions, it might still be ambiguous how such expertise can be understood empirically. The empirical evidence I reviewed may suggest that well-developed network connectivity between individual functional components explains the nature of ethical expertise. We may refer to neuroimaging studies that

examined the network connectivity between the main networks addressing moral functioning, i.e., the DMN, SN, and CEN, across various populations. In these studies, robust connectivity between the network components significantly predicted enhanced moral and social functioning (Jung et al. 2016; Ribeiro Da Costa et al. 2022). Also, clinical neuroscience research has shown that aberrant connectivity is significantly associated with psychopathy and anti-morality (Chen et al. 2015; Dotterer et al. 2020). Studies examining white-collar criminals suggest that superiority in specific cognitive components could not sufficiently predict optimal moral functioning (Raine et al. 2012; Raine 2019). Instead, robust connectivity, coordination, and interaction between the functional constituents are also essential. At the behavioral level, one recent study also reported that connectivity between moral functioning components predicted prosocial civic engagement (Han 2024).

These findings commonly suggest that successful co-activation and co-regulation of functional components constituting ethical functioning represented as robust network connectivity are required. If we take this, it would be possible to propose that the abovementioned connectivity across the functional constituents can explain the nature of moral expertise, which was described as a conceptual basis for *phronesis* by the Aretai Model. If a person has successfully cultivated individual functions, e.g., ethical sensitivity and associated cognitive and emotional processes proposed by the Aretai Model, and robust network connectivity between them, it would be possible to say that the person has moral expertise.

The reviewed neural-level evidence can suggest how the two models can cooperate to describe the concept of *phronesis* more accurately. As I mentioned earlier in this section, it would not be appropriate to conclude that one specific model is better supported by

evidence than the other. Given the evidence supports the empirical validity of the functional constituents of *phronesis* proposed by the Jubilee Model, I argue that the Jubilee Model is specialized in describing what constitutes *phronesis* at the psychological level. On the other hand, along with the evidence underscoring the interconnected network-natured moral functioning, the Aretai Model explains how *phronesis* functions as the coordination and interaction among network nodes, i.e., the individual functional components. Consequently, these two models can address two aspects of the network of moral functioning, i.e., its constituents and inter-constituent dynamics, proposed by empirical science. Thus, they cooperatively explain the structure and interactive mechanism of *phronesis*.

In the following section, based on what I have explored regarding *phronesis* models with empirical evidence, I will briefly discuss how to cultivate *phronesis*.

Practical Guidelines for *Phronesis* Cultivation

So far, I have proposed that empirical evidence in neuroscience supports the standard *phronesis* models, i.e., the Jubilee and Aterai Centre Models. Network-based analyses have demonstrated that optimal moral functioning requires multiple functional components, so they support the main argument of the Jubilee Model, the multifaceted nature of *phronesis*. In addition, the network connectivity research suggests that robust network connectivity can explain moral expertise emphasized by the Aretai Model. Based on these, I will briefly discuss how we can cultivate *phronesis* by focusing on its constituents and their connectivity.

First, moral educators need to consider how to establish connectivity between individual functional components, i.e., moral reasoning, emotion, and motivation, rather

than merely concentrating on a single component. One functionally cannot exclusively generate ethical behavior given neuroimaging evidence. Instead, cognitive, affective, and motivational processes significantly interact and coordinate during the course (Althof and Berkowitz 2006). Thus, during moral education, educators need to teach their students skills for coordinating different functional components instead of focusing on one of them. For instance, in the case of service learning through volunteering, teachers may need to employ deliberation and reflection before and after service engagement (Dubinsky 2006). Students cannot have an opportunity to make the experience more meaningful by connecting motivational and behavioral components with cognitive and affective processes if their service learning activity ends at the end of volunteering. Such an integrative approach might be a way to promote long-term sustained prosocial engagement.

Second, educators may consider moral exemplars impactful sources for *phronesis* cultivation (Han 2023). Although I mentioned that educators should employ educational activities to promote connectivity and coordination between different components, it is hard to imagine how they might look. Moral exemplars, who do ethical behavior by implementing the integration and coordination among functional components in reality, can show us how to achieve such a goal with concrete examples (Damon and Colby 2013). By closely examining and discussing moral exemplars, we can study how their psychological processes work together during moral behavior. Given the network analysis of moral functioning showed more robust network strength is associated with greater prosocial engagement (Han 2024), moral exemplars likely demonstrate more robust inter-component connectivity than ordinary students. Hence, reverse-engineering and emulating their psychological processes can be possible educational methods.

Concluding Remarks

In this paper, I examined whether the standard models of *phronesis*, i.e., the Jubilee and Aretai Centre Models, can be supported by evidence in neuroscience. I focused on the evidence demonstrating the network-natured moral functioning at the neural level. Meanwhile, I discussed whether the evidence could address the concerns against the standard models raised by *phronesis* eliminativism. Neuroscience has shown that we should examine moral functioning and related psychological processes based on connectivity and coordination among networks constituting individual functional components, such as the DMN, SN, and CEN. Furthermore, I also explored how the two models can create a more integrative big picture of *phronesis* based on the evidence. Finally, I briefly discussed some practical suggestions for *phronesis* cultivation.

Although I proposed that evidence supports the validity and credibility of the standard models, more philosophically sophisticated accounts are out of the scope of this paper. As a psychologist and neuroscientist, my primary interest was whether neuroscientific and psychological evidence provides empirical support for the existing standard models. I hope moral philosophers interested in *phronesis* further develop their models and accounts based on what I overviewed and reviewed in this paper.

In addition, perhaps due to the multifaceted nature of *phronesis*, I had to examine the neural correlates and networks associated with moral constructs constituting *phronesis* rather than those of *phronesis* per se. Thus, even if we were able to see several network structures in moral and cognitive domains, such evidence might not directly reveal the network(s) of *phronesis* themselves. In future studies, it would be necessary to conduct psychological and neuroscientific experiments while employing measures and

experimental paradigms directly targeting *phronesis* as an individual construct to address this issue.

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