

Toward a Neuroscience of Wisdom

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1. TOWARD A NEUROSCIENCE OF WISDOM

Wisdom is a quality of human nature that has been discussed extensively throughout history, perhaps most notably by Aristotle. In modern times, however, despite being considered a pinnacle of human cognition, there has been little public discourse about wisdom or its importance in human enterprise and even less scientific study of wisdom, although in recent years this has been increasing. Furthermore, much of the scientific study of wisdom has focused on describing the components of wisdom and its association (or lack thereof) with age and not on wisdom as a unified construct or how wisdom may be cultivated in life, although this too has been changing in recent research. In general, wise decisions and actions go beyond being smart, clever, or knowledgeable—being wise requires the quality of *prudent* judgment based on reflection of the reasons and values underlying one's own and others' thoughts, motivations, and behaviors. Aristotle defined one kind of wisdom as involving practical decisions that lead to human flourishing (*phronêsis*) or well-being, grounding wisdom in a more prosocial notion of human well-being in terms of seeking the highest human good. On this view, which

is in line with modern philosophical and psychological descriptions, wisdom integrates a balance of cognitive and social expertise and knowledge.

In contrast to descriptions arising from ancient western philosophy, early eastern descriptions of wisdom, originating primarily from India and China, emphasized emotional balance. While there have been distinct differences in how wisdom was characterized between eastern and western cultures, there is also significant overlap in descriptions of wisdom, including aspects of prosocial consideration, gaining an understanding of oneself and others through careful reflection, value relativism, and tolerance.

The empirical study of wisdom began in earnest in the 1970s when psychologists began to make inquiries into the skills and dispositions that contribute to successful aging. Accordingly, the initial research on the association of age and wisdom has been driven by folk psychological intuitions that wisdom comes with age.¹ This makes intuitive sense, as each day that a person lives provides opportunities to gain and learn from experience, and these experiences may facilitate wisdom.² It appears then that age may be necessary but certainly not sufficient for wisdom. Emotional regulation and reappraisal are two characteristics that tend to improve with age and may account for

age-related increases in wisdom.³ Furthermore, research indicates that everyday practical wisdom increases with experience,⁴ which suggests that perhaps instead of age being necessary for wisdom, age may serve as a proxy for experience. We need to better understand the kinds of experiences that lead to wisdom. As wisdom research has developed beyond the scope of associations between wise reasoning and aging, investigation has shifted focus from the nature of context-general wisdom⁵ to focus on the practical applications of wisdom and wise reasoning to complex everyday situations.

Prior to the relatively recent emergence of multiple psychological theories, definitions, and descriptions of wisdom, the study of wisdom was largely the province of philosophy and religion. Today, wisdom research is increasing as researchers across a range of disciplines seek to understand positive human characteristics related to well-being and how such characteristics may be cultivated. Wisdom is inherently difficult to define, as reflected in the numerous psychological definitions that currently exist in wisdom literature, though this hardly makes wisdom not worth studying and reflects similar difficulties that existed in early intelligence research.⁶ While varied across research labs and modes of measurement, there are several commonalities among definitions, such as the need for a large base of pragmatic knowledge gained from life experience, self and other reflectiveness, and prosocial attitudes and behaviors. At the end of a research project supported by the John Templeton Foundation, referred to as the Defining Wisdom Project,⁷ a group of scholars and scientists proposed the following as a definition:

We distinguish wisdom from intelligence, cleverness, knowledge, and expertise. Wisdom requires moral grounding, but is not identical to it (i.e., wisdom must be moral but morality need not be wise). Wisdom can be observed in individual or collective wise action or counsel. Action or counsel is perceived as wise when a successful outcome is obtained in situations involving risk, uncertainty, and the welfare of the group. (We recognize that understanding the definition of a successful outcome is a substantial problem on its own.) Wisdom flexibly integrates cognitive, affective, and social considerations, but can be studied profitably by understanding its constituent elements. Because of the fundamentally multifaceted nature of wisdom, interdisciplinary discourse is extremely useful in advancing the research.

1.1 Roots of Wisdom Research

By Socrates' account, wisdom was an awareness of and humility toward one's own knowledge and its limitations. Aristotle further defined wisdom as an intellectual virtue of harmony between plan and action, without regret. He made a distinction between general wisdom, as it pertains to the knowledge of a god-like entity, and practical wisdom, which is gained through everyday experience and insights taken from one's own life.

In the Aristotelian view, wisdom is treated as an integrated trait reserved for persons who follow a virtuous development into *male* adulthood, though contemporary views tend to represent wisdom as a multicomponent characteristic distributed across the general population and not restricted to one or another gender.

Concepts of wisdom go far back into Eastern traditions as well, as ancient practices like Buddhism view it as one part of a series of attributes, trainable by contemplation, toward a path of enlightenment. Eastern philosophy tends to emphasize wisdom as having a strong component of emotional stability, compared to the strong emphasis on knowledge and cognition in Western philosophy. However, significant overlap between Eastern and Western philosophy exists in defining wisdom as including components of compassion, altruism, and insight. Present-day psychological models of wisdom are varied but have in common a core of attributes influenced by these ancient roots, including an extensive knowledge of the world and how it works, social expertise based in empathy, compassion, prosocial behavior toward others, and decision-making based on insights gained from reflection on oneself and others.⁸ By viewing wisdom as a synthesis of existing personal characteristics situated in specific but varying contexts and situations, early neuroscientific research into these characteristics, contexts, situations, and their interactions can help move forward an understanding of the neural bases for wisdom and wise decision-making.

1.2 Modern Wisdom Research

Ancient philosophers described the nature and function of wisdom, and in recent years, philosophers such as Tiberius⁹ have carried on this tradition, while contributing further to describe the process by which wisdom may be practiced and developed. Tiberius describes wisdom as knowledge and reasoning based on practical reflection on the reasons behind decision-making in situations that involve multiple conflicting values, in which wise reasoning should lead to the best possible outcome for the largest number of people. This description of wisdom is a process model that allows for the development of wisdom through life experience. Wise reflection takes into account one's own values and perspectives, as well as the values and perspectives of others affected in a particular situation or context. Determining the most appropriate or wise action relies on knowing what matters in a particular situation, presumably based on knowledge gained from life experience, awareness of the limitations of that knowledge, and based on sensitivity to one's own and others' emotions. In this way, wisdom may increase with experience, though the extent to which this relationship exists depends on the types of experiences that occur, the perspective taken toward knowledge gained,

and the ability to reflect on and tolerate multiple conflicting points of view. Wisdom as practical reflection on the values and reasoning behind beliefs fits well with psychological models of wisdom that have developed over the latter part of the twentieth and the beginning of the twenty-first century.

Following initial work by Clayton and colleagues to understand wisdom as it may relate to aging, the effort to measure and describe wisdom systematically was initially led by the Berlin wisdom group, which conceptualized wisdom as a sort of expert pragmatic knowledge system based largely in cognitive processes that develop with age. The Berlin group describes a multicomponent model of wisdom using data taken from responses to vignettes describing possible real-life social scenarios involving other people. This model includes five interacting parts including the following: (a) a rich and practical factual knowledge of the world and its complexities; (b) a rich procedural knowledge of strategies to solve problems related to life; (c) life span contextualization, or the ability to understand the varying contexts and temporal relationships of life; (d) a relativistic point of view, in which one has an understanding of individual differences in goals and values; and (e) a comfort with uncertainty and the ability to manage it. Researchers in this group have described wisdom largely by collecting from typical people and from individuals deemed to be wise based on responses to a “life-review problem.” Success in resolving such problems is determined by trained researchers who independently judge responses based on the Berlin model of wisdom.

Wisdom is not pragmatic knowledge alone, but also relies on balancing interpersonal, intrapersonal, and extrapersonal interests in order to come to a solution that strikes a balance between adapting to the existing environment, changing this environment, and selecting a new environment.¹⁰ In the context of group social affiliation and leadership, wisdom exists as a synthesis of intelligence—the ability to successfully adapt to the environment—and creativity—the ability to produce high quality, novel, and appropriate solutions for the task at hand.¹¹ Intelligence in this context refers to pragmatic intelligence, influenced by personal and social experiences, as opposed to abstract reasoning abilities, such as crystallized intelligence and working memory.⁴ Wisdom incorporates intelligence and creativity while maintaining its role as a unique attribute, as a wise person must make and carry out decisions on a balance between a need for change, requiring creativity, and a need to maintain the stability of existing environmental and social structures, requiring intelligence.¹² By this model, a wise person would necessarily be both intelligent and creative, but an intelligent or creative person would not necessarily be wise. Successful leaders, for example, require wisdom and the disposition to carry out wise decisions, in

addition to intelligence and creativity, to be successful in the long term. Consider that a leader who is intelligent in a relevant domain, and creative in their approach to problem solving, would require pragmatism and interpersonal sensitivity to ensure that wise decisions are carried out and are not only self-serving, but also take into account the greatest common good. These prominent models of wisdom suggest that the neuroscientific study of inter and intrapersonal intelligence, mental flexibility in the form of creativity, value relativism, and ambiguity tolerance, are good candidates for investigation in the study of the neurobiological bases of wisdom.

Personal wisdom varies largely across individuals and grows through life experience but can be described as the use of certain types of pragmatic reasoning skills that are prosocial and help to navigate and resolve important life challenges. Like the concept of multiple intelligences,¹³ wisdom may be conceptualized as a single construct with separable but overlapping dimensions.⁸ The cognitive dimension of wisdom is similar in part to Baltes’ definition of wisdom as a deep pragmatic knowledge of life,¹⁴ or to Socrates’ concept of epistemic humility—to be aware of and to acknowledge the limits of what one knows, an acknowledgment of the positive and negative aspects of human nature, and a willingness to work within the context of inherently limited and often ambiguous knowledge. Diminished emotional self-centeredness and a deeper understanding of others’ affairs characterize the affective dimension of wisdom, which is marked by compassion and overlaps with Aristotle’s concept of wisdom as, by definition, being tied with a virtuous disposition. The reflective dimension of wisdom is characterized by an increased accuracy in perceiving reality brought about by looking at it from many different points of view. Because it is associated with gaining a deep understanding of life and because genuine feelings of sympathy and compassion require perspective taking, reflective wisdom is said to be the most crucial dimension of wisdom, facilitating the cultivation of cognitive and affective wisdom.

1.3 Neurobiology of Wisdom

As wisdom is manifested in human thought and behavior within specific contexts and environments, it will be illuminating to understand the neurobiological basis of wisdom if it exists as a part of human psychology. One seminal overview¹⁵ of wisdom research outlines a broad set of brain regions associated in the processing of information related to characteristics aligned with the components of wisdom described above. Meeks and Jeste point out in their analysis that wisdom is a unique psychological characteristic and not merely a convenient label for a collection of desirable traits. In this synthesis

of the various extant models and conceptualizations of wisdom, the authors classified wisdom across six categories and mapped each domain to neurobiological substrates in order to facilitate future research into the neurobiological bases of wisdom.

Wisdom by this model is a stable but malleable attribute broken down to include: (1) prosocial attitudes and behavior, (2) social decision-making (i.e., pragmatic knowledge of life), (3) emotional homeostasis, (4) reflection and self-understanding, (5) value relativism, and (6) acknowledgment of and dealing effectively with uncertainty and ambiguity. The brain regions associated with these categories include frontal and parietal regions related to intelligence and reasoning,¹⁶ as well as cingulate and subcortical regions associated with affect and reward. The inclusion of cingulate and subcortical regions^{17,18} points to the importance of emotional self-regulatory strategies^{19,20} that bring about the emotional homeostasis needed for wise decision-making. More specifically, frontal and prefrontal regions interact with cingulate and subcortical emotional regions to downregulate emotion in contexts that require reason and prudent use of intelligence. While neuroscientific research into the components of wisdom—such as self and other reflection, moral reasoning, prosocial attitudes and behavior, and emotional homeostasis—indicate a large variety of unique and networked regions of activation,²¹ some (such as the medial prefrontal and cingulate cortex) appear particularly important for bringing together cognitive strategies and emotional regulation for the goal of wise reasoning.

If wisdom can be decomposed into constituent cognitive and affective components, future investigations of how these components develop and change in the specific context of wisdom and wise decision-making can provide insight into mechanisms by which wisdom is cultivated and how it affects reasoning and decision-making. Though the work to date has looked at how the different components have been studied largely outside of this context, the overall pattern is that wisdom arises as higher-order cognitive regions, such as the prefrontal cortex, work to regulate immediate reward and emotional processing in striatal and cingulate cortex structures. *Prosocial attitudes and behaviors*, for example, are associated with the putative mirror neuron system—frontal and prefrontal brain regions that show the same pattern of activation during both motor performance and observation—and cortical regions that show activation in response to simulating the mental states of others, a process related to Theory of Mind.²² It is important to note in describing associations between attitudes, behaviors, and associations of brain regions in functional Magnetic Resonance Imaging (fMRI)—given the nature of such research—findings presented here are merely potential avenues to explore the neural

underpinnings of wisdom components and may not represent direct mechanisms for the representation of wisdom in the brain.

Associations between *pragmatic decision-making* and neural activity in the medial prefrontal cortex overlap with that of prosocial attitudes and behaviors. In a study among business students who viewed moral and non-moral narratives,³¹ viewing moral narratives evoked greater activation in medial prefrontal cortex, as well as in the posterior central sulcus and superior temporal sulcus, than did nonmoral narratives. Wise reasoning often requires self-regulation of instinctual impulses in the pursuit of a greater good. As such, *emotional homeostasis* is brought about by a coordination of functional activity between prefrontal control and emotional regions in the cingulate cortex. Specifically, the dorsal anterior cingulate cortex (dACC)—believed to detect conflict between automatic emotional responses and more socially acceptable responses—coordinates with the lateral PFC—believed to coordinate responses in working memory that are perceived to be socially advantageous.²³ *Self and other reflectiveness* also relies on activation of lateral PFC regions, as studies of “Theory of Mind” suggest that this region allows one to inhibit one’s own point of view, in order to take on the perspective of others.²⁴ Furthermore, patients with lesions to this region are highly self-focused and exhibit difficulty in interpreting the social cues of others.^{25,26} The neural bases of *value relativism* are somewhat similar to those described for other wisdom-related characteristics. Automatic amygdala activation in response to the depiction of other races and ethnicities—depictions in which effort to overcome prejudice may contradict automatic emotional responses—is mediated by dACC regions that detect such conflict and lateral PFC regions that regulate reaction.^{27,28} A thorough understanding of these networks of regions, their individual characteristics, and cross-regional interaction is important for the development of a neurobiologically informed model of wisdom and wise decision-making.

While outlining how different regions of the brain are associated with components of wisdom does a great deal to help in understanding how it is represented in the brain, there is currently a lack of understanding of wisdom and its neurobiological foundation as a unified construct. If wisdom represents the regular joint action of automatic processing in regions like the amygdala, regions that are controlled upstream by higher-level cortical prefrontal and cingulate regions, and that wisdom develops as a practice of practical reflection contexts and situations of ambiguous information and interests, we would expect that there is an underlying network structure, albeit dynamically modified, that would relate to wisdom. The development of such a view requires emotional regulation abilities to manage negative emotions and stress during reasoning and decision-making that

may arise as one takes in personal and vicarious values in coming to an appropriate decision. As such, wisdom may be reflected neurobiologically by an increased functional and structural connectivity of the brain regions described above, implicated in social pragmatic decision-making, value relativism, emotional homeostasis, prosocial attitudes and behaviors, and the skill and disposition to reflect on one's own and others' beliefs.

1.4 Practical Wisdom

As described, it is commonly understood that wisdom encompasses thoughtful or pragmatic decision-making, compassion, prosocial goals, moral judgment, and insight into personal and interpersonal problem solving via practical reflection. As described by Tiberius,²⁹ wisdom depends on a process in which possible decisions or choices are evaluated in the context of specific value commitments, when those value commitments are grounded in the virtues. Wise decisions are made by being able to flexibly shift perspectives (as in taking another person's perspective or the perspective of another culture) and comparing the value commitments for other perspectives for making decisions. As such, wise decisions depend on epistemic humility (recognizing the importance of other value commitments, knowledge, and perspectives than one's own), on reflection (being able to think analytically about value commitments and perspectives, as well as engage others in discourse about these), perseverance and the willingness to engage in intellectual struggle to deal with difficult problems or choices, and cognitive creativity to seek solutions that may not be apparent. These are all very high-level psychological constructs that are rooted in the flexible use of attention, working memory, long-term memory, reasoning and problem solving, sophistication of language use and knowledge, social interaction and understanding, and emotional reasoning. Given that there is not a single language region, memory region, or knowledge region in the brain, understanding the neurobiological bases of wisdom will depend on the interaction of complex neural networks.

Wisdom can therefore be characterized as a complex psychological process that is related to interactions of higher-order processing in the cortex, emotional activity in cingulate cortices, and reward processing in striatal regions of the brain, as well as insula processing related to homeostatic regulation and, along with other regions such as the amygdala, sensitivity to risks and negative outcomes. To the degree that wisdom is considered the successful integration of thought and affect during decision-making, the discussion of potential neuroscientific models of wisdom is related to the way individuals make moral decisions based on a pragmatic knowledge of life and how such decisions are rooted in empathy,

compassion, and altruism. Given the need in wise reasoning to take on multiple conflicting points of view, emotional regulation is a critical component of wisdom, and such regulation is again rooted in the interaction of frontal, cingulate, and reward processing regions of the brain. Of particular interest is how individuals use self-reflection and other reflection and social interaction to overcome individual emotional reactions to stress and anxiety—owing to the uncertainty and ambiguity that exists in complex real-life problem solving scenarios, where personal values and those of others may come into conflict. Following a review of moral sensitivity and decision-making, prosocial attitudes and behavior, self-regulation and emotional homeostasis, self/other reflectiveness, and value relativism, this chapter will put forward ideas on how wisdom may be developed across the lifespan and how the components of wisdom may be synthesized into a neurobiologically unified construct.

1.5 Tying Practical Wisdom Philosophy to Psychobiology

After the dust settles following a particularly challenging situation, decisions are often judged as wise when they are shown to lead to the largest benefit for the greatest number of people over the long-term. Wise reasoning then depends on thought processes that take into account multiple points-of-view and an understanding of the larger third-person perspective. Reducing uncertainty and confusion in conflict resolution may require what philosopher Valery Tiberius²⁹ refers to as practical reflection. Such reflection must take into account not only the facts as they pertain to the context and situation, but also one's personal values and the possibly conflicting values of others. Taking into account the values of others is not just a matter of knowing what is important to other people—it also depends on feeling the impact of those value commitments. In order to realize that impact, it is important to be able to adopt someone else's perspective. As a result, wise reflection depends on flexibility in shifting perspective. In this way, reflection and perspective taking are central to wise reasoning, and both rely largely on the cognitive awareness of facts and contingencies, as well as on the subjective sense of possible affective outcomes of decision-making. This description incorporates psychological constructs of wisdom by requiring a strong pragmatic knowledge base, the ability to reflect on one's own values and the values of others, and the disposition to carry out reasoned decision-making with regard for social goods. Further, wisdom and wise reflection suggests a process by which wisdom could be practiced and cultivated.

In situations that require wisdom, decisions are based on value judgments. Values differ between and within groups of people. Therefore, people have some level of

consideration that their values are justified. However, as Tiberius points out,²⁹ sometimes this is just a sense that values are justifiable, which means that people sometimes accept what others around them do (perhaps through culture) and that there exists some justification that could be recovered in some fashion. Sometimes, justification simply occurs at a gut level through some intuitive sense from cultural exposure, but value justification can also be based on reflection from internal considerations, as well as from discussions with others. In general, this view suggests that we generally take a perspective in which one set of value commitments holds and for a reflective person, these value commitments frame the decision process. A wise person can go beyond this process, flexibly shifting perspectives to adopt or consider other value commitments than their own, and the value commitments of the wise person in some perspectives are grounded in virtues such as generosity or kindness. This does not necessarily mean that wise reasoning through practical reflection leads to objectively correct conclusions, but such reflection leads to decisions that are based on what is known and on a mental simulation of how outcomes of wise reasoning will play into one's own interests, as well as the interests of others.

Because the wise person takes into consideration the outcomes and prospects of his or herself, as well as those of others, wise decisions require moral sensitivity to understand the relativity of values across individuals. Such an understanding can facilitate outcomes of wise reasoning that lead to the greater good of all those involved in a particular situation or context. Moral sensitivity has been studied extensively using psychological and neuroscientific methods, the results of which characterize it as being paramount for decision-making that leads to the greatest benefit for self, others, and society as a whole.

1.6 Moral Reasoning

Wise reasoning relies on the ability to frame reasoning in the context of moral values not only from one's own point of view, but also from the perspective of other people and groups. The ability to use moral value commitments relies both on moral sensitivity and the disposition to carry out moral decisions. To balance decision-making in such a way as to account for personal goals and goals for a larger group or society as a whole, moral sensitivity and decision-making relies on autobiographical memories of past decision-making during moral conflicts, as well as on perspective taking to gain insight into possible outcomes of decision-making for others. Flexibly using one's own and others' perspectives and goals relies on both cognitive and affective systems in cortical and subcortical regions of the brain related to affect, intention, memory, perspective taking, and decision-making.

Moral sensitivity refers to the awareness of how different individuals or groups of individuals may be affected by the outcome of a decision based on a particular issue.³⁰ Given the overlap of personal experience and taking into account the perspective of others in making wise and moral decisions, it follows that neural regions underpinning moral sensitivity are those associated with autobiographical memory retrieval and social perspective taking processes.³¹ Moral sensitivity is itself a prerequisite for ethical decision-making, which is central to wise reasoning about human social behavior.

Functional magnetic resonance imaging, in which the metabolic activity of neurons and glial cells is used as a proxy for activation of large regions of neural tissue, points to three main brain regions as important for moral sensitivity.³¹ These regions include the medial prefrontal cortex (MPFC), the posterior cingulate cortex (PCC), and the posterior superior temporal sulcus (pSTS). The MPFC has been implicated in both implicit and explicit moral decision-making^{32–34} and is tied to self-monitoring behavior and self-referential processing. In contrast to self-referential processing, the MPFC with the temporoparietal junction (TPJ) is also associated with theorizing about others' states of mind, also known as mentalizing or Theory of Mind (ToM).³⁵ This implies that moral sensitivity may be a perspective taking process that involves both self-knowledge, as well as other knowledge and reflections.

The PCC has been linked to emotional evaluations of the appropriateness of responses to personal moral dilemmas³² and may serve as an interface between emotion and cognition.³⁶ It is possible that the PCC facilitates moral sensitivity by integrating emotional, cognitive, and affective memories of past moral conflicts. The pSTS and adjacent TPJ contribute to moral sensitivity by facilitating the integration of one's personal point of view with the point of view of others, which facilitates empathic emotions such as guilt and compassion.³⁷

Because it facilitates moral and ethical decision-making, moral sensitivity is an antecedent of wisdom, and its understanding may contribute to a greater discourse about wisdom in national and international enterprise. Its training may facilitate greater wisdom, particularly given that postconventional reasoning—principles of moral reasoning in which social good is placed above personal or selfish motives—has been shown to plateau during professional development unless ethics interventions are present. Professional enterprise may be considered a largely moral enterprise, and decisions taken in business that affect many partners and associates across a range of situations and contexts require wise reasoning, making it a critical environment for the practice of wise reasoning. Professional educational research suggests that moral reasoning may be trained through the implementation of ethics interventions in professional

education settings.³⁸ It is possible that the use of such interventions could generally impact wisdom, and future interdisciplinary research is needed to investigate this possibility.

1.7 Prosocial Attitudes and Behavior

As has been described, wisdom requires the processing of personal values and perspectives in coordination with the points of views and possibly conflicting values and perspectives of others. It follows that wise reasoning requires empathy and compassion in coordinating personal thoughts and behaviors with those of other people within a particular context or situation. Empathy is a feeling or sense of sameness between one's emotions and those experienced by others. Empathy may lead to prosocial behavior, but it could also cause the kind of distress that leads to disengagement from the empathy-inducing circumstance. Wise reasoning must strike a balance between dampening empathic distress while increasing empathic concern, so that feelings of vicarious distress do not interfere with social reasoning processes that may facilitate prosocial behavior.

Empathy can be broken down into cognitive and affective components, reflecting differences in the mental understanding and affective mirroring of others' thoughts, feelings, and intentions. The first step of cognitive empathy is in distinguishing one's own feelings, thoughts, and intentions from those of others. Following this cognitive distinction, one may imagine how another person feels or believes in a manner that will not overly tax one's own emotional state. With this imagined model of others' states of mind, it is then possible to extrapolate future thoughts, feelings, intentions, and behaviors. Though, to the degree that this mental model is built on one's existing understanding of the world and its workings, predictions will have varying degrees of accuracy. As an interaction of lower-level emotional processes in the automatic mirroring of others' emotions, and higher-level cognitive control of these reactions, empathy recruits affective regions in subcortical, as well as more highly evolved medial prefrontal regions that are implicated in the coordination of emotion and behavior.

Social situations involving multiple persons or groups—within uncertain and ambiguous contexts and in which the thoughts, feelings, and intentions of others in respect to the self may be very different—can give rise to negative emotional responses. For wise reasoning to take place, negative feelings in situations of ambiguity must be regulated and reflected upon, so that the most appropriate actions can be executed. Given the previous description of moral sensitivity as taking into account personal and vicarious points of view, the cognitive and emotional processes underlying empathy share neurophysiological bases with processes of moral reasoning.³⁹

In a meta-analysis of almost 80 studies, Seitz and colleagues⁴⁰ found that the MPFC, for example, plays a prominent role in multiple separable components of empathy. These components relate to cognitions, emotions, and intentions to act triggered by internal and external states of introspection and mentalizing. Furthermore, these processes are coordinated via functional connectivity between the MPFC and the anterior cingulate cortex (ACC), as internal thoughts and emotions and external circumstances may come into conflict during social interaction.

Mentalizing refers to the ability to identify and comprehend the beliefs, intentions, traits, and emotions of oneself and others,⁴¹ and core regions subserving these functions include the MPFC and the TPJ. Mentalizing is more than the mental simulation of others' thoughts and feelings and requires some conceptual knowledge of how the mind works.³⁵ Recent research has shown that mentalizing skills are stronger among individuals from interdependent cultures than among people from individualistic cultures, and these differences are likely due to a decreased self-centeredness and increased focus on the importance of others' thoughts, feelings, and motivations.⁴² While this does not speak to wisdom directly, these findings imply that wisdom may be manifested in different ways across different cultures.

Empathy may be central for the self-control of behavior, as it is thought to allow the subjective experience of others' mental and affective states,⁴³ which in turn informs present and future social behavior. Evidence suggests that the accomplishment of cognitive functions related to empathy is brought about by large-scale cortical networks through nodes of convergence that link info from different and varying sources. These nodes include the temporal pole, which gives access to knowledge of past experience; the superior temporal sulcus, which provides information about observed behavior; and MPFC, which serves to link cognitive information to basic emotion⁴⁴ and is recruited preferentially by mentalizing processes, but only very rarely for nonsocial executive functioning such as working memory and attention.⁴⁵ The social nature of wise reasoning and the differential use of the MPFC between social and nonsocial processing reflects the difference between wisdom and more commonly studied processes, such as intelligence and attention.

Humans are social animals, and virtually all actions, from external behaviors to internal thoughts and desires, occur in response to others.⁴⁶ As such, wise reasoning in social settings relies on empathy (which one may use to understand the feelings of others), compassion, or a feeling that motivates helping behavior. Vital to the development and sense of empathy is an awareness of others' emotions, as well as emotional regulation to maintain a self-other affective distinction.

As such, empathy is a complex form of psychological inference in which memory, knowledge, and reasoning are combined to yield insights into the thoughts and feelings of others.⁴⁷ Put another way, empathy incorporates a cognitive component of knowing what another person is feeling, an affective component of feeling what another person is feeling, and a behavioral component of intending to respond compassionately to the distress of others. However, not all empathic responses are cognitive, affective, and intentional, as sociopaths and patients with lesions to the MPFC may be capable of cognitive, but not affective, empathy, and even in the case that one feels and knows another's emotional state, this does not necessitate action to alleviate such vicarious distress. Furthermore, one may be moved to compassionate responding without affectively resonating with their pain.

To reason wisely, it is not enough to simply reflect the emotions of others and predict future outcomes based on these predictions. It is also important to reflect on one's own model of how the world works and how others work within it. This reflects the idea that an understanding of how the world and people within it work is never complete or accurate, and that only by careful reflection on one's own and others' internal states and external circumstances can one come to more accurately predict and prepare for the future. Such reflection on one's own internal state in comparison to others—in either case, these emotions may be dissonant—takes emotional self-regulation.

1.8 Emotional Homeostasis and Impulse Control

Emotional homeostasis refers to emotional stability in the face of uncertainty,⁴⁸ which is considered in the Ardel Three-Dimensional Wisdom Scale to be a part of the affective dimension of wisdom.⁴⁹ As it takes place by an interaction of cognitive and affective processes, emotional homeostasis is associated with functional changes in lateral and medial prefrontal cortices, as well as in orbital frontal cortices and the amygdala.¹⁵ Emotional self-regulation is associated with old age, such that positive affect increases across the lifespan.⁵⁰ Neuroscientific findings suggest that emotional regulation strategies change over the lifespan, as individuals in later life seek emotional homeostasis through cognitive regulation, regulate negative affect, and feel good in the present moment.⁵¹

It can be argued that those who become wiser in old age are those who can successfully regulate emotional responding in complex personal and social situations. Like other components of wisdom, such as moral reasoning, emotional homeostasis requires an interaction of both cognitive and emotional abilities, which is reflected in the interplay of corresponding neural substrates.

Specifically, emotional regulation is largely understood as a cognitive regulation of emotional appraisal and response through a dampening of emotional and impulsive responses in the ventral striatum by the prefrontal cortex.^{52–54} Evidence suggests that emotional regulation strategies are used without deficit across the lifespan, though the mechanisms by which these regulation strategies are carried out changes with old age.

One way in which negative feelings may be regulated in social conflicts, like those associated with wise reasoning, is through a strategy of cognitive reappraisal. Cognitive reappraisal refers to a flexible regulatory strategy that draws on cognitive control and executive functioning to reframe stimuli or situations within the environment to change their meaning and emotional valence.⁵⁵ These functions and processes are associated with activation within the PFC and the posterior parietal cortex.³² Recent research suggests that both young and older adults use cognitive reappraisal strategies, despite evidence of age-related declines in PFC volume.⁵⁶ However, reappraisal in old age appears to rely even more on PFC activation than in youth, particularly at points of peak emotional experience. Additionally, integration of PFC with other cognitive regulation regions, such as the ACC, is as robust in old age as in young adulthood.⁵⁷ This suggests that how people maintain emotional homeostasis changes over the lifespan, without degrading as with other cognitive functions.

Older and young adults similarly recruit the ACC when using cognitive reappraisal strategies, but the network of functional connectivity between this region and others is what appears to set older adults apart from youth.⁵⁷ The ACC plays an important role in emotional homeostasis, as its activation is associated with conflict detection. Functional connectivity in this circumstance refers to the network of regions that are similarly active with the ACC during moments of cognitive reappraisal. While both youth and older adults show ACC and PFC activation during cognitive reappraisal, unlike young adults, elders recruit regions associated with the inhibition of negative emotional reactivity in the lateral portion of the orbital frontal cortex. Younger adults recruit dorsolateral and dorsomedial cortices, which are associated with the manipulation of reappraisal in working memory and the monitoring of the success of cognitive reappraisal. As the affective dimension of wisdom is described, not only as an increase in positive emotions in the face of uncertainty, but also as a decrease in negative emotions,⁸ that older adults differentially recruit regions associated with the inhibition of negative affect compared to youths is in line with this view of wisdom. Experience with life problems and adversity across the lifespan may also lead to changes in the way that problems are represented in memory, such that older adults'

working memory is not as taxed in situations requiring wise reasoning.

1.9 Practice and Wisdom

As described in this chapter, wisdom develops with life experience, though the type of experience and reactivity of the individual in context is critical to the cultivation of wisdom. Wise reasoning seems to be invoked by the ability to reflect on one's own and other's thoughts, beliefs, and actions, by empathy, compassion, and prosocial behavior, and by epistemic humility—the Socratic notion *I know one thing: that I know nothing*. If wisdom may be increased by some intervention, this may occur by targeting specific components of wisdom that are thought malleable, such as perspective taking, compassion, and prosocial behavior. There are gender and cultural differences in perspective taking, which may inform ways in which perspective taking may be targeted for improvement, and recent research indicates that certain forms of contemplative practice may train key components of wisdom, such as compassion. Complementary to this research, our lab has shown that certain structured practices, such as meditation and even ballet, are associated with increases in wisdom. While research into the cultivation of wisdom by practice is only beginning, it holds great promise for the development of curriculum for the intentional teaching of wisdom.

The ability to take others' perspectives is vital to reflecting on others' points of view, which contributes to wise reasoning. Perspective taking is often linked to ToM, or the ability to take on the mental states of others to understand their emotions, motivations, and frames of mind, and how these differ from our own.⁵⁸ An extensive literature shows that these abilities develop during the preschool ages of three to five years old,^{59,60} and ToM and related skills continue to develop throughout life. While ToM skills develop similarly in all typically developing children, interdependent East Asian cultures tend to have increased abilities in ToM compared to individualistic cultures, such as those in Western countries. Further, gender differences in ToM that are evidenced in Western cultures, whereby females score higher on tests of mentalizing compared to males, are not as strong among East Asian cultures.⁶¹ Understanding the mechanisms by which these differences occur can help to inform future interventions aimed at increasing perspective taking and facilitating the reflective nature of wisdom.

Evidence that an interdependent point of view may lead to better perspective taking comes from research in which either Chinese or American participants were asked to follow instructions on how to move objects in a grid, following a director's instructions.⁴² Chinese participants in this study made fewer critical mistakes—mistakes that required perspective taking to avoid.

By careful analysis of decisions and reaction times, the authors were able to determine that increased perspective taking abilities stemmed from a focusing of attention toward others and away from the self. Given the Chinese culture of interdependence, increased perspective taking comes about because the self is defined by its relationship with others, increasing the importance of and focus on the role that others play, as well as of their actions, knowledge, and needs. Kessler and colleagues⁶¹ have additionally found that Westerners are slower than East Asians at tasks involving embodied perspective taking and show stronger gender differences in speed and depth of mental perspective taking. Taken together, these results suggest that individuals with a stronger ability to take on the thoughts, emotions, and motivations of others, rather than simply imagining their visual point of view are better perspective-takers and have increased associated social skills. It is possible that such increases are also associated with increased wise decision-making, though continued research must be conducted into whether this is the case.

One method by which perspective taking may be enhanced is by structured meditation practice. Participants trained in a secularized compassion meditation program (cognitive-based compassion training; CBCT) show increased empathic accuracy in the Reading the Mind in the Eyes Task (RMET), compared to an active control group.⁶² The RMET involves identifying the affect expressed in a series of black-and-white pictures of eyes, requiring the cognitive simulation of others' feelings from minimal visual cues, and performance has been shown to improve with the experimental administration of oxytocin,⁶³ a hormone associated with social bonding. Mascaro and colleagues claim that meditation could act as a behavioral intervention to enhance empathy by defending against deleterious nervous system responses during stressful or adversarial situations. If the meditation experience leads to increased understanding of others' emotions, which in turn increases interpersonal and prosocial interactions, this could indicate that it increases wisdom over a period of sustained practice.

Interventions based in the practice of loving-kindness meditation have also been used in recent years to facilitate increased compassionate feelings and responding. Recent interest in the experimental manipulation of compassion for the easement of suffering and promotion of prosocial behavior have deep roots in ancient contemplative practices linked to the cultivation of wisdom and cessation of suffering.⁶⁴ A steadily growing body of literature is building the case that brief compassion training may increase positive interpersonal skills and behavior, skills that are important for wisdom and wise reasoning. Further, these changes in interpersonal skills have been tied to changes in different networks of activation in the brain related to affiliation and perception of pain.⁶⁵

Some of the earliest studies of compassion provide evidence of increased wisdom-related skills and dispositions, such as increased support and implicit positive evaluation of others following compassion-state induction brought about by a brief loving-kindness meditation.^{60,66} In a study of loving-kindness meditation, participants who practiced only a brief meditation showed increased connectivity to and positive regard for others, compared to controls.⁶⁷ In a more recent study, in which participants played a social Simon task, which measures the integration of their own and others' perspectives in decision-making, practicing Buddhists showed greater self-other integration than non-religious controls.⁶⁷ Moreover, in a study that used magnetic resonance imaging (MRI) to measure cortical gray matter volume in expert meditators compared to novices, experts had greater gray matter volume in regions of the brain associated with affective regulation.⁶⁸ This suggests that increased social-connectedness, and subsequently increased compassion and empathy, are related to long-lasting effects of meditation practice over time.

More recently, compassion training has been associated with decreased negative affect in response to videos depicting others in distress—videos that previously elicited increased negative affect following a similar program to train empathy in the same participants.⁶⁵ The authors of this study used behavioral and neurobiological measures to suggest that compassion increases the ability to cope with distress not by suppression of negative emotions in response to suffering, but by the generation and strengthening of positive affect. This is in line with the concept of the wise individual as one who does not push away negative emotions, but instead sees things from a larger perspective in order to cope with a situation appropriately. Compassion training has further been associated with increased prosocial behavior in both laboratory-based and in real-world settings.^{68,69} This recent body of research holds promise for the development of programs to cultivate wisdom through compassion, possibly through long-term changes in regions of the brain associated with empathy, feelings of affiliation with others, and prosocial behavior.

Research from our own lab (in review) indicates that meditation and certain structured practices, such as ballet, are associated with increased cognitive, reflective, and compassionate dimensions of wisdom, as measured by Ardelt's Three-Dimensional Wisdom Scale (3DWS⁸). The association between wisdom and meditation is not surprising, given the above-described findings and historical associations between meditation and the development of wisdom in Buddhist and Taoist traditions.⁷⁰ The association between wisdom and ballet experience is more surprising, for while ballet requires great physical and mental self-regulation to excel to high levels of expertise, as a practice, it is not typically associated with wisdom or wise reasoning.

Meditation is generally associated with characteristics that have also been identified as essential components of wisdom, such as regulation of attention, self-control, and interpersonal understanding.^{15,62,71} Wisdom incorporates several interrelated characteristics that seem linked to meditation. For example, greater wisdom is associated with increased prosocial behavior, based around both self-reflection and compassion.^{8,72} Furthermore, the openness, curiosity, and acceptance of experience found in meditation is similar to several components of wisdom, including tolerance and value relativism, the development of pragmatic knowledge of life, and the ability to effectively deal with uncertainty and ambiguity.^{72,73}

Though the practice comes in many forms, meditation often involves the cultivation of characteristics belonging to a state of mindful awareness. These characteristics break down into self-regulation of attention and an investigative awareness characterized by openness, curiosity, and acceptance of experience.⁷⁴ This state of open awareness is thought to lead eventually to the acceptance of experiences that may otherwise cause stress, thereby allowing meditation practitioners to navigate life with lower anxiety and increased cognitive capacity in the present moment. In a study of focused-breathing meditation, for example, trained participants viewed both neutral and negative pictures significantly less negatively and were more willing to view optional negative pictures than were control participants,⁷⁵ suggesting lowered stress responses to negative stimuli. Research into mental training associated with meditation has been linked to lowered anxiety,⁷⁶ and lowered anxiety can in turn free up valuable cognitive resources like working memory (a short-term memory system involved in cognitive control). When working memory resources are disrupted by anxiety, performance can suffer,⁷⁷ but interventions that reduce worrying and decrease anxiety have been shown to boost cognitive performance.⁷⁸ Meditation practice may play a similar intervening role, in that lowering anxiety frees up mental resources, creating a reflective mental space that promotes wise decision-making.

The ability to deal successfully with hardship correlates with an increase in psychological health for elders identified as wise and may be a prerequisite for the development of wisdom.⁷⁹ By improving psychological health, it is possible that practicing meditation helps people deal with hardship in a more successful and wise manner. Meditation practice in general, and mindfulness practice in particular, is associated with improvements in psychological well-being, as evidenced by improvements across a variety of psychiatric disorders, such as depression, anxiety, and addiction.⁸⁰ Regular meditation practice then may provide psychologically healthy individuals with resources to handle a challenge rather than viewing it as a threat. It is also true that many people are attracted

to begin meditation as a means to deal with hardship, which suggests the possibility of a self-selection bias toward meditation favoring those who develop wisdom. Future research utilizing interventions among meditation for naïve individuals is needed to further understand whether meditation experience leads directly to the development of wisdom and over what time frame.

1.10 Conclusion

While wisdom has been a topic of discussion and debate among philosophers for thousands of years, wisdom research did not begin in earnest until the second half of the twentieth century, led by researchers interested in its association with successful aging.^{1,14,81} Such research gained momentum near the beginning of the twenty-first century, as a consensus grew toward a unified definition of wisdom, or at least wisdom as it exists within individuals. Of particular interest in the context of this chapter is the development of research into the neurobiological underpinnings of personal wisdom.

Based on a study of wisdom experts,⁸² there is now some agreement over what constitutes the characteristics of wisdom. In a development that promotes the unification of wisdom as a construct in the psychological literature, these characteristics largely fall into three categories that align with the cognitive, reflective, and affective dimensions of wisdom developed by Monica Ardelt⁸ for the Three-Dimensional Wisdom Model. A rich knowledge of life, skills in social cognition, tolerance of ambiguity, and acceptance of uncertainty, for example, map onto a cognitive dimension; a sense of justice and fairness, self-insight, and tolerance of differences among others belong to a reflective dimension; and characteristics that compose the affective dimension include empathy and social cooperation. In terms of relating wisdom to neurobiology, five of the characteristics described by wisdom experts also appear in a review of the neurobiological underpinnings of wisdom.¹⁵

Wisdom characteristics, notably prosocial attitudes and behaviors, social decision-making and pragmatic knowledge of life, emotional homeostasis, and self and other reflection, are facilitated by the coordinated effort of higher-order processing systems in the prefrontal and temporal cortices, the anterior cingulate cortex, and the ability of these regions to regulate otherwise automatic processing in deeper brain regions, such as the amygdala and ventral striatum, that are associated with fear, reward, and punishment. As noted by Tiberius,²⁹ it is possible that one may cultivate wisdom by practicing self and other reflection, but it is unclear at this time, at least from the perspective of psychological science, whether such practices lead to changes in wisdom, and complementarily, long-term changes in the neural substrates of wisdom characteristics: more empirical research is

needed. As an advance in wisdom research along these lines, we have shown that one form of structured practice, meditation, which tends to focus on self and other reflection, is associated with increased wisdom. However, future research is needed to better understand this relationship, and through what mechanism—such as by increased practice reflecting on oneself or others—meditation may affect wisdom.

Prior to the wisdom research of the latter part of the twentieth and the beginning of the twenty-first century, wisdom was largely ignored by science and was little spoken of outside of these research paradigms, perhaps because of the somewhat mysterious and fuzzy nature of wisdom as a topic. By understanding the underpinnings of wisdom, both psychologically as well as neurobiologically, it may be possible to develop interventions or classroom curricula that cultivate wise reasoning. As a nation that seeks to cultivate entrepreneurship and innovation, intelligence and creativity are prized characteristics. However, as has been described in this chapter, successful aging takes something beyond intelligence and creativity, specifically the wisdom to know when to apply intelligence and when to apply creativity in a prudent and prosocial manner.

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