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Moving from Humanities to Sciences: A New Model of Wisdom Fortified by Sciences of Neurobiology, Medicine, and Evolution

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> "A man is not called wise because he talks and talks again; but if he is peaceful, loving and fearless then he is in truth called wise."
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> — The Dhammapada: The Sayings of the Buddha (translated by Cleary, 1995)

We want to thank the Editor for the privilege of writing this commentary in response to the outstanding scholarly article by Grossmann, et al. in the current issue of Psychological Inquiry. We will begin with a general introduction to the topic of wisdom, followed by a brief summary of the Grossmann, et al. review, and then a discussion of our own model of wisdom, which is based on psychology, gerontology, and cognitive sciences, fortified by the sciences of neurobiology, medicine, and evolution. Toward the end, we discuss various unresolved issues in this arena, including some considered by Grossmann and colleagues.

Wisdom, like many of its multidimensional and sociologically complex brethren, was birthed in the humanities. Wisdom was initially conceived, and continues to be conceived by many, as a concept rooted in religions and spirituality as exemplified by the Book of Job (Achenbaum & Orwoll, 1991) and the Bhagavad Gita (Jeste and Vahia, 2008), as well as in philosophy, with Socrates and Confucius as its guardians. Until recently, wisdom was not studied empirically by the modern sciences. Wisdom is not alone in this category; several other constructs that were long considered "too fuzzy" for hard sciences have in recent decades undergone considerable empirical research following thoughtful and illuminating conceptualizations by the humanities. For example, philosophers and adherents to various religious sects across the world conceived and explored the concept of consciousness for

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literal millennia prior to the development of psychology and neuroscience. Hunt's (2007) history of psychology starts in ancient Greece, and captures thinkers like Seneca, St. Thomas Aquinas, Descartes, and Kant, all before arriving at any person we might now recognize as a psychologist. The separation of humanities and sciences used to be much less absolute. These distinctions grew in tandem with empiricism, and our ability to test more and more specific hypotheses with advancing methodology. Wisdom, like consciousness, emotion, cognition, stress, and resilience, can indeed be examined *via* both humanities lens and scientific lens (Jeste, Lee, Cassidy, et al., 2019). Moreover, the integration of these lenses can help drive our primary agenda: improvements in public health, well-being, and longevity.

The first empirical investigation on wisdom began in the 1970s, by pioneers in this field, Baltes and Smith in Germany (e.g., Smith & Baltes, 1990) and Clayton and Birren in the US (e.g., Clayton & Birren, 1980). Baltes and colleagues (Baltes & Staudinger, 2000; Staudinger & Glück, 2011) believed that wisdom was rare, and they proposed five criteria for defining it: deep knowledge of life's dynamic conditions; clear, context-based understanding about how to deal with these conditions; understanding how different elements of life interact; respect and humility for individual and cultural differences; and acceptance of uncertainty. Clayton and Birren proposed that wisdom had three specific components: an affective component including empathy and contentedness, a cognitive component comprised of knowledge and experience, and a reflective component consisting of intuition and introspection (Clayton & Birren, 1980). Ardelt expanded the latter model to conceptualization of wisdom as the integration of affective (or compassionate), cognitive, and reflective personality qualities that positively impacted subjective well-being (see Ardelt, 2011). Sternberg's balance theory postulated a balance across intrapersonal, interpersonal, and extrapersonal interests; short-term and long-term consequences; and environmental responses to help achieve common good (Sternberg, 1998). Vaillant's Harvard Study of Adult Development found that while wisdom and well-being were correlated among 80-year-olds, their predictors varied from openness to experience to greater emotional stability (Ardelt, Gerlach, & Vaillant, 2018). Blazer focused on practical wisdom (Blazer, 2014) and Cloninger studied associated personality characteristics (Zwir et al., 2019). A number of other researchers including, of course, Grossmann and his coauthors of the paper in this issue of *Psychological Inquiry,* have made major contributions to the science of wisdom.

Grossman and Colleagues' Review

Grossman and colleagues present an outstanding review of the concepts of wisdom, mainly from the fields of philosophy, psychology, cognitive sciences, and education. They also present the results of a mixed-methods survey of 44 international wisdom researchers, mainly from psychological science. We laud the authors' focus on relating working definitions of wisdom used in empirical research to key characteristics of wisdom for navigating life's challenges. The latter are akin to the ancient Greek construct of phronesis as well as the modern writings on practical wisdom. The authors also connect wisdom's moral aspirations to the meaning of common good. Based on their findings, Grossman, et al. construct a wisdom model for empirical sciences that combines the broad concepts of moral

aspirations with meta-cognitive skills. The moral grounding features include balance of self- vs. other-oriented interests, orientation toward shared humanity, and pursuit of truth. The meta-cognitive factors consist of context adaptability, perspectivism, dialectical and reflective thinking, and epistemic humility. The authors do an excellent job of distinguishing related constructs, such as (general) intelligence and emotional intelligence, which are necessary but not sufficient for wisdom. The review of empirical approaches to measuring wisdom and variations in the levels of wisdom among different individuals is comprehensive. The authors' recommendation for more research on the contribution of positive and negative life challenges to the development of wisdom is well taken. The discussion of unresolved scientific issues related to wisdom is thought provoking. Overall, this is a highly thoughtful and balanced review that will be invaluable to current and future researchers.

Our Model of Wisdom

One of the criteria for wisdom is acceptance of uncertainty and diversity of perspectives - meaning that there can be different, and often equally valid, ways of understanding and addressing complex issues. Congruent with that principle, we present our own model of wisdom, which overlaps in some respects with but differs in others from the Grossmann, et al. model. Our model is based on the fields of psychology and cognitive sciences as Grossmann et al.'s is, but also includes contributions from neurobiology, medicine (including psychiatry), and evolutionary genetics, with the ultimate purpose of harnessing wisdom to promote personal and societal health, well-being, and longevity.

Definition of Wisdom

Our group started work on wisdom about 15 years ago. In medical fields, which have traditionally focused on diseases and pathology, wisdom was (and in many places continues to be) considered a vague, abstract, and unscientific construct, based primarily in philosophy and religion. Interestingly, large segments of medicine have had similar near-dismissive notions about various other non-disease-focused abstract constructs like consciousness, emotion, stress, and resilience, that were thought to be defined indistinctly, and lacking objective measurement (a cornerstone of quantitative sciences), based on personal perceptions and cultural mores. Yet, today those constructs have become a part of medical practice and research, thanks to empirical biological and epidemiological research in recent decades. That history led us to consider wisdom from biological and public health perspectives. It is worth noting that by and large, psychiatry, a medical discipline, has been slower than psychology in incorporating positive constructs like resilience, optimism, and wisdom. Whereas Seligman and others popularized the concept of positive psychology beginning in the 1990s (Gillham and Seligman, 1999), the first paper on positive psychiatry was not published until five years ago (Jeste, et al., 2015).

We began by reviewing the published literature on existing definitions of wisdom, and found several common components listed below (Meeks and Jeste, 2009). Next, we completed a Delphi or Rand Panel study with about 30 international experts who had published papers or book chapters on wisdom to assess if wisdom was viewed as differentiable from intelligence

and spirituality, two of the concepts closely related to wisdom (Jeste et al., 2010). Despite a few overlapping features, these experts agreed that wisdom was distinct from both intelligence and spirituality; that wisdom is unique to the human experience; it is a component of advanced cognitive and emotional processes; and is a personality trait that can be measured, and is likely to improve over the lifespan. Intelligence and spirituality may be necessary but are not sufficient for acquiring wisdom. The components of wisdom specified by the experts were almost identical to those in our literature review. While this was reassuring, a question remained whether we were only tapping into the definition of wisdom as considered by modern (mostly western) investigators. Therefore, we decided to examine wisdom in an ancient Indian scripture – the Bhagavad Gita, which has been thought of as the religious and philosophical guide to wisdom since hundreds of years Before the Common Era (BCE). We conducted a mixed-methods qualitative-quantitative study of components of wisdom as described in the Gita, using an anthropologist as a consultant (Jeste and Vahia, 2008). We sought to determine the characteristics of wise (versus foolish) persons as noted in the Gita. We were surprised to find that most of these characteristics were similar to those we had found in our empirical literature review and Delphi study of scholars/researchers with expertise in the study of wisdom. There were a few differences such as an emphasis on love of God (in the deistic sense of that term) and denunciation of materialistic possessions in the Gita, in contrast to the modern western concepts; nonetheless, the similarities were striking. Based on all these sources, we proposed that wisdom may be defined as a multidimensional human trait containing several specific components: social decision making and pragmatic knowledge of life, pro-social attitudes and behaviors such as empathy and compassion, emotional homeostasis (with a tendency to favor positive emotions), reflection and self-understanding, acknowledgement of and coping effectively with uncertainty, and decisiveness (Meeks and Jeste, 2009). A later review found a few more components common to definitions of wisdom - spirituality, openness to new experience, and a sense of humor (Bangen et al., 2013).

Neurobiological Underpinnings of Wisdom

These notable commonalities among conceptualizations of wisdom across time and cultures suggested to us that wisdom may have a biological foundation. This led us to review the literature on neurobiology of wisdom. At that time, we did not find a single study titled “neurobiology of wisdom.” The likely reason was that most neuroscientists in the past did not consider wisdom as an empirical construct amenable to empirical methods. However, we did find a number of published papers on the neurobiology of individual components of wisdom such as empathy and compassion and their antithesis – antisocial personality. These neurobiological, especially neuroimaging and neuropathological, studies as well as relevant animal research revealed another notable finding. Most of the components included in our definition of wisdom seemed to be localized primarily in the prefrontal cortex and the limbic striatum (Meeks & Jeste, 2009). The prefrontal cortex is the primary player involved in emotional regulation, reason-based decision-making, theory of mind, affective empathy, and pro-social behaviors. These conclusions are supported by functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) studies that map the areas of increased brain activity during or in response to a task (e.g., making decisions, solving moral dilemmas) or emotional state. Parts of the limbic striatum (involved in the central reward

circuitry) are reportedly activated in social cooperation and altruistic tasks. Increased activity within the default mode network circuitry (the medial prefrontal cortex and the posterior cingulate cortex) has been thought to be important for self-referential processing. Complex decision-making processes such as with moral dilemmas and delayed rewards involve the dorsolateral and medial prefrontal, and orbitofrontal cortex. The anterior cingulate cortex has been found to be activated in utilitarian-based moral decision-making. One study found that people with higher scores on a wisdom scale had greater activation of the default mode network in response to moral and personal dilemmas. Studies have also shown that neurophysiological mechanisms seem to play a role in facilitating or inhibiting activities that are putatively related to components of wisdom - for example, dopaminergic and serotonergic activity in specified brain regions is critical to mood and impulse control, social behavior, and decision-making. More detailed and specific references to the various studies can be found in Greene et al., 2004, Meeks and Jeste, 2009, and Thomas, et al., 2019.

An important limitation of the above studies was that they sought to localize individual components of wisdom but not wisdom as an entity, to specific brain regions. Therefore, we sought out in the literature “experiments of nature” in which focal brain lesions or damage resulted in specific personality and behavioral changes that resembled loss of wisdom. For example, in one of the most famous cases in neuroscience, Phineas Gage, a construction foreman in Vermont, USA, in the late 19th century, exhibited marked changes in personality after sustaining an unusual brain injury from an iron rod that penetrated his skull and left frontal lobe, though the rest of his brain was relatively unaffected (Haas, 2001; Koenigs et al., 2007). In fact, Gage did not lose consciousness at the time of the incident, retained his speech and motor abilities, and lived for more than a decade afterwards. Prior to his accident, Gage was known as a disciplined, shrewd, and virtuous person. After the accident, he was described by his personal physician as a profane, impulsive, emotionally charged, and intemperate person with unpredictable behavior. Similar case studies of persons who suffered a traumatic brain injury (Adolphs et al., 1994; Cato et al., 2004) have reported evidence of localized damage in the prefrontal cortex and/or limbic striatum resulting in specific behavioral and psychological changes that indicate a loss of prosocial behaviors, emotional regulation, and self-reflection, accompanied by a decline in social and behavioral functioning. Clinically, fronto-temporal dementia or FTD (a form of dementia with onset typically during the fifth decade of life, with characteristic personality changes) and frontal lobe tumors that target the prefrontal cortex, produce symptoms of impulsivity, poor social or self-awareness, disinhibition, and apathy, indicating a loss of wisdom.

Based on all this evidence, indirect as it was, Meeks and Jeste (2009) proposed a putative model of the neurobiology of wisdom that involved specific parts of the prefrontal cortex and limbic striatum. Interestingly, it seemed to center on a balance of activity between phylogenetically newer regions (prefrontal cortex) and phylogenetically older brain regions (limbic system). Understanding these mechanisms will help us understand wisdom at its more basic level, and will also help identify how wisdom may develop and change with age.

A critical caveat that must be mentioned is that localization of mental functions in specific brain areas is only relative. The whole brain acts in concert, thanks to the billions of synaptic

connections. The current level of our neurobiological understanding of wisdom is in very early stages, and requires considerable more research.

Measuring Wisdom

Given the possible neurobiological basis of wisdom components, we sought to develop a new scale based on each of these entities - the San Diego Wisdom Scale (SD-WISE; Thomas et al., 2019). The SD-WISE is a 24-item scale that includes four items for each of its six subscales representing the wisdom components – i.e., Pro-Social Behaviors, Emotional Regulation, Self-Reflection or Insight, Tolerance / Acceptance of Divergent Value Systems, Decisiveness, and Social Advising. In the original study of this scale, participants included 524 adults living in the community, aged 25-104 years. They completed the SD-WISE along with two validated measures of wisdom, the 12-item Three-Dimensional Wisdom Scale (3D-WS-12; Thomas et al., 2017), and the 40-item Self-Assessed Wisdom Scale (SAWS; Webster, 2003, 2007). Factor analyses confirmed six factors. SD-WISE total scores demonstrated good to excellent reliability and both convergent and discriminant validity. SD-WISE scores correlated negatively with emotional distress, and positively with well-being. The effect sizes of these relationships were small, supporting the scale's measurement specificity.

Grossman and colleagues (this issue) correctly note that socially desirable responding is a drawback of self-report survey-based measures. Many people have some implicit or explicit interest in impression management that may impact survey response. To assess the impact of this confound in our testing of the SD-WISE, we used a measure of socially desirable responding (the Balanced Inventory of Desirable Responding, Short Version [BIDR-16, Hart et al., 2015]), which allowed us to evaluate the discriminant validity of the SD-WISE. SD-WISE scores demonstrated a stronger correlation with the BIDR-16 Self-Deceptive Enhancement subscale when compared to the BIDR-16 Impression Management subscale, which supports the scale's discriminant validity (Taylor et al., 2011). Overall, the SD-WISE had strong theoretical foundation, good to excellent psychometric properties, and ease of administration (self-administered, requiring 5 minutes to complete), making it a useful measure for wisdom research.

Wisdom and Aging

Eastern traditions consider wisdom as a characteristic of aging. However, empirical data suggest a more complex pattern. First of all, as Grossmann et al, note, to date there are no published longitudinal studies of wisdom using a validated rating scale; all of the data are cross-sectional. Age and scores on wisdom scales tend to be minimally correlated (Karelitz et al, 2010; Oxman, 2018). There is indirect evidence, however, that wisdom, on average, seems to increase from adolescence to early adulthood, but more research is needed to map such changes to social and neurobiological maturation factors (Karelitz et al., 2010). The trajectory in later life may more heavily depend on which component of wisdom is considered (e.g., cognitive vs. emotional), and the normal age-related changes in the underlying neurobiological substrates of those components, as well as acquisition of experience and better emotional regulation over the lifespan.

A number of cross-sectional studies suggest (but do not prove) that at least certain components of wisdom (e.g., emotional regulation, pro-social behaviors like empathy and compassion, self-reflection) are present to a higher level in many older adults compared to their younger counterparts. There are possible neurobiological explanations for this phenomenon. These include a) Posterior-to-Anterior shift of Aging (PASA) resulting in greater activation of prefrontal areas involved in wisdom, b) Hemispheric Asymmetry Reduction of OLD age (HAROLD) facilitating compensation for neuronal and synaptic loss with recruitment of additional neuronal networks, and c) a decrease in sensitivity of amygdala to negative or stressful stimuli in older people (Cabeza, 2002; Davis et al., 2008; Greenwood, 2007; Scheibe & Carstensen, 2010). While it has not been proven that such brain changes increase components of wisdom, they at least suggest that such an increase is compatible with the aging of the human brain. Wisdom of aging is not inevitable, however, as illustrated by some young but wise people, and some old but unwise individuals. It is likely that wisdom with aging is a phenomenon of healthy aging, seen in people who keep their minds, brains, and bodies active, allowing neuroplasticity of later life (Jeste and Oswald, 2014). In contrast to fluid intelligence, crystalized intelligence is stable or may improve over the adult lifespan until the 70s or 80s. One type of crystalized knowledge is expertise. The social advising component of wisdom may benefit from the expertise that comes with aging, particularly the increased experience and mature perspective that older adults have acquired in reference to a wide range of social dilemmas or situations (Salthouse, 1990). Emotional regulation may show a non-linear increase in early adulthood with improved executive control through the mid-life, and a decline in functioning during advanced age due to maturational and age-related changes in the efficiency and intregrity of the frontal-subcortical circuits of the brain underlying executive functions (Wiebe & Karbach, 2017).

Evolutionary Significance

While it is likely that wisdom as a multidimensional trait is uniquely human (or at least restricted to higher primates), certain components can also be seen in non-primates. In one study, we found that mice responded with behavior suggesting empathy when observing their peers under the type of stress that they themselves had experienced day before (Sanders et al., 2013). Other investigators have reported social modulation of pain as evidence for empathy in mice (Langford et al., 2006). Of course, interpretation of rodent behavior in human terminology is open to debate. There is, however, little doubt about presence of compassion in dogs, horses, elephants, and other higher order animals.

Wisdom of aging may have evolutionary value (Foster, et al., 2012; Narvaez, 2014; also see Jeste and Oswald, 2014). The loss of fertility (on top of increasing physical disability) with aging makes it difficult to reconcile increasing human longevity with Darwin's theory of survival of the fittest, which posits an end of life shortly after becoming infertile, as is seen among animals in the unprotected wild. A possible speculative explanation for the decades-long human survival after loss of fertility comes from the so-called Grandmother Hypothesis of wisdom, which is based on studies in bottle-nose dolphins, killer whales, and Seychelles warblers as well as in ancient tribes and modern human societies. These investigations show that when grandmothers help their daughters raise young children, the daughters live longer

and are more fertile than their mothers. In other words, while older women cannot reproduce after menopause, they can help the survival of the species by adding to the longevity and fertility of their daughters. It is also possible to argue that wisdom of aging may serve to compensate for declining physical health in older age. Some researchers have proposed that there are Grandparent Genes such as variants of APOE and CD33 that protect against heart disease and Alzheimer's disease, allowing older people to live longer with better functioning hearts and brains, thus enabling transfer of wisdom from older to younger generations (Schwartz et al., 2016).

There are empirical data showing that intergenerational activities improve health and well-being of both the generations and that when older adults are involved in helping raise children, there is a significant reduction in the incidence of behavior problems in childhood and adolescence (Attar-Schwartz et al., 2009; Barnett et al., 2010).

Importance of Wisdom for Health and Well-Being

Research from our group and others supports the link between wisdom and overall health, well-being, happiness, life satisfaction, resilience, and perhaps longevity. Our Successful AGing Evaluation (SAGE) study gathered data from 1,546 community-based adults without dementia, aged 21-100 years, who were selected using random digit dialing. The data included telephone interviews and in-home or online surveys. We found that although physical and cognitive function seemed to decline with age, mental health appeared to improve over the same time period (Thomas et al., 2016). A recent study of 661,880 adults aged 18 to 70+ from across the USA also reported a progressive reduction in subjective distress over the age range (Twenge, et al., 2019). This means that despite loss of physical and cognitive ability in older age, along with other losses that can adversely impact people, many find improved mental health and subjective well-being as older adults. In a subsample of 994 community-dwelling adults aged 51-99 years from the SAGE study, we found that greater wisdom, measured with the 12-item Three-Dimensional Wisdom Scale (3D-WS-12; Thomas et al., 2017), was associated with improved ability to handle adverse life events like losses (Ardelt & Jeste, 2018).

Wisdom in Serious Mental Illnesses

Given that wisdom tends to be associated with positive mental and physical health outcomes, it is possible that the inverse is also true: that having serious mental illnesses would be associated with impairments in at least some domains of wisdom. There are only two published studies in this area, to our knowledge. The first one assessed levels of wisdom based on the 39-item Three-Dimensional Wisdom Scale (3D-WS; Ardelt, 2003) and the Adult Self-Transcendence Inventory (ASTI; Levenson et al., 2005) among 46 men living in Canada and Pakistan, one-half of whom had high functioning autism and the other half did not have autism (Khan & Ferrari, 2018). The men with autism had lower scores in the reflective and affective (compassionate) domains of the 3D-WS compared to those without autism, but there were no significant differences in the cognitive domain or in scores on the ASTI. Additionally, when asked to nominate the wisest people among their acquaintances, the men with autism were more likely to nominate a friend compared to those without autism. Within the group of men with autism, Canadians displayed higher affective wisdom

both on the 3D-WS and in their qualitative descriptions of wise people compared to participants from Pakistan; although the sample sizes were admittedly small.

Recently, we studied 65 stable adult outpatients with chronic schizophrenia or schizoaffective disorder and 96 non-psychiatric comparison participants (Van Patten et al., 2019), using the 3D-WS-12 (Thomas et al., 2017). People with schizophrenia or schizoaffective disorder had lower wisdom scores compared to those without psychiatric diagnoses. Importantly, among people with serious mental illness, those with higher scores on the wisdom scale performed better on multiple cognitive tests than those with relatively lower scores, and the reflective wisdom domain (which represents unbiased introspection and perspective-taking) was significantly correlated with mental health variables including anxiety, depression, happiness, resilience, and optimism.

Interventions to Increase Wisdom

The literature illustrating the connection between wisdom and constructs like mental health and well-being in the community and in people with serious mental illnesses makes it clear that interventions targeting wisdom should be an important avenue to improve health and longevity. Different traits vary in their genetic and environmental determinations. Thus, intelligence is less malleable than resilience. Wisdom probably is closer to resilience than to intelligence in that regard. Several, though not all, randomized controlled trials (RCTs) have reported that emotional regulation, spirituality, and pro-social behaviors like compassion and self-compassion can be enhanced with psychosocial or behavioral interventions in people from the community as well as those with physical or mental illnesses, with medium to large effect sizes (Lee et al., in press). Enhancing components of wisdom is, however, not the same as increasing overall wisdom.

We found only two published studies reporting significant enhancement of wisdom. One of them was a pilot study of life-review intervention and PTSD treatment in two groups of Viet Nam veterans (Daniels, et al., 2015.). The other one is our recently completed trial of an intervention to improve resilience, wisdom, and perceived stress (Treichler, et al., 2020). This study is one of the first to test a psychological intervention in senior housing communities, delivered by trained but unlicensed residential staff; both of these elements increase its implementation viability and accessibility for aging adults. The intervention, labeled Raise Your Resilience (RYR), is a manualized group intervention that focuses on savoring, gratitude, and engagement in value-based activities. The study was a pragmatic trial with modified stepped-wedge design. Eighty-nine adults age 65 and over, from five different senior housing communities across three states in the US completed a one-month control period, followed by one-month RYR intervention, and then a three-month follow-up period without intervention. Treatment adherence and satisfaction were high; median completion rate of the assigned daily diary was 28 of 31 possible days. Although well-being scores did not change significantly, the scores on the scales for wisdom and perceived stress improved over the intervention period whereas those for resilience improved over the intervention + follow-up period. The effect sizes were small, probably due to ceiling effects because the sample had relatively high baseline scores on resilience and wisdom.

Nonetheless, this trial illustrates the potential for psychosocial interventions to promote wisdom in the real world.

Societal Wisdom

Grossmann, et al. begin by mentioning the recent increase in incivility, misinformation, distrust, and lack of ethical consideration. This raises a question whether there is such a thing as societal wisdom and if so, is it declining? We agree that this is an important issue (Jeste and Oswald, 2014). Even more than individual wisdom, societal wisdom is a highly complex construct. There are currently no definitions or criteria for societal wisdom, and therefore, no clear answer to the question whether societal wisdom is increasing or decreasing. Perhaps the answer is yes to both - societal wisdom is increasing in some ways and declining in other ways. On the former side are facts such as a remarkable reduction in murders, genocides, national invasions and occupations, autocratic rulers, and elitist societies with discrimination against women, disabled people, older adults, and racial/ethnic/religious minorities, etc., compared to the dark ages and middle ages (Pinker,2018), and even early to mid-20th century. While modern societies still leave so much to be desired, there are now at least debates on ways to increase diversity and ensure rights of the underserved and traditionally neglected segments of the communities.

On the other hand, we believe that the cause for concern from the viewpoint of societal wisdom is the escalating amount of stress impacting practically all the segments of the society, especially the youth. There is also a recent increase in political polarization and intolerance of diverse perspectives in many parts of the world. During the last three decades, there has been an epidemic of deaths of despair. In the US, deaths from opioid use, suicides, and social isolation have grown several folds, causing a drop in average longevity for the first time since the 1950s. A common factor underlying these maladies is loneliness, which is a widespread phenomenon well beyond the US borders, that is multi-determined, but with major contributions from globalization and ultra-rapid growth of technology (Jeste, et al., 2020, in press). In the UK, there is a new Ministry of Loneliness, and several other countries are contemplating similar steps.

Fortunately, there may be a silver lining to this crisis in the form of wisdom. We found a strong inverse correlation between loneliness and wisdom after controlling for various potentially confounding factors (Lee, et al., 2019). We have confirmed this finding in two other larger studies (unpublished data). The strongest inverse relationship of loneliness seemed to be with the pro-social behavior component of wisdom (empathy and compassion). We also conducted qualitative interviews with 30 older adults aged 65-92 years, living in a senior housing community, to understand their experience of loneliness, its common risk factors, and ways to prevent and intervene (Morlett Paredes et al., 2020). Although they were living in a housing community intended to avoid isolation, these residents described significant feelings of loneliness that were impacting their health and well-being. Several residents also described internal traits and external actions to change or cope with loneliness, many of which align with our model of wisdom: compassion, emotional regulation, acceptance of losses, and self-reflection. These results support our previous finding from the

SAGE study that wisdom can protect against the negative impacts of adverse events (Ardelt & Jeste, 2018).

While it is obviously unwise to generalize from limited research, these data provide an opportunity to consider wisdom – both at individual and societal levels – as a possible neutralizer of loneliness.

Unresolved Issues

Below we consider some specific topics from the Grossmann, et al. review that warrant further discussion.

State or Trait

We believe that wisdom is a personality trait – i.e., a relatively stable characteristic pattern of a person's thinking, feeling, and behavior. Wisdom does not refer to specific bodies of knowledge, as it is sometimes colloquially referred to, but rather to an individual who displays wisdom steadily over time in both their internal processes (e.g., thoughts, emotions) and external activities (e.g., behaviors).. Although people often mention wise decisions, a large majority of the published wisdom scales do not measure wisdom of decisions.

At the same time, the dichotomy between traits and states implied in comparing traits vs. states is not quite accurate. For example, loneliness is both a trait and a state. There are people who tend to be more lonely than others most of the time, yet such a person may be more lonely at one time than at another. Traits like resilience and optimism are only about 50% inherited, and wisdom may be similar. Furthermore, even the expression of inherited genes is affected by environment and behavior. A more nuanced understanding of these constructs is needed. For example, while loneliness as a state is understandable, it is also inherited as a trait in the form of sensitivity to social isolation and disconnection (Abdellaoui et al., 2018; Eisenberger, 2012). It is worth noting that in the Table 1 in Grossmann et al.'s paper, 11 out of the 15 measures listed examine wisdom as a trait. The fact that a person's behavior is partly determined by social and other contexts does not negate its being a trait. Optimistic people may become pessimistic under severe stress, and *vice versa*. Similarly, although intelligence is largely inherited, intelligent people may perform poorly when under duress or in different social contexts. As is the case for intelligence, it is also likely that there is a large range within which environmental, social, and biological factors can positively or negatively influence phenotypic expression of the genes (largely undetermined at present) relevant to wisdom.

Criteria for Defining Wisdom

An important limitation of subjective measures is socially desirable responding. However, this does not necessarily make subjective responses invalid. A large study of U.S. citizens living in different parts of the country found a highly significant correlation between self-rated quality of well-being with objective indicators of quality of life among people in the same region (Oswald and Wu, 2010). There was a strong region-by-region match between subjective and objective well-being, attesting to the validity of self-reports of personal constructs. Furthermore, the so-called objective ratings by other people are no less

subjective, as they are likely to be biased by the respondent's knowledge of and attitude toward the subject.

Another question is whether all the listed components of wisdom are equivalent. For example, pro-social behavior would seem to be a "must" criterion. The most intelligent person who meets all the other criteria for wisdom but is antisocial, cannot be considered wise. How essential is every one of the other components of wisdom?

A similar consideration relates to whether the whole is greater than the sum of its parts. Typically, the total score on a scale for measuring wisdom is computed by adding the scores on individual items. Alternatively, an average score is calculated by obtaining the mean of the scores on several subscales within the larger scale. Instead, should there be a global wisdom score? If so, who would determine it and based on what additional criteria?

Yet another issue is whether higher scores on a wisdom scale are necessarily better. For instance, should the wisest people have total emotional regulation – i.e., they don't have (or at least express) any emotion any time? This would seem not only impractical but also socially inappropriate. A wise leader or teacher should be able to feel and express sadness when encountering someone who just experienced a tragic event. Similarly, an overly compassionate person who gives everything away will not be able to survive for long and would not be around to help others with her or his wise advice. Wisdom is, therefore, not about total control over oneself, but rather about balance, insight, and the use of human experience for goodness. How do we determine those qualities?

Cultural Differences and Interventions

Grossman and colleagues reviewed the current literature on cultural factors and related context that may impact wisdom, finding differences in both concepts of wisdom by culture and differences by group on performance in measures of wisdom. This is an important area of study. At the same time, wisdom as a basic trait is probably similar across cultures, though the specific way in which it is expressed may vary. For example, emotional regulation (or at least expression of emotions) may be different between eastern cultures which prefer non-demonstrative behaviors in contrast to some, albeit not all, western cultures with high emotional expressiveness. Yet, most cultures would not favor extremes of emotionally expressive behavior as seen in instances of road rage on the highways. We believe that the basic construct of wisdom is similar across the cultures though the expression of specific behaviors may vary.

Likewise, despite cultural variations, interventions to promote wisdom may include similar strategies in different societies. As Grossman and colleagues write, the concept of ren or benevolence from the Confucian tradition in East Asian cultures can inform intervention strategies in today's western world. Arguably, we already see this occurring with interventions like Dialectical Behavioral Therapy (Linehan et al., 2006), which was explicitly based on Zen Buddhism and teaches principles like radical acceptance and acceptance of seeming oppositional ideas, and mindfulness-based therapies including Mindfulness-Based Stress Reduction (Gu et al., 2005), which teaches intentional but non-judgmental living, based on living in the present moment.

From Artificial Intelligence (AI) to Artificial Wisdom (AW)

Inspired by human intelligence, Artificial Intelligence (AI) has made significant impact on our daily lives. As indicated by its name, AI shares many characteristics with human intelligence although it is superior in terms of processing speed and pattern recognition, but lags in reasoning and new skill learning. The current AI is designed to handle only specific tasks, and therefore, considered narrow or weak AI. The expected acceleration of technological growth during the coming decades will likely to lead to the development of strong or broad AI or Artificial General Intelligence (AGI), which would be capable of the full range of human cognitive abilities (Gil and Selman, 2019). Beyond AGI, futurists have envisioned Superintelligence - an AI that exceeds all human capabilities (Bostrom, 2014).

There is excitement along with serious concern regarding the super-fast development of such AI technologies. However, the term “superintelligence” does not adequately represent the technological needs of advancing society, because intelligence alone does not guarantee well-being either for individuals or societies. It is not intelligence, but wisdom, that is associated with greater well-being, happiness, health, and perhaps even longevity of the individual and the society. Thus, the future need in technology is for artificial wisdom (AW), which will also serve to mitigate the risks associated with advanced Ais (Jeste, et al., 2020, under review). AW would be modeled after human wisdom and contribute to our understanding of wisdom by clarifying mechanisms or psychological underpinnings. AW development will require close collaboration among computer scientists and engineers, neuroscientists, mental health experts, and ethicists to ensure that AW is developed in a way that best complements and supports human lives. From a medical perspective, AW will be useful for facilitating access to better healthcare even for the most disenfranchised segments of the society such as mentally ill adults.

Wisdom Deficit or Loss as a Psychiatric/Medical Disorder?

Just as intellectual disability disorders are now a well-established category of psychiatric disorders, it is possible that wisdom deficit or loss might qualify for a medical diagnosis. As a matter of fact, a number of neurobehavioral disorders are already known to be characterized by impairments in components of wisdom. Examples include autism spectrum disorder with impairments in empathy in terms of theory of mind and perspective-taking, which can impact social behaviors; Fronto-Temporal Dementia (FTD) with loss of emotional regulation, compassion, self-reflection, and other components of wisdom; traumatic brain injuries with damage to prefrontal cortex or limbic striatum; and antisocial personality with lack of compassion.

There is a century of psychological, educational, and psychiatric research devoted to the science of behavior change. There is a need for empirical investigation of the application of such behavioral change methods to focused wisdom-enhancement efforts. Indeed, as noted above, psychosocial / behavioral interventions may be able to increase wisdom among those who would benefit from additional support (Lee, et al., 2020 in press; Treichler, et al, 2020).

The intervention aspect is of particular importance for the treatment of the disorders mentioned above. If brain injuries (e.g., the case of Phineas Gage) or diseases (e.g., FTD)

affecting specific regions of the brain can result in a loss of wisdom or at least a decline in some components of wisdom, can biological interventions to optimize the activities of those regions increase wisdom? There is a likelihood of developing not just psychosocial/behavioral but also neurobiological interventions like deep brain stimulation for the treatment of the people affected. Of course, it will take years if not decades before such interventions become a reality.

A concern for the societies of the future will be: if and when biological interventions to enhance wisdom are developed, could some people use them for enhancing wisdom in the general population? The answer should be an emphatic NO, because a wise society needs diversity in various ways. As we learn more about wisdom through different cultures, we also benefit through neurodiverse people. People who are disabled physically, mentally or socially should be as integral and equal members of the society as those without disabilities.

We want to stress that we are not suggesting "medicalizing" the field of wisdom, with the word "medicalizing" being used to connote pathology or dysfunction. At the same time, we should consider that it is the society's obligation to treat people who lack or lose wisdom because of diseases or injuries and want to be helped.

Conclusion

Wisdom has been an important construct in religion and philosophy for millennia, academic humanities for centuries, and in the last several decades, in psychology and gerontology. In recent years it has also begun attracting scientists from biological sciences, such as medicine, genetics, neuroscience, evolution, as well as in engineering and computer science. These developments are exciting because as one of the pinnacles of humanity, wisdom indeed deserves study by all human-focused sciences. Not only will the sciences help us understand wisdom better, but in the process those sciences themselves may become wiser.

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