THE ONTOGENETIC COURSE AND MULTICOMPONENT NATURE OF WISE REASONING ACROSS THE ADULT LIFESPAN: PERSPECTIVES FROM NEUROPSYCHOLOGY

BRI SUSANNA DARBOH

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Abstract

Wisdom has long been revered as a desirable feature of aging in theoretical, folk, and lay discourse. In recent decades, there has been a surge of empirical psychological research on the association between wisdom and age, including the underlying cognitive mechanisms that may contribute to its expression. However, this remains an ongoing area of debate, with diverse and often conflicting views reported in the research literature. Further, less is known about how the cognitive architecture of wisdom may differ in younger and older adults. The current work aimed to empirically examine whether 'older is wiser', and the cognitive and neural substrates associated with wise reasoning in younger and older adulthood.

We begin with a systematic review and meta-analyses to quantify the current consensus in the literature regarding the relationship between general (insight into life in general) and personal (insight into oneself) wisdom with (i) cognition (Study 1) and (ii) age (Study 2). Study 1 included 22 studies for which outcomes were categorized into six cognitive domains to facilitate domain-specific meta-analyses: i) crystallized intelligence, ii) fluid intelligence, iii) general intellectual functioning, iv) memory, v) attention, and vi) executive function. We observed a significant positive effect of crystallized and fluid intelligence on wisdom, with the most robust effects observed for crystallized intelligence. Aggregate effect sizes in the remaining cognitive domains were null. Study 2 included 52 studies to examine the relationship between wisdom and age. There was a significant positive effect of age on wisdom, with larger effects observed for general versus personal wisdom.

Extending from these systematic reviews we next conducted two empirical studies. First, we examined associations among wisdom, age, and specific aspects of cognitive function implicated in wise reasoning (leveraging findings from Studies 1 and 2) in 344 neurologically

healthy younger (n = 181) and older (n = 163) adults (Study 3). While older adults scored higher on measures of self-reported personal wisdom, performance-based general wisdom was stable across the adult lifespan. Memory was a stronger predictor of general than personal wisdom in the combined, young, and older adult samples, and this association was more robust in older adults.

Finally, in an exploratory analysis (Study 4), we examined relationships among wisdom, memory, and brain function (resting-state functional connectivity) in 286 neurologically healthy younger (n = 157) and older (n = 129) adults. General wisdom was associated with greater integration among frontoparietal (CONT) and default (DN) subnetworks than personal wisdom in the combined age sample. General wisdom in older adulthood was associated with more robust network dedifferentiation than in young, while the opposite pattern was observed for personal wisdom (i.e., greater within-network connectivity of CONT and DN regions in older than younger adulthood).

Taken together, these findings illustrate that older *may be* wiser, and critically depends on the problem-solving context (intra-personal versus extra-personal). Moreover, our findings provide converging evidence that personal and general wisdom are discrete abilities, with distinct age-related trajectories, cognitive determinants, and underlying neural architectures.

Dedication

This dissertation is dedicated to my mother and father, Juliana and Raphael Darboh, whose boundless and ever-expanding wisdom was the inspiration for my interest in this work. Thank you for showing me that the limit *far* exceeds the sky. I am profoundly grateful for your unwavering support.

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This dissertation represents the culmination of years of hard work and dedication from all of these individuals and more. Their contributions have left an indelible mark on this project and on me. I am immensely grateful for their presence in my life.

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CHAPTER 1: OVERVIEW OF CURRENT WORK

1.1 A GLOBALLY AGING POPULATION

The global population is rapidly aging, with predictive models suggesting that the older adult segment of the population will expand to more than 2 billion worldwide by the year 2050, accounting for 22% of the world's population—more than double the proportion observed in 2015 (World Health Organization (WHO), 2022). Alongside this sociodemographic shift, the demand for healthcare services is expected to rise in concert with the greater health-related support that is characteristic of older adulthood (Globerman, 2021; WHO, 2022). Given these shifts, there is a critical need to enrich our collective understanding of how to effectively promote health and well-being throughout the later stages of life. This imperative extends to both the broader perspective, such as health systems, as well as the individual level, encompassing personal well-being. An integral aspect of this initiative will entail conducting comprehensive, multidisciplinary scientific investigations into the complexities of aging, of which neurocognitive outcomes and interventions will continue to be a primary focus.

Is aging simply synonymous with decline? Historically, Western society has been characterized by a zeitgeist that adopts a declination model of aging, suggesting that growing older is a time associated with loss in function rather than gains (Baltes & Staudinger, 1993; Ng & Lim-Soh, 2020; Spreng & Turner, 2019). This perspective is deeply intertwined with ageism, a prevalent theme that perpetuates negative stereotypes about older adults, undervaluing their contributions, while promoting youthfulness as the ideal (Ayalon & Tesch-Römer, 2018; Palmore, 2005). This societal framework manifests in a variety of domains, such as healthcare, employment, media representation, and interpersonal contexts, all of which synthesize to facilitate exclusion, marginalization, diminished opportunities, and ultimately, the risk of

reduced well-being in older adulthood (Ayalon & Tesch-Römer, 2018; Freeman et al., 2016; Levy & Macdonald, 2016). Such ingrained biases not only undermine the dignity and rights of older adults, but also hinder the recognition of one's potential for growth and valuable traits that may actualize in later life (Ayalon & Tesch-Römer, 2018; Palmore, 2005; Levy & Macdonald, 2016; WHO, 2021).

1.2 CHALLENGING THE DECLINATION MODEL OF NEUROCOGNITIVE AGING

From a cognitive perspective, there is a growing body of literature on neurocognitive aging suggesting that the declination model of aging is incomplete. Indeed, the study of neurocognitive aging has witnessed significant developments in recent years, challenging conventional models that portray aging as a process characterized solely by cognitive decline (Spreng & Turner, 2019). Rather, empirical evidence suggests that the full spectrum of cognitive aging is characterized by both gains and losses, reflecting a shifting cognitive architecture from younger to older adulthood (Park et al., 2001, Figure 1.1). Critically, we predict that this shift may serve to promote wise reasoning into older age, both behaviourally and at the level of brain function. The following sections provide a brief overview of the shifting cognitive architecture hypothesis, and parallels with functional brain changes. The concluding sections of Chapter 1 connect these models of neurocognitive aging to the primary focus of this dissertation (i.e., wisdom), setting up the studies and hypotheses that form the core of this research program.

The Duality of Fluid and Crystallized Intelligence

Two widely studied domains within the realm of neurocognitive aging are fluid and crystallized intelligence. Fluid intelligence, or cognitive control, comprises activities that engage goal-directed (controlled) processing, with minimal reliance on declarative knowledge from prior

learning (e.g., formal and informal education, accumulation of experiences throughout life) (Carpenter et al., 1990; Cattell, 1971). Fluid capacities are implicated in one's ability to inhibit distraction, recruit relevant cognitive resources, and modulate attentional resources in service of goal-directed behaviour (Carpenter et al., 1990; Cattell, 1971). Critically, fluid intelligence underlies one's ability to flexibly navigate and adapt to *novel* contexts (e.g., abstract or creative problem-solving, adapting to new technologies, solving complex problems), characterized by Cattell (1967) in his seminal work as the capacity "to perceive relationships independent of previous specific practice or instruction related to those relationships." (p. 8). In contrast, crystallized intelligence encompasses one's repertoire of semantic knowledge accrued over the lifespan (Cattell, 1971). In direct opposition to fluid capacities, crystallized abilities leverage the *familiar*, recruiting accumulated knowledge and skills acquired from prior learning to support action (Cattell, 1963; Cattell, 1971). These include routines, habits, and schemas (Spreng & Turner, 2019). Crystallized intelligence may be reflected in one's knowledge of vocabulary (Cattell, 1963), historical events, general facts, or expertise in a specific field (e.g., psychology, medicine, law) (Sternberg, 1999).

Distinct Age-Related Trajectories of Fluid and Crystallized Cognitive Capacities

One of the leading evidence-based theories in the field of neurocognitive aging is that fluid and crystallized abilities demonstrate discrete developmental courses across the adult lifespan (Park et al., 2001). Specifically, it is well-established that fluid intelligence (cognitive control) tends to peak in one's early twenties and exhibits linear declines thereafter into older adulthood (Park et al., 2001; Verhaegen & Cerella, 2002). On the other hand, crystallized intelligence has reliably demonstrated stability and/or gains into late life (Park et al., 2001; Verhaegen, 2003). As depicted in Figure 1.1, the architecture of cognitive functioning undergoes

a marked shift in mid-life, in which tasks that rely on cognitive control and processing speed (i.e., fluid intelligence) show stark performance declines with age (e.g., pattern comparison), while performance on tasks that are more dependent on semantic memory and general knowledge (i.e., crystallized intelligence) is relatively well-preserved or improved with age (Park et al., 2001).

In line with this phenomenon, evidence has demonstrated that there is an age-related shift towards a greater reliance on semantic memory and knowledge to support goal-directed behaviour in older adulthood—hereafter referred to as 'the semanticization of cognition' (Spreng & Turner, 2019; Turner & Spreng, 2015). This shift has been conceptualized as a compensatory mechanism in the context of attenuated cognitive control with increasing age—that is, older adults recruit crystallized abilities (semantics) during goal-directed behaviour to compensate for normal age-related decline in fluid (cognitive control) capacities (Craik & Bialystok, 2006). The semanticization of cognition in older adulthood has far-reaching implications across various cognitive domains and in real-word scenarios, representing a complex interplay of context-dependent benefits and costs with respect to functional capacities in later life (Spreng & Turner, 2019, 2021, and see Chapter 3).

Figure 1.1

A Shifting Cognitive Architecture Across the Adult Lifespan

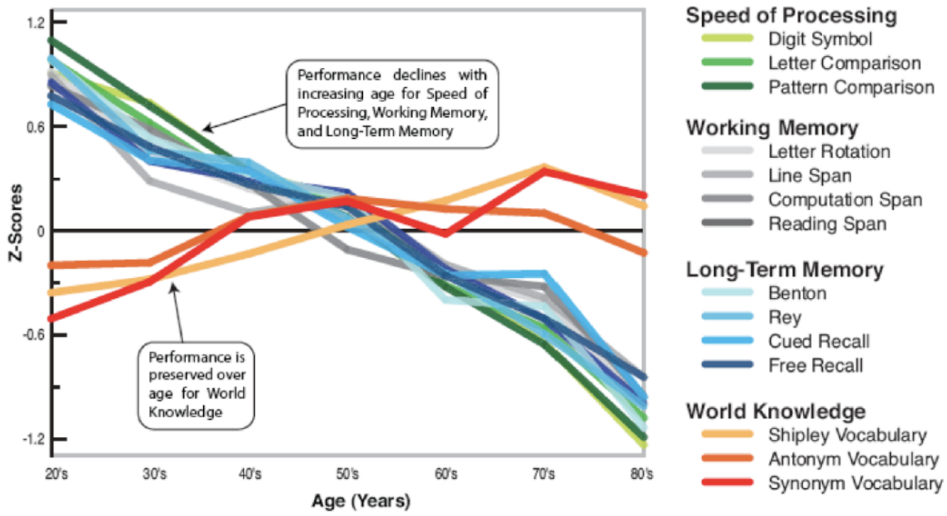


Figure 1.1. Fluid cognitive abilities (cool coloured lines) show linear decline across adulthood. In contrast, crystallized cognitive abilities show increases well into later life. These dual trajectories result in a shift in the fundamental architecture of cognition from younger to older age (reproduced from Park et al. 2001).

The Shifting Neural Architecture of Cognition with Age

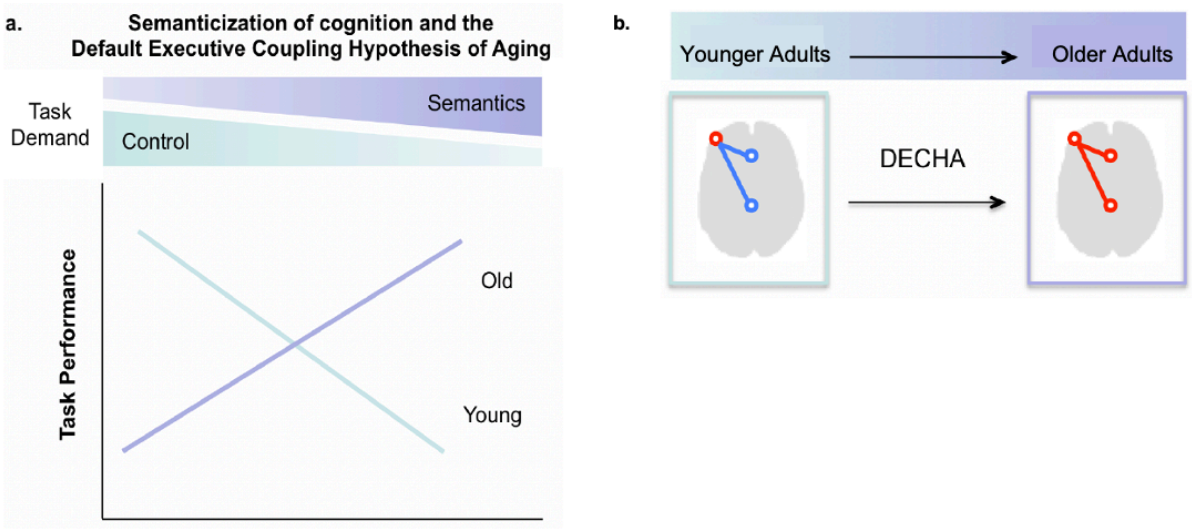
Paralleling cognitive changes at the behavioural level, divergent age-related trajectories have also been observed in the neural substrates associated with fluid and crystallized capacities, including both structural and functional brain changes in older adulthood (Spreng & Turner, 2019, 2021; Turner and Spreng, 2015). With respect to brain structure, healthy neurocognitive aging is characterized by changes in grey matter, white matter, and ventricular volume, with the lateral prefrontal cortices (critical for cognitive control) and default network (implicated in access to stored – or crystallized – representations of oneself and the world) being especially susceptible to structural brain changes (Andrews-Hanna et al., 2012). From a functional perspective, with age, brain networks demonstrate greater dedifferentiation (i.e., more integration), wherein network configurations exhibit a growing lack of specialization and

become more interconnected (Setton et al., 2023). This manifests as reduced connections within networks, coupled with an increase in between-network connections (Chan et al., 2014; Geerligs et al., 2015), which are poorly modulated by task demands (Damoiseaux, 2017). Through this lens, brain regions and assemblies of functionally-connected regions, once associated with distinct cognitive functions, may become less distinct with age. Two of the most prevalent and widely investigated patterns of functional brain changes with age involve: (i) heightened recruitment of prefrontal cortical regions associated with cognitive control, especially the lateral prefrontal cortex (Grady, 2012), and (ii) diminished suppression (i.e., increased activation) of the default network regardless of task context (Grady, 2012; Andrew-Hanna et al., 2014).

Taken together, these hallmark patterns of neurocognitive aging form the basis of the 'Default to Executive Coupling Hypothesis of Aging' (DECHA), which argues that lateral prefrontal engagement and reduced default network suppression are functionally and inflexibly coupled in older, but not younger, adulthood (Turner & Spreng, 2015). The paradigm is grounded in the theory that as cognition becomes increasingly semanticized in older adulthood, the DECHA mechanism is recruited in service of declining cognitive control resources (regulated by lateral prefrontal cortices in young), representing a discrete framework for supporting goal-directed cognition in older versus younger adulthood (see Figure 1.2).

Figure 1.2

The Semanticization of Cognition in the Context of the Default to Executive Hypothesis of Aging



Note. Adapted from Spreng & Turner, 2019

Figure 1.2. **Panel A**. Shifting task demands, from controlled processing to greater reliance on semantics (prior knowledge), impacts task performance differently for younger and older adults. When control demands are high, there is a relative performance benefit for young (leftward aspect of the graph). As prior knowledge becomes more goal relevant, the performance advantage shifts to older adults (rightward aspect of the graph). **Panel B**. Brain schematics represent the Default to Executive Hypothesis of Aging. Left schematic reflects greater reliance on cognitive control processes in younger adulthood. This is associated with engagement of lateral prefrontal brain regions (red circle) and suppression of default network brain regions (blue circles). Blue lines reflect negative functional connectivity between default and executive regions (i.e., greater frontal activation in the context of default network suppression). Right schematic reflects greater reliance on prior knowledge in older adulthood. This is associated with increased and positive functional connectivity between lateral prefrontal regions and the default network. It is hypothesized that this pattern of increased functional connectivity serves as a neural network mechanism promoting the semanticization of cognition in later life.

1.3 WISE REASONING: CONTRADICTING THE DECLINATION MODEL?

Despite the prevailing ageist views in Western society, long-held adages have highlighted a specific positive attribute that tends to emerge in later life—the idea that with age comes wisdom. Indeed, the association between wisdom and age has pervaded time across theoretical and folk literature, evident in the archetype of the ‘wise elder.’ In recent years, there has been a

flurry of psychological research that has sought to empirically investigate the phenomenon of wisdom, revealing its potential benefits in older adulthood, including gains in life satisfaction (Ardelt, 1994, 1997). Further, investigations have begun to demonstrate how wisdom may mitigate some of the adverse phenomena associated with aging, such as late-life depression or fear of death (Staudinger & Glück, 2011b). However, questions remain about how one attains wisdom and the factors that influence its manifestation. There is a novel and timely opportunity to delineate our understanding of this ancient concept to support the promotion of successful aging. The current work ascribes a neuropsychological framework to examine the construct of wisdom (hereafter interchangeably referred to as wise reasoning) as it relates to age, including underlying cognitive and neural correlates that contribute to its expression in consideration of the seminal models of neurocognitive aging outlined in Section 1.2.

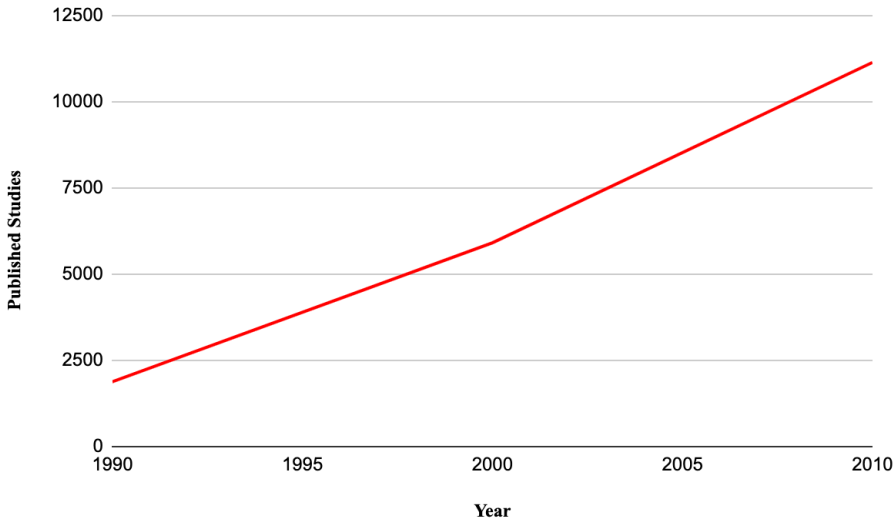
The Rise of Scientific Inquiry into Wisdom

For millennia, wisdom has captivated the minds of philosophers and theologians, while scientific disciplines have historically regarded the construct as too elusive to empirically investigate (Aristotle & Henry-Lewes, 1890; Baltes & Kunzmann, 2003; Glück & Bluck, 2011; Shields, 2020). At the core of philosophical conceptualizations of wisdom is the notion of an optimal integration of mind and virtue (i.e., high moral standards) and the contemporaneous synthesis of knowledge with character (Baltes & Kunzmann, 2003). Erikson's (1959) model of lifespan psychosocial development marked the earliest efforts to study wisdom from a psychological framework. The model proposes that successful navigation of the final stage of human development, marked by the conflict between ego integrity and despair, culminates in the realization of wisdom (Erikson, 1959). Since then, the dawn of the 21st century ushered in a new era for scientific exploration into wisdom, leading to a surge of psychological research within the

realms of social and cognitive sciences. This significant shift has resulted in a rich psychological archive devoted to the study of wisdom, with momentum steadily increasing over the past three decades (see Figure 1.3). This growing interest in the study of wisdom reflects the evolving recognition of its importance within the field of psychology.

Figure 1.3

Frequency of Psychological Wisdom Research Since 1990



Conceptualizing and Assessing Wisdom: An Ongoing Challenge

The Oxford English dictionary defines wisdom as the "capacity of judging rightly in matters relating to life and conduct; soundness of judgment in the choice of means and ends; sometimes, less strictly, sound sense, especially in practical affairs: opposed to folly." (Oxford English Dictionary, 1926). While there is limited consensus on a single, all-encompassing definition of wisdom in the psychological literature, there is strong agreement that it is an exceedingly complex construct that is dichotomous in nature, comprising both personal (insight into oneself, i.e., personal wisdom) and general (understanding of life in a broader sense, from an

observer's perspective, i.e., general wisdom) knowledge stores (Glück & Bluck, 2011). In recent decades, theories have organically fallen into three overarching conceptual categories of wise reasoning: (i) developmental (related to mature personality development in adulthood, e.g., Erikson, 1959), (ii) cognition-focused (centred on a comprehensive knowledge base about life matters and procedures, e.g., Baltes & Staudinger, 2000), and (iii) integrative (focused on the synthesis of cognition, affect, and metacognition, e.g., Ardelt, 2004).

Unsurprisingly, the heterogeneity amongst conceptualizations of wisdom in the field has presented a significant challenge in the development of gold standard measurement tools. Despite these hurdles, there have been concerted efforts in recent years to develop empirically validated assessments of wisdom. Several of these have become well-established and widely used in the literature, including self-report (questionnaires requiring self-evaluation along specific dimensions, e.g., the Three-Dimensional Wisdom Scale (Ardelt, 2003), the Self-Assessed Wisdom Scale (Webster, 2003)) and performance-based (real-world scenario-based problem-solving tasks, e.g., the Berlin Wisdom Paradigm (Baltes & Staudinger, 2000)) tools (Glück et al., 2013).

Is Older Wiser?

The dichotomous nature of wisdom, with its personal and general facets, has yielded diverging findings into the ontogenetic (i.e., development and growth from early to late life) correlates of wisdom. The current state of knowledge has largely been informed by two overarching methodological approaches to the study of wisdom and aging (Baltes & Staudinger, 1993): implicit (laypersons' conceptions of wisdom) (e.g., Sternberg, 1985, 1998) versus explicit (empirically tested) (e.g., Baltes & Staudinger, 2000) perspectives. Implicit studies of wisdom have provided abundant support for the notion that laypersons tend to characterize wisdom as a

function of increasing age (Ardelt, 2008a; Denney et al., 1995; Edmondson, 2005; Heckhausen et al., 1989; Jeste et al., 2010; Knight & Parr, 1999; Linley et al., 2007; Sahrani et al., 2014; Sawchuk, 2015; Smith, 2012; Sorokowski et al., 2017; Yang, 2013).

Theorists have proposed that the lay perspective on the developmental course of wisdom held greater significance prior to the rise of technological and scientific advancements (Landis, 1947). Specifically, it is argued that historically, one of the primary methods of knowledge acquisition involved the oral dissemination of information, with elders passing down their learnings to younger generations (Landis, 1947). In this view, by virtue of having lived longer, elders had more opportunities to accumulate wisdom about the world around them (Landis, 1947). However, in the current era of tremendous technological and scientific advancement, obscure knowledge is readily accessible even in the absence of historically used oral traditions (Landis, 1947); thus, the lay notion that 'wisdom comes with age' may be antiquated and/or incomplete. As wisdom is one of the very few attributes to counter the declination model of aging, it is imperative to examine this relationship from an empirical standpoint to achieve a more precise understanding of the ontogenetic course of wisdom. Emerging evidence from explicit paradigms has both corroborated and refuted lay sentiments, with some studies suggesting a positive association between wisdom and age (e.g., Ardelt, 2009), while others report decline (e.g., Ardelt et al., 2018b) or stability (e.g., Baltes & Staundinger, 2000) across the adult lifespan.

1.4 THE CURRENT WORK: AN EMPIRICAL ASSESSMENT OF THE MECHANISMS OF WISE REASONING AND DIFFERENCES WITH AGE

Since the advent of psychological inquiry into the phenomenon of wisdom, there have been widespread efforts to disentangle its relationship with aging, with varied and often

conflicting views presented in the literature. To address this challenge, this dissertation comprises a comprehensive examination of the developmental nature of wisdom across the adult lifespan, including the underlying cognitive mechanisms purported to contribute to its expression. We begin with a systematic review and meta-analysis to investigate associations between wisdom and cognitive abilities in typically developing adults (Chapter 2: Study 1). This review provides the foundation for the studies that follow examining neurocognitive aging, wisdom, and brain function. For the systematic review we identified six cognitive domains: i) crystallized intelligence, ii) fluid intelligence, iii) general intellectual functioning, iv) memory, v) attention, and vi) executive function. Chapter 2 also presents a meta-analytic review of the published literature examining the relationship between wisdom and age (Study 2). Collectively, the objective of Studies 1 and 2 is to provide the first quantitative syntheses of wisdom-related neuropsychological correlates, and differences with age.

Building on the insights and themes uncovered in the reviews, Chapter 3 presents two empirical studies aimed at elucidating the cognitive and neural underpinnings of wise reasoning in younger and older adulthood. Study 3 investigates the relationship between wisdom, cognitive function, and age. Drawing upon our 'shifting architecture of cognition' and 'semanticization of cognition' hypotheses of neurocognitive aging (see Section 1.2 above), we specifically examine associations between wise reasoning, crystallized and fluid cognition, and differences with age. Consistent with our earlier work (Spreng et al., 2018), here we examine crystallized and fluid cognition through the lens of memory functioning, availing of the well-characterized pattern of declining episodic and stable semantic memory into older age, to examine age differences in the cognitive architecture of wisdom. Study 4 extends Study 3 by examining how associations between wisdom, cognition, and age may reflect the shifting network architecture of the brain, as

predicted by the DECHA model (Spreng & Turner, 2019; Turner & Spreng, 2015). In Chapter 4, we consider the broader research, personal, and policy-level implications of our findings, including promoting healthy brain and cognitive aging, and countering the pervasive sociocultural implications that arise from the declination model of aging.

CHAPTER 2: THE COGNITIVE AND ONTOGENETIC CORRELATES OF WISDOM ACROSS THE ADULT LIFESPAN: A SYSTEMATIC REVIEW & META-ANALYSIS

2.1 UNVEILING THE PATH TO WISDOM: PAST AND PRESENT INSIGHTS

Wisdom has long been revered as a valuable and desirable quality, often attributed in philosophical literature and lay theories to individuals who possess deep insight, sound judgment, and exceptional problem-solving skills (Glück & Bluck, 2011). Across various contexts, wisdom has been closely linked to the phenomenon of aging, with lay conceptions purporting that wisdom increases with age, and older adults accounting for the majority of wisdom nominees in lay research (Glück & Bluck, 2011). Moreover, both lay and theoretical notions of wisdom often highlight a diverse range of cognitive processes as integral to its manifestation (Glück & Bluck, 2011; Staudinger & Glück, 2011a, 2011b). Frequently cited cognitively-meditated capacities implicated in wise reasoning by theorists and laypersons include one's access to a rich knowledge store and the application of prior learnings to present contexts (Denney et al., 1995; Glück et al., 2009; Lyster, 1996; Oh, 2013; Osbeck & Robinson, 2005), the ability to navigate novel contexts (Sternberg, 2005c), and critical thinking (Staudinger & Glück, 2011b; Sternberg, 2000).

The tremendous rise in psychological inquiry into wisdom in recent decades has resulted in considerable variability in the conceptualization, operationalization, and measurement of the construct. Correspondingly, characterizing the relationship between wisdom, cognition, and age has varied across research groups. Wisdom has been reliably correlated with a number of positive psychosocial outcomes (e.g., life satisfaction, well-being) (Ardelt, 1994, 1997; Staudinger & Glück, 2011b), particularly during late life (Ardelt, 1997). As such, enriching our understanding of wisdom and the factors which contribute to its development may hold

significant promise for enhancing wise reasoning, and well-being more broadly, across the adult lifespan and into older adulthood.

Understanding the Complexity of Wisdom: Diverse Conceptual Frameworks

Wisdom, as a profound and multifaceted construct, encompasses insights, heuristics, and skills that are manifest across all life contexts (Glück & Bluck, 2011). Researchers have approached the study of wisdom from two general perspectives: implicit (folk or lay conceptions of wisdom) and explicit theoretical approaches (hypothesis-driven, empirical studies) (Baltes & Staudinger, 1993). A variety of definitions have gained prominence over the years in the quest for a common theoretical conceptualization of wisdom.

Pioneering psychological wisdom researchers adopted a *developmental lens*, suggesting that wisdom is an aspect of personality development in adulthood (e.g., Erikson, 1959) constituting the ideal endpoint of human development (Erikson, 1959; Ryff & Heincke, 1983). Developmental theorists have argued that the realization of wisdom peaks in older adulthood, marked by the capacity to reflect on past experiences, achieve a sense of closure, and accept the finiteness of life (Erikson, 1959; Heckhausen et al., 1989). These sentiments were influential in substantiating long-held lay perspectives about the facilitative nature of age on increasing wisdom—the notion that 'older is wiser'. Subsequent definitions parallel earlier ideas about wisdom as a form of maturity in personality development, but emphasize the role of *cognition* in the expression of wisdom. Theorists promoting this perspective highlight the integral nature of post-formal dialectical reasoning in wisdom, which is described as recognition, consideration, and integration of diverse perspectives on a given issue (Grossmann et al., 2020). Here, wisdom is conceptualized as an expanded form of intelligence and cognitive-emotional expertise in the

fundamental pragmatics of life (e.g., Baltes & Smith, 2008; Baltes & Staudinger, 2000; Brienza et al., 2018; Grossmann, 2017a, 2017b; Mickler & Staudinger, 2008; Sternberg, 1998).

Another approach to the conceptualization of wisdom ascribes an *integrative* lens (Glück & Bluck, 2011), proposing that wisdom is a fusion of personality traits categorized into cognitive (knowledge about the human condition), reflective (ability to adopt multiple perspectives), and affective dimensions (empathic attitudes toward others) (Ardelt, 2004). Researchers adopting this perspective also suggest that the reflective capacity to transcend beyond the self to consider oneself as a part of a constantly shifting ecosystem of social, cultural, and economic factors (i.e., self-transcendence) is an essential feature of wisdom (Levenson et al., 2005). Given the breadth of operational definitions, there have been numerous efforts to develop psychometrically-valid and reliable measures of wisdom, grounded in diverse conceptual frameworks.

Measuring Wisdom: Performance-Based General Wisdom and Self-Reported Personal Wisdom

Despite the lack of a centralized definition in the field, wisdom is widely perceived as a dualistic construct, comprising both broad, universal knowledge (i.e., general) and individualized, personal knowledge (Staudinger, 2013). ‘General wisdom’ pertains to broader insight into life in general from an observer’s standpoint, analogous to the third-person perspective (Staudinger, 2013). 'Personal wisdom’ comprises one’s insight into themselves and/or one’s own challenges and is analogous to the first-person perspective (Staudinger, 2013). To illustrate this distinction, in a scenario where an individual faces a challenging or uncertain life situation, one’s ability to effectively confront and navigate this challenge would constitute personal wisdom. In contrast, one’s capacity to provide shrewd counsel when offering guidance to others dealing with similar challenges would demonstrate their level of general wisdom.

Despite the lack of explicit differentiation between the two facets of wisdom across studies, researchers often implicitly prioritize the measurement of either general or personal wisdom in their study design and accompanying operational frameworks (Staudinger, 2013).

A number of wisdom assessments have gained prominence in the field and can be broadly categorized into 'self-report' or 'performance-based' instruments. Self-report measures comprise questionnaires that require individuals to endorse statements along specific dimensions presumed to reflect wisdom (Ardelt, 2003; Webster, 2003; Levenson et al., 2005; Moraitou & Efklides, 2012), and typically assess personal wisdom. Performance-based measures require participants to solve specific problem sets, which are often scenario-based, involving multi-step and multidimensional problem-solving strategies (Glück et al., 2013; Baltes & Staudinger, 2000; Mickler & Staudinger, 2008; Sternberg, 1998), often tapping into general wisdom. A hybrid approach to wisdom assessment has recently emerged, combining self-report and performance-based approaches (Brienza et al., 2018) (see Table 2.1 for a list of available wisdom measures).

Table 2.1

Published Wisdom Instruments

Code	Measure	Type	Cat.	Reference
ASTI	Adult Self-Transcendence Inventory	P	SR	Levenson, M. R., Jennings, P. A., Aldwin, C. M., & Shiraishi, R. W. (2005). Self-transcendence: Conceptualization and measurement. *The International Journal of Aging and Human Development*, *60*(2), 127-143.
A-TD-WS	Abbreviated Three-Dimensional Wisdom Scale	P	SR	Thomas, M. L., Bangen, K. J., Ardelt, M., & Jeste, D. V. (2017). Development of a 12-Item Abbreviated Three-Dimensional Wisdom Scale (3D-WS-12). Assessment, 24(1), 71-82. https://doi.org/10.1177/1073191115595714
BWP	Berlin Wisdom Paradigm	G	P	Baltes, P. B., & Staudinger, U. M. (2000). Wisdom: A metaheuristic (pragmatic) to orchestrate mind and virtue toward excellence. *American psychologist*, *55*(1), 122.

PWT	Bremen Wisdom Paradigm (Personal Wisdom Task)	P	P	Mickler, C., & Staudinger, U. M. (2008). Personal wisdom: validation and age-related differences of a performance measure. *Psychology and aging*, *23*(4), 787.
BWSS	Brief Wisdom Screening Scale	P	SR	Glück, J., König, S., Naschenweng, K., Redzanowski, U., Dorner, L., Straßer, I., & Wiedermann, W. (2013). How to measure wisdom: Content, reliability, and validity of five measures. *Frontiers in psychology*, *4*, 405.
DDWR-IH	Daily Diary Study of Wise Reasoning	P	SR	Grossmann, I., Gerlach, T. M., & Denissen, J. J. (2016). Wise reasoning in the face of everyday life challenges. *Social Psychological and Personality Science*, *7*(7), 611-622.
SAWS	Self-Assessed Wisdom Scale	P	SR	Webster, J. D. (2003). An exploratory analysis of a self-assessed wisdom scale. *Journal of Adult Development*, *10*, 13-22.
SAWS-15	Self-Assessed Wisdom Scale—15	P	SR	Leeman, T. M., Knight, B. G., Fein, E. C., Winterbotham, S., & Webster, J. D. (2022). An evaluation of the factor structure of the Self-Assessed Wisdom Scale (SAWS) and the creation of the SAWS-15 as a short measure for personal wisdom. *International Psychogeriatrics*, *34*(3), 241-251.
SD-WISE	San Diego Wisdom Scale	P	SR	Thomas, M. L., Bangen, K. J., Palmer, B. W., Martin, A. S., Avanzino, J. A., Depp, C. A., ... & Jeste, D. V. (2019). A new scale for assessing wisdom based on common domains and a neurobiological model: The San Diego Wisdom Scale (SD-WISE). *Journal of psychiatric research*, *108*, 40-47.
SWRS	Situated Wise Reasoning Scale	G	P	Brienza, J. P., Kung, F. Y. H., Santos, H. C., Bobocel, R., & Grossman, I. (2018). *Situated WIse Reasoning Scale (SWIS)* [Database record]. APA PsycTests. https://doi.org/10.1037/t70486-000
TD-WS	Three-Dimensional Wisdom Scale	P	SR	Ardelt, M. (2003). Empirical assessment of a three-dimensional wisdom scale. *Research on aging*, *25*(3), 275-324.
WITHAQ	Wise Thinking and Acting Questionnaire	P	SR	Moraitou, D., & Efklides, A. (2012). The Wise Thinking and Acting Questionnaire: The Cognitive Facet of Wisdom and Its Relation with Memory, Affect, and Hope. Journal of Happiness Studies, 13, 849-873. http://dx.doi.org/10.1007/s10902-011-9295-1
WR	Wise Reasoning Task	G	P	Grossmann, I., Na, J., Varnum, M. E., Park, D. C., Kitayama, S., & Nisbett, R. E. (2010). Reasoning about social conflicts improves into old age. *Proceedings of the National Academy of Sciences*, *107*(16), 7246-7250.

Table 2.1. 'Type' denotes wisdom type examined by a given measure, where 'P' = personal wisdom and 'G' = general wisdom. 'Cat.' refers to the assessment approach of a given measure, where 'SR' = self-report and 'P' = performance-based instrument.

Refining our Understanding of the Cognitive Correlates and Age-Related Trajectory of Wisdom

As the global population continues to age, the study of wisdom as it relates to cognition and age has been gaining momentum. There is widespread agreement that wisdom as a psychological construct extends far beyond mere knowledge accumulation, with general consensus across the research community that it is a multifaceted ability requiring the integration of multiple modes of processing (Ardelt & Oh, 2016; Staudinger & Glück, 2011b). Considerable efforts have been dedicated to unraveling the link between wise reasoning and various cognitive capacities, with the overarching aim of elucidating the fundamental components that contribute to the expression of wisdom. Indeed, despite the noteworthy variability across theoretical notions, there is widespread agreement among researchers that cognitive processing plays a vital role in the realization of wisdom (Ardelt & Oh, 2016; Staudinger & Glück, 2011a, 20llb). While age has long been considered a critical factor in the development and manifestation of wisdom by theorists, the precise nature of the relationship between wisdom and age is an ongoing subject of debate, with studies reporting age-related gains (e.g., Ardelt, 2010; Grossmann et al., 2013), equivalence (e.g., Baltes & Staudinger, 2000; Grossman & Kross, 2014), or even declines (e.g., Ardelt et al., 2018b) in wisdom across the adult lifespan (Ardelt & Oh, 2016; Staudinger & Glück, 2011b).

By delving into investigations of the relationship between wisdom, age, and cognition, we may be able to identify the factors that contribute to the construct of wisdom. The literature is varied and often conflicting on the relationships among cognition, aging, and wisdom. This confounds efforts to extrapolate lifespan trajectories and identify common features, necessary to develop strategies towards sustaining or enhancing wise reasoning into older age. To address this

gap, this chapter of the dissertation presents a comprehensive review of the literature, first examining associations between wisdom and cognitive functioning, followed by a review of the literature asking the question: “Is older wiser?”.

The Current Review

Central to enhancing our understanding of the cognitive and age-related correlates of wisdom is a comprehensive review of the research literature. To be clear, we are not alone in this endeavor. We identified 43 reviews of the psychological literature examining wisdom. The majority of these reviews focused on the synthesis of findings on the construct’s definition/conceptualization, operationalization, measurement, or assessment (71%), and developmental course or relation to age (17%). We identified only three systematic reviews published in English: two of these focused on the definition/conceptualization and operationalization of wisdom (Bangen et al., 2013; Karami et al., 2020), while one centred on the cross-cultural correlates of wisdom (Dewangen & Ghosh, 2022). A fourth systematic review was identified that was not available in English (Mansour & Al-Hidabi, 2021). None of the systematic reviews published in English have explored the cognitive and/or age-related underpinnings of wise reasoning.

Despite the lack of consensus on a singular conceptualization of wisdom in the field, there is general agreement that wise reasoning taps into specific cognitive abilities (e.g., knowledge, metacognition) and psychological features (e.g., personality style, affect) of the human experience (Baltes & Staudinger, 1993; Bangen et al., 2013; Staudinger & Glück, 2011b). Further, there is preliminary evidence that wisdom and age are related (Staudinger, 1999; Staudinger & Glück, 2011b). To date there has not been a systematic review of the literature examining (i) the neuropsychological correlates of wisdom (Study 1) and (ii) age-differences in

wisdom across the adult life span (Study 2). To address this gap, we conducted a systematic review to inform meta-analyses which examine the cognitive correlates of wisdom and differences in wise reasoning over the course of adult and late life development. As these reviews provide a comprehensive exploration of the current research literature, we refrain from stating explicit hypotheses for the reviews. However, these findings will directly inform hypothesis development for the empirical studies that follow in Chapter 3 of the dissertation.

2.2 INTEGRATED METHODS FOR STUDIES 1 & 2: SYSTEMATIC REVIEWS & META-ANALYSES

Study Eligibility Criteria and Screening Protocol

The current study was not submitted for institutional ethics approval as we reviewed only publicly available data from published journal articles or collected works. In accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021a; Page et al., 2021b), articles were first screened by one coder (BSD) for alignment with the following inclusion criteria: (i) specifically described or investigated wisdom and one of the prescribed correlates based on the article or chapter title, (ii) published in English, (iii) published in a peer-reviewed journal or collected work, and (iv) study population of 18 years or older. When alignment could not be determined from the title, abstracts of the selected sources were reviewed by one coder (BSD) to further ascertain fit. Any identified sources whose abstracts pertained to the concept of wisdom and were not available online, were subsequently searched for in all physical libraries at York University, Toronto, ON. Additionally, corresponding authors were contacted to obtain any missing sources in order to ensure maximum inclusion of relevant findings. Subsequently, two coders (BSD & Kristen Heald (KH))

independently assessed eligibility of the remaining full-text sources to determine fit for inclusion in the review. Here, availability of quantitative data to facilitate meta-analysis was included as an additional eligibility criterion. Correspondingly, secondary sources (e.g., review papers or theoretical accounts) were excluded at this stage. Discussions between the two coders were initiated for any disagreements until consensus was reached (n = 5). This process ensured the robustness and comprehensiveness of the data collection and inclusion procedures.

Search Strategy

The search strategy was developed in collaboration with library staff at York University with expertise in systematic reviews. PsycINFO, Web of Science, MEDLINE, Nursing and Allied Health Database, and CINAHL databases were selected for the search. All articles and collected works published up to and including April 2023 were included in the search and no further restrictions were placed on dates of publication. Two searches were conducted for the primary domains of interest: cognition ('Study 1') and aging ('Study 2').

The search for Study 1 targeted the cognitive correlates of wisdom using the following terms, developed based on the authors' expertise in neuropsychology and cognition: ("wisdom" OR "wise" OR "wiser") AND ("cognition" OR "intelligence" OR "intellect" OR "fluid" OR "crystallized" OR "crystallised" OR "crystalized" OR "memory" OR "retrieval" OR "recall" OR "recollect*" OR "reasoning" OR "judgment" OR "executive" OR "executive function" OR "attention" OR "processing speed" OR "speed" OR "cognitive speed" OR "speed of processing" OR "verbal fluency" OR "fluency" OR "sensorimotor" OR "motor" OR "visual motor" OR "visuomotor" OR "sensation"). The search for Study 2 focused on the age-related or ontogenetic course of wisdom using the following terms: ("wisdom" OR "wise" OR "wiser") AND ("aging"

OR “age” OR “old” OR “older” OR “older adult*” OR “adult” OR “geriatric” OR “senior” OR “old age” OR “end of life” OR “ontogene*” OR “development” OR “lifespan” OR “elder*”).

Screening of duplicates resulted in 7302 unique items from the initial search for cognition (Study 1) and 1487 for aging (Study 2). The initial search was supplemented with a manual review of the reference lists of relevant articles to ensure the full scope of relevant material was included in the current study. Moreover, while review articles were not included in the meta-analyses to follow, reference lists of identified relevant review papers were examined for comprehensiveness. Overall, 231 unique items for the cognitive search and 276 for the aging search were included in the full-text review process. Following full-text review (BSD, KH), 32 cognitive and 73 aging studies were identified as eligible for the qualitative syntheses. Further screening resulted in 22 cognitive and 52 aging studies that were eligible for the quantitative syntheses (meta-analyses). The PRISMA flow charts, which summarizes the various stages of each search, are illustrated in Appendix A and B respectively.

Data Synthesis and Extraction

Data were manually extracted by a single coder (BSD) and compiled into a comprehensive table of results. Studies were coded according to one or more of the outlined correlates of interest, and cognitive studies were coded to map onto specific domains to facilitate separate cognition-focused meta-analyses. This yielded a total of six distinct domains for which separate meta-analyses were conducted in Study 1: i) crystallized intelligence, ii) fluid intelligence, iii) general intellectual functioning, iv) memory, v) attention, vi) executive function. A seventh analysis was conducted for age in Study 2. While visuospatial function and sensorimotor abilities were explored in the enacted systematic search, none of the identified articles explored wisdom as it relates to these cognitive domains.

When available, the following information was extracted for each included study: i) *a priori* study focus, hypothesis, or research question, ii) participant demographics (age, sex), iii) sample size (*n)*, iv) means (*M*) and standard deviations (*SD)* of wisdom outcome measures, v) statistical framework and reported outcomes, and vi) direction of the observed relationship (positive, negative, null). While Hedge's *g* has been identified in the literature as the soundest estimate of standardized effect size (Lakens, 2013), the majority of studies did not have sufficient publicly available data to calculate this metric. Accordingly, Cohen's *d* was implemented as the standardized effect size of choice. If effect sizes were reported in an alternate format, analyses were employed to convert these to the intended standardized effect size in accordance with the framework outlined in Bornstein and colleagues (2009). When *M* and *SD* were reported, the conventional formula for computing Cohen's *d* was applied to derive standardized effect sizes (Borentein et al., 2009). If *SE* was reported instead of *SD*, *SE* was converted to *SD* prior to calculating Cohen's *d*. If descriptives were not reported (i.e., *M, SD, SE*), other statistics were extracted to estimate standardized effect sizes (e.g., Pearson's *r*, *F*-test) (Borenstein et al., 2009).

Meta-Analytic Framework

In accordance with the framework detailed by Borenstein and colleagues (2009), Cohen's *d* and sampling variance (Cohen, 1988) were calculated for all eligible studies. We employed a random-effects model as we hypothesized that there would be notable heterogeneity across effect size estimates. We anticipated that this heterogeneity would likely be attributable to the variability in the conceptualization and measurement of wisdom as well as diversity in cognitive measures, differences in sample characteristics (e.g., age cohort, culture, occupation), and covariate effects (e.g., education, sex).

During the data extraction process, we identified a number of studies in both the cognitive and aging review that reported multiple outcomes, such as effect sizes for composite wisdom scores and individual subscales, or subgroup analyses within a given sample. This raised concerns about non-independence among extracted effect sizes, which violates a fundamental assumption of standard meta-analytic procedures (Bornstein et al., 2009). Moreover, as effect sizes were not transformed into Hedge's *g*, the standardized values (i.e., Cohen's *d*) did not correct for biases in effect size estimates related to small sample sizes (see Lakens, 2013). To address these issues, we adopted the robust variance estimation (RVE) framework, utilizing the robumeta *R* package (Fisher & Tipton, 2015), which yields estimates of aggregate effect sizes, while controlling for non-independence and small sample sizes (Tipton, 2015). Accordingly, the final model used to derive point-estimate outcomes is a random-effects model with correlated effect weights.

The primary focus of each of the meta-analyses was to examine the impact of one of the seven prescribed correlates on self-reported or performance-based outcomes of wisdom (composite scores of a given wisdom metric) or wisdom-related knowledge (subscale scores of a given wisdom metric). For all meta-analyses using RVE, instances where the Satterthwaite degrees of freedom (*df*) were less than 4, were deemed unreliable and were not interpreted, regardless of confidence intervals and associated levels of significance (*p*-values). This is consistent with the literature which suggests inflated Type I error rates beyond $p = .05$ and attenuated reliability of observations when Satterthwaite *df* are less than 4 (Tipton, 2015; Tanner-Smith et al., 2016).

Summary effect size estimates for each meta-analysis were fit using an intercept-only model and were deemed to be significant if the 95% confidence interval did not cross zero.

Estimates of effect size heterogeneity were derived using I^2 (proportion of total variability in effect sizes beyond chance, where ≤ 25% = low, 26 to 50% = moderate, and >50% = high) and τ^2 (between-study variance of the 'true' effect) (Borenstein et al., 2009; Higgins et al., 2003). Subsequent meta-regression models examined the potential impact of the aforementioned moderating variables as predictors of effect size outcomes. Follow-up post-hoc analyses were employed for all significant point-estimates of the overall effect size to examine mean differences between effect sizes within distinct levels of a given moderator. These analyses were undertaken to further quantify and explicate any potential moderating effects that are not evident at the aggregate summary effect size level.

Moderator & Post-Hoc Analyses

Two moderators based on past relevant research (e.g., Glück et al., 2013) were extracted from eligible studies, dummy coded as binary variables, and included in meta-regression models as moderators of effect size magnitude in both Study 1 and Study 2. First, we investigated the moderating effect of the age cohort characteristics of the study sample (i.e., adult lifespan (ages 18 – 90), younger adult (ages 18 – 40), or older adult (ages 40+)). Of note, the older adult spectrum was expanded beyond typical conventions in the aging literature (i.e., 60+) to encompass the middle-aged adult segments across studies. While many studies examined an adult lifespan sample, several investigated the relationship between wisdom, cognition, and age in more homogeneous age samples (i.e., younger adults or older adults). Given the well-established distinct neurocognitive trajectories in younger versus older adulthood, we anticipated that the magnitude and/or direction of aggregate effect sizes may be moderated by the age cohort under examination in a given study. For example, effect sizes associated with increasing age and

wisdom may be larger in adult lifespan than younger or older adult samples, wherein there is more heterogeneity in the age range of the sample.

Given the call for explicit differentiation of personal and general wisdom in the literature (Staudinger, 2013), the second moderator analysis examined whether wisdom type (i.e., personal or general) moderated the observed point-estimates between wisdom and our respective predictor variables. We also considered the effects of data collection methods (i.e., self-report versus performance-based). However, in the vast majority of cases, personal and general wisdom instruments mapped exclusively onto self-report and performance-based methods respectively (but see, Bremen Wisdom Paradigm; Mickler & Staudinger, 2008). Further, we identified no measures of general wisdom that employed an exclusively self-report approach. As such, measurement approach and wisdom type cannot be disambiguated in these reviews.

Publication Bias

Publication bias arises from the tendency for scientific studies with certain results to demonstrate a higher likelihood of being published (Cooper et al., 2019; Renkewitz & Keiner, 2019). This typically manifests in a failure to publish findings due to the magnitude or direction of the observed relationships (Cooper et al., 2019). Through this lens, studies with statistically significant affirmative results are more likely to be published than null findings, or those that are in contrast to *a priori* hypotheses (Cooper et al., 2019). Publication bias is a critical consideration when formulating impressions from the results of a meta-analysis and may pose a significant threat to the validity of the aggregate effect size (Cooper et al., 2019; Renkewitz & Keiner, 2019).

Traditional approaches to assessing the degree of publication bias involve a qualitative assessment of a funnel plot, in which effect sizes are plotted against their corresponding standard

error (Borenstein et al., 2009; Cooper et al., 2019). Asymmetry of the funnel plot is indicative of potential concerns with publication bias (Borenstein et al., 2009; Cooper et al., 2019). More recently, quantitative approaches have been developed that employ regression models to derive a numerical metric of the significance of the observed asymmetry (Egger et al., 1997). In the present study, we generated funnel plots to visually examine the degree of publication bias within each meta-analysis. Subsequently, we implemented a modified Egger's regression test, recently validated in RVE approaches (Rodgers & Pustejovsky, 2021), to further elucidate the observed relationship. Here, standard error was used as the predictor of the effect size (Rodgers & Pustejovsky, 2021). Publication bias was deemed to be significant if the regression covariate was significant at an alpha-level of .05 in a two-tailed significance test (Sterne & Egger, 2005).

2.3 RESULTS OF STUDY 1: RELATIONSHIP BETWEEN COGNITIVE FUNCTION AND WISDOM

Data extraction and synthesis allowed us to categorize included outcomes into one or more of the following six cognitive domains, for which separate meta-analyses were conducted to derive domain-specific summary effect sizes: i) crystallized intelligence, ii) fluid intelligence, iii) general intellectual functioning, iv) memory, v) attention, and vi) executive function. Table 2.2 contains an overview of the 22 unique studies that met inclusion criteria for the quantitative review, mapped according to one or more specific cognitive correlates. Supplementary Appendix A provides a summary of additional study characteristics and available quantitative statistics. The most prominently explored cognitive feature of wisdom in the literature is crystallized intelligence (64%) followed by fluid capacities (45%). There are relatively few studies across the other four core cognitive domains, and none of these summary effect sizes were significant. In

the main text, we report only the findings for the two significant models. For completeness, results for the null models are displayed in Supplementary Appendices B to E.

Table 2.2

Studies Included in Cognitive Meta-Analyses and Associated Domains

Study Title	Author	Domain(s)
The psychometric location of wisdom-related performance: Intelligence, personality, and more?	Staudinger et al., 1997	Crystallized intelligence, fluid intelligence
Do advanced moral reasoners also show wisdom? Linking moral reasoning and wisdom-related knowledge and judgement	Pasupathi & Staudinger, 2001	Crystallized intelligence, fluid intelligence
Correlates of wisdom-related performance in adolescence and adulthood: Age-graded differences in paths toward desirable development	Staudinger & Pasupathi, 2003	Crystallized intelligence, fluid intelligence
Personal wisdom: Validation and age-related differences of a performance measure	Mickler & Staudinger, 2008	Crystallized intelligence, fluid intelligence
Reasoning About Social Conflicts Improves into Old Age	Grossmann et al., 2010	Crystallized intelligence, fluid intelligence
Aging and wisdom: Culture matters	Grossmann et al., 2012	Crystallized intelligence, fluid intelligence, attention
The Wise Thinking and Acting Questionnaire: The cognitive facet of wisdom and its relation with memory, affect, and hope	Moraitou & Efklides, 2012	Memory
How to measure wisdom: Content, reliability, and validity of five measures	Gluck et al., 2013	Crystallized intelligence, fluid intelligence
A route to well-being: Intelligence versus wise reasoning.	Grossmann et al., 2013	Crystallized intelligence, attention, executive function
Wisdom and narcissism as predictors of transformational leadership	Greaves et al., 2014	General intellectual functioning

Adaptation of the Three-Dimensional Wisdom Scale (3D-WS) for the Korean cultural context	Kim & Knight, 2015	Crystallized intelligence
Social class and wise reasoning about interpersonal conflicts across regions, persons, and situations	Brienza & Grossmann, 2017	Crystallized intelligence
An empirical approach to wisdom processes	Dumbravă, 2017	Executive function
Hard-earned wisdom: Exploratory processing of difficult life experience is positively associated with wisdom	Weststrate & Glück, 2017	Crystallized intelligence, fluid intelligence
Early and midlife predictors of wisdom and subjective well-being in old age	Ardelt et al., 2018a	General intellectual functioning
Value relativism and perspective taking are two distinct facets of wisdom-related knowledge	Kunzmann et al., 2018	Crystallized intelligence, fluid intelligence
Theory of mind and wisdom: The development of different forms of perspective-taking in late adulthood	Rakoczy et al., 2018	Crystallized intelligence, attention, executive function
HIV and three dimensions of wisdom: Association with cognitive function and physical and mental well-being	Vásquez et al., 2020	General intellectual functioning
Effect of Zhongyong thinking in the relationship of crystallized intelligence and wisdom	Wei & Wang, 2020	Crystallized intelligence, fluid intelligence
Exploration of the effect of wisdom on the academic performance of college students	Arif et al., 2021	General intellectual functioning
Development of a 12-Item Abbreviated Three-Dimensional Wisdom Scale (3D-WS-12): Item Selection and Psychometric Properties	Thomas et al., 2021	
Wisdom and fluid intelligence are dissociable in healthy older adults	Lindbergh et al., 2022	Attention, memory, executive function

Crystallized Intelligence and Wisdom

The meta-analysis to investigate the relationship between crystallized intelligence and wisdom included a total of 14 studies with 41 outcomes (M = 2.93 outcomes per study; *Range* = 1 to 7). The majority of observations explored general wisdom (76%) in an adult lifespan sample (85%). Table 2.3 outlines the outcome measures of crystallized intelligence, wisdom, and their

respective frequencies among included studies. Wisdom was most often assessed using the Berlin Wisdom Paradigm, which was employed in 50% of studies and accounted for 22% of the included outcomes. The WAIS index score derived from Vocabulary and Comprehension subtests was the most frequently used metric of crystallized intelligence across studies, appearing in 24% of studies and comprising 34% of included outcomes.

Table 2.3

Frequencies of Outcome Measures of Included Observations in Crystallized Intelligence Meta-Analysis

		n (%)		
Code	Outcome Measure	Outcomes	Studies	Reference
	Wisdom			
ASTI	Adult Self-Transcendence Inventory	1 (2)	1 (7)	Levenson et al., 2005
BWP	Berlin Wisdom Paradigm	9 (22)	7 (50)	Baltes & Staudinger, 2000
BWP-VR	*Value-Relativism Subscale*			
PWT	Bremen Wisdom Paradigm (Personal Wisdom Task)	1 (2)	1 (7)	Mickler & Staudinger, 2008
BWSS	Brief Wisdom Screening Scale	1 (2)	1 (7)	Glück et al., 2013
M-WR-PT	Modified Wise Reasoning Task: Perspective-Taking Subscale	1 (2)	1 (7)	Kross & Grossmann, 2012
SAWS	Self-Assessed Wisdom Scale	1 (2)	1 (7)	Webster, 2003
SRC	Self-Report Composite (TD-WS, SAWS, ASTI)	1 (2)	1 (7)	Weststrate & Glück, 2017
SSI	Semi-Structured Interview	10 (24)	2 (14)	Grossmann et al., 2013
SWRS	Situated Wise Reasoning Scale	3 (7)	2 (14)	Brienza et al., 2018
SWRS-IC	*Interpersonal Conflicts Condition*			
SWRS-SC	*Societal Conflicts Condition*			
TD-WS	Three-Dimensional Wisdom Scale	5 (12)	2 (14)	Ardelt, 2003
TD-WS-K	*Three-Dimensional Wisdom Scale (Korean Version)*			Kim & Knight, 2015
TD-WS-K-CF	*Cognitive Flexibility Subscale (Korean Version)*			
TD-WS-K-EM	*Empathic Modesty Subscale (Korean Version)*			
TD-WS-K-VR	*Viewpoint Relativism Subscale (Korean Version)*			
WR	Wise Reasoning Composite (Semi-Structured Interview)	8 (20)	2 (14)	Grossmann et al., 2010
WR-AF	*Attentional Flexibility Subscale*			
WR-PT	*Perspective-Taking Subscale*			

WR-PS	*Perspective-Shifting Subscale*			
WR-PC	*Prediction of Change*			
WR-SC	*Search for Compromise Subscale*			
WR-SCR	*Search for Conflict Resolution Subscale*			
WR-URLK	*Uncertainty/Recognition of Limits of Knowledge Subscale*			
	Crystallized Intelligence			
	Hamburg Wechsler Intelligenztest German Version—Vocabulary	2 (5)	1 (6)	Wechsler, 1982
	HAWIE Vocabulary	3 (7)	3 (18)	Wecshler, 1982
	Index Score (WAIS Vocabulary and Comprehension)	14 (34)	4 (24)	Wecshler, 1982
	Mehrfachwahl-Wortschatz- Intelligenztest Vocabulary Test	7 (17)	2 (12)	Lehrl, 2005
	Multiple-Choice Word Test	3 (7)	2 (12)	Lehrl, 2005
	Practical Knowledge Questionnaire (Adapted from HAWIE Knowledge Subtest)	1 (2)	1 (6)	Lindenberger et al., 1993
	Shipley-Hartford Test of Vocabulary	4 (10)	1 (6)	Shipley, 1940
	WAIS Comprehension	3 (7)	1 (6)	Wecshler, 1982
	WAIS Vocabulary	4 (10)	2 (12)	Wecshler, 1982

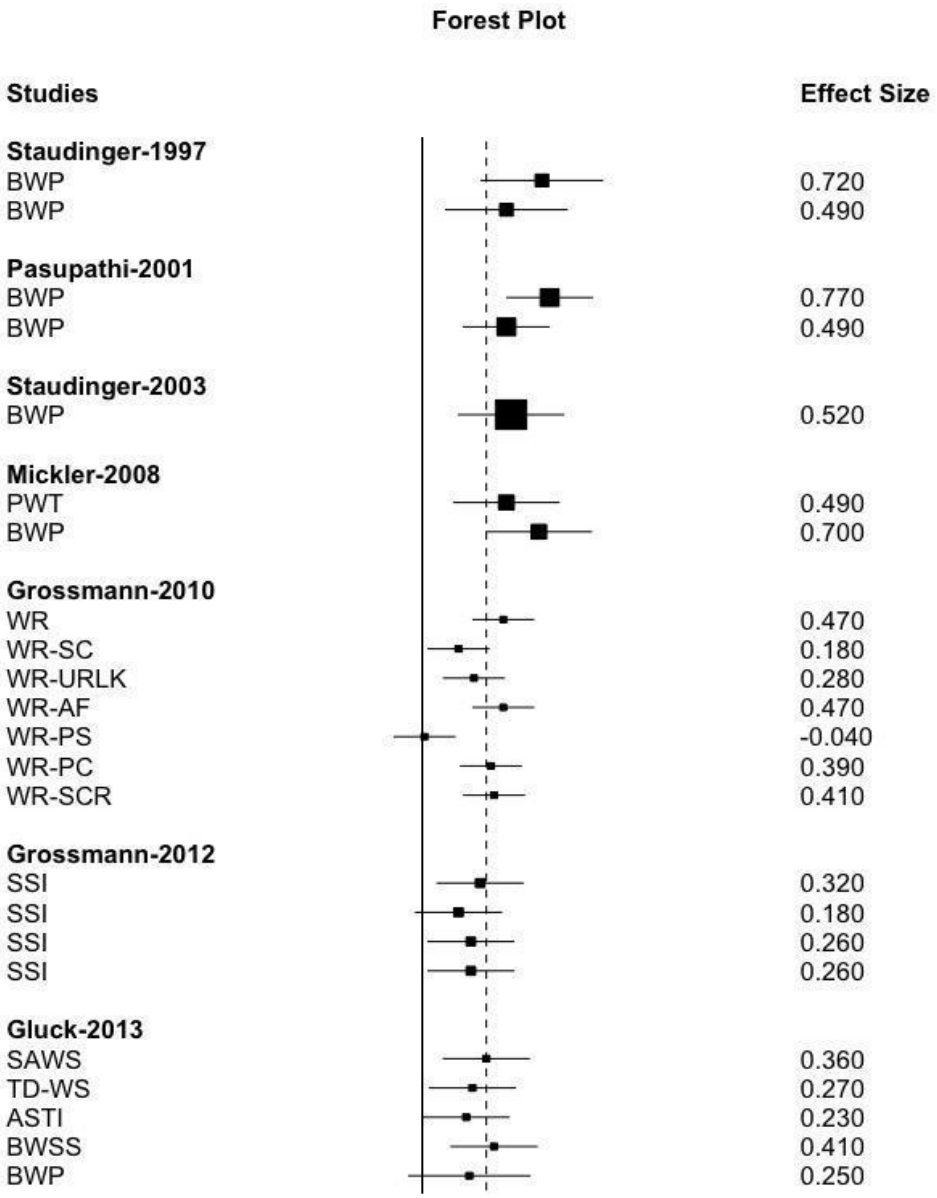
The results revealed a significant positive association between crystallized intelligence and wisdom, with a summary effect size of $d = .36$, 95% CI [.251, .469], $SE = .0501$, $t(12.1) = 7.18$, $p < .001$. This suggests that greater crystallized capacity is associated with higher wisdom scores. A summary of these effect size estimates is provided in a forest plot in Figure 2.1. Notably, effect sizes were characterized by a moderate degree of heterogeneity among studies ($I^2 = 63.62\%$, $\tau^2 = .0304$), indicating variability across the extracted effect sizes. Next, moderator analyses were conducted to examine the potential influence of the wisdom type on the observed relationship between crystallized intelligence and wisdom.

Neither personal ($B = -.096$, $SE = .0894$, $p = .35$) nor general ($B = .096$, $SE = .0894$, $p = .35$) wisdom demonstrated a significant moderation effect on the observed relationship, indicating that the relationship between crystallized intelligence and wisdom does not significantly vary based on the type of wisdom examined. Consistent with these findings, follow-up post-hoc analyses did not provide support for a significant difference in mean effect sizes of

general (*M* = .37, *SD* = .20) and personal (*M* = .27, *SD* = .12) wisdom, *t*(39) = -1.27, *p* = .11 (see Appendix C for boxplots). As most (85%) of the reported studies examined the adult lifespan, age cohort was not explored as a moderator in this analysis.

Figure 2.1

Forest Plot of Effect Sizes and Point-Estimate of Aggregate Effect Size for the Relationship Between Crystallized Intelligence and Wisdom



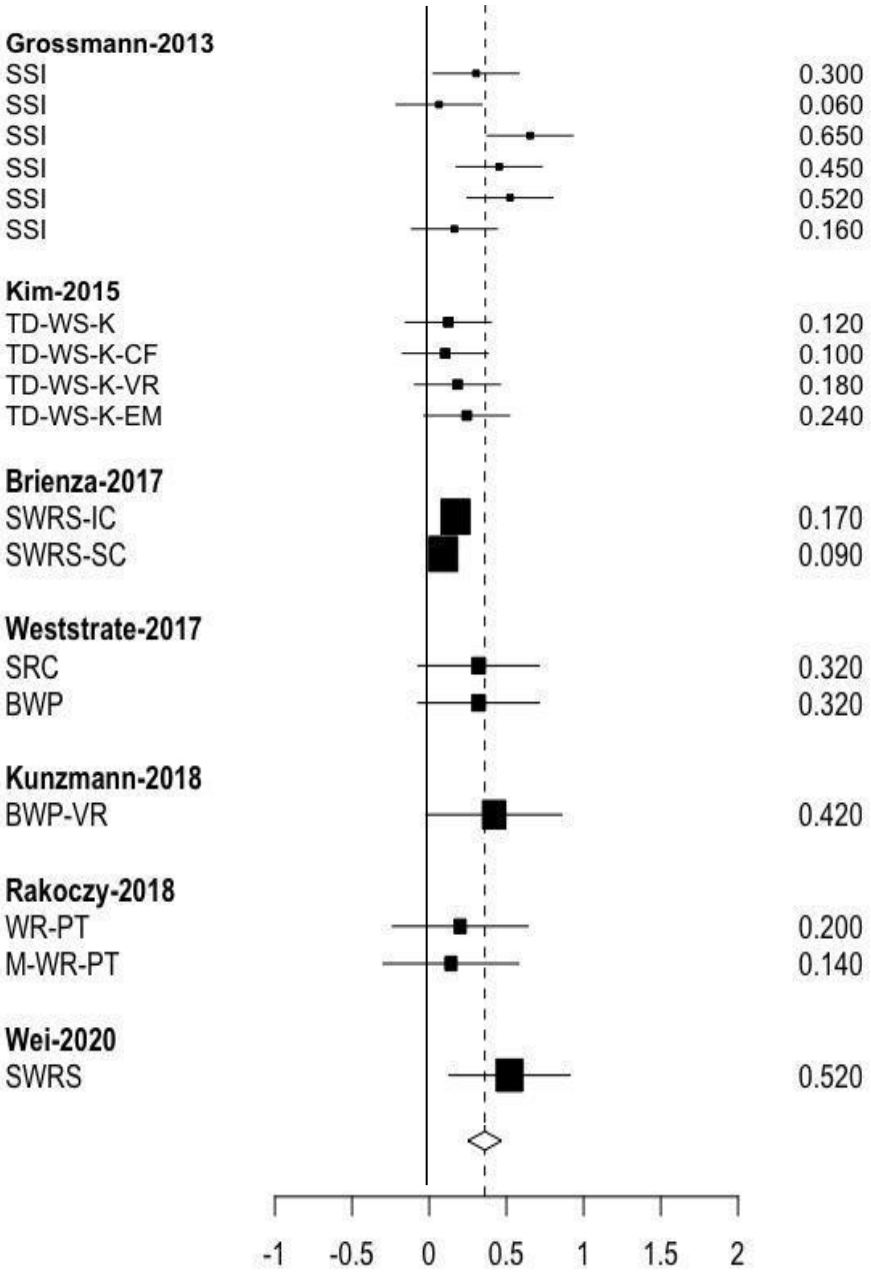


Figure 2.1. Black squares and whiskers represent the individual effect sizes and 95% CI respectively. The solid black vertical line represents the line of no effect, where effect sizes are equal to zero. The dotted line passing through the vertical midpoint of the white diamond depicts the point-estimate of the aggregate effect size. The left- and right-most angles of the white diamond illustrate the lower and upper limits of the 95% CI of the point-estimate.

A funnel plot was generated and Egger's regression analysis was conducted to assess the presence of publication bias. The test was not significant (B = 8.557, SE = 7.044, p = .25) and visual inspection of the funnel plot in Figure 2.2 is suggestive of relative symmetry of the

observed effects around the point-estimate of the aggregate effect size. These findings indicate that there is limited potential of publication bias.

Figure 2.2

Funnel Plot of the Effect of Publication Bias on the Observed Relationship Between Crystallized Intelligence and Wisdom

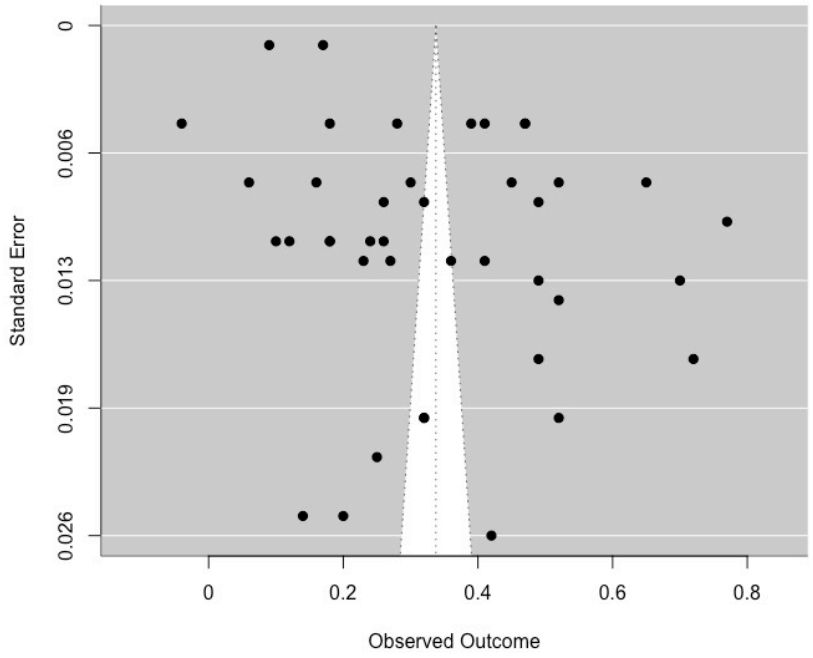


Figure 2.2. The x-axis represents the individual effect size estimates (Cohen's *d*) for included outcomes. The y-axis represents the standard error (precision estimate) associated with each individual effect size. The vertical midline of the triangle represents the line of no effect. Data points falling along this line are indicative of studies with null observed effects. Each data point in the meta-analysis is represented by a black dot on the plot. When all studies (i.e., black dots representing data points) are symmetrically distributed around the vertical line, this is indicative of no concerns with publication bias. Asymmetry is suggestive of potential concerns with publication bias. Funnel plot of the effect of publication bias on the relationship between crystallized intelligence and wisdom reveals relatively symmetrical distribution of observed effects around the meta effect-size.

Fluid Intelligence and Wisdom

The meta-analysis to investigate the relationship between fluid intelligence and wisdom included a total of 10 studies with 25 outcomes (*M* = 2.5 outcomes; *Range* = 1 to 7). Of these, the majority of observations examined general wisdom (76%) in an adult lifespan sample (76%).

Outcome measures of fluid intelligence, wisdom, and their respective frequencies across studies are outlined in Table 2.4. The Berlin Wisdom Paradigm was the most frequently used measure of wisdom, featured in 70% of studies and comprising 28% of outcomes. Fluid intelligence was most often measured using the Advanced Progressive Matrices Test—Short Version, which was implemented in 30% of studies and accounted for 15% of outcomes.

Table 2.4

Frequencies of Outcome Measures of Included Observations in Fluid Intelligence Meta-Analysis

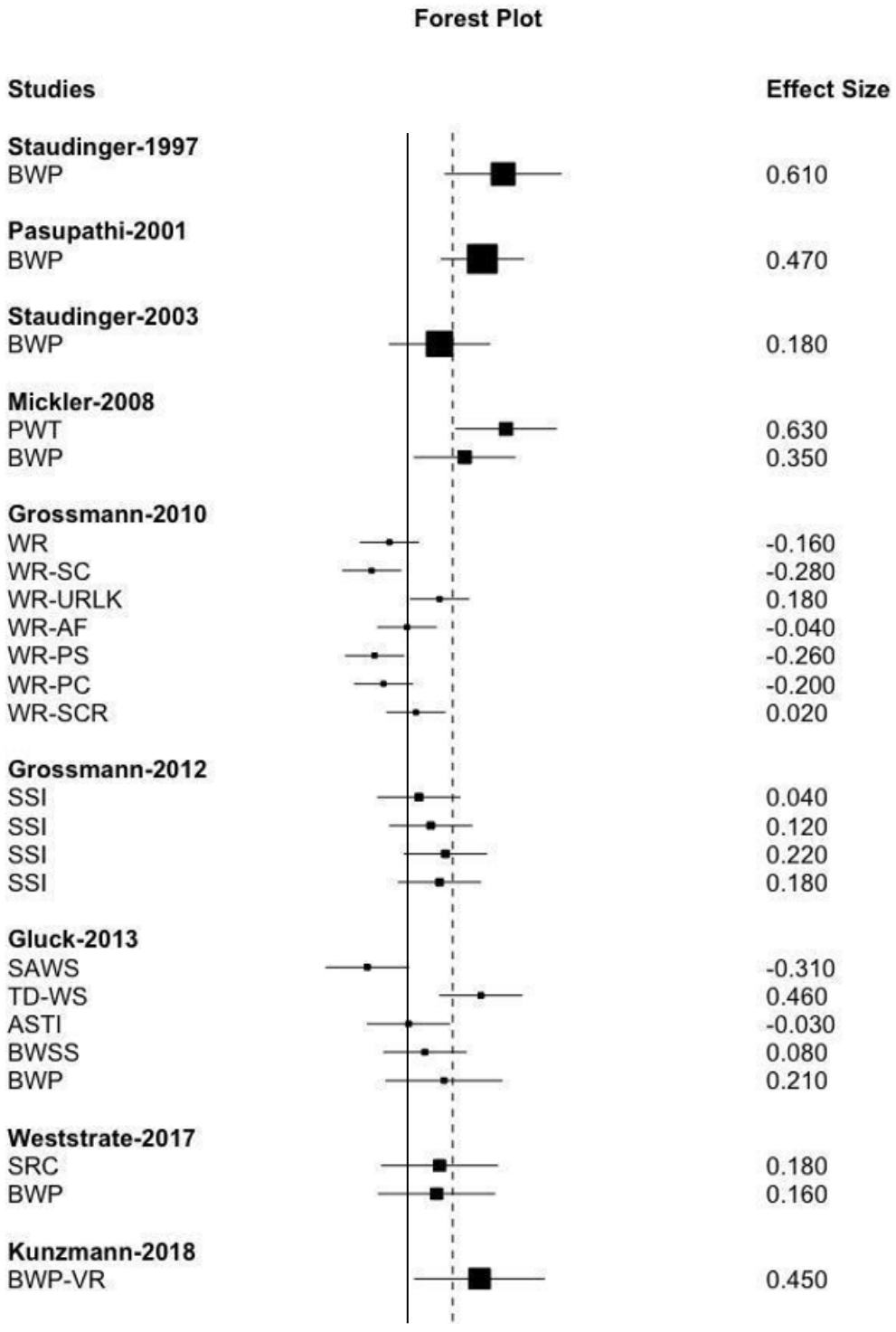
		n (%)		
Code	Outcome Measure	Outcomes	Studies	Reference
	Wisdom			
ASTI	Adult Self-Transcendence Inventory	1 (4)	1 (10)	Levenson et al., 2005
BWP	Berlin Wisdom Paradigm	7 (28)	7 (70)	Baltes & Staudinger, 2000
BWP-VR	*Value-Relativism Subscale*			
PWT	Bremen Wisdom Paradigm (Personal Wisdom Task)	1 (4)	1 (10)	Mickler & Staudinger, 2008
BWSS	Brief Wisdom Screening Scale	1 (4)	1 (10)	Glück et al., 2013
SAWS	Self-Assessed Wisdom Scale	1 (4)	1 (10)	Webster, 2003
SRC	Self-Report Composite (TD-WS, SAWS, ASTI)	1 (4)	1 (10)	Weststrate & Glück, 2017
SSI	Semi-Structured Interview	4 (16)	1 (10)	Grossmann et al., 2013
SWRS	Situated Wise Reasoning Scale	1 (4)	1 (10)	Brienza et al., 2018
TD-WS	Three-Dimensional Wisdom Scale	1 (4)	1 (10)	Ardelt, 2003
WR	Wise Reasoning Composite (Semi-Structured Interview)	7 (28)	1 (10)	Grossmann et al., 2010
WR-AF	*Attentional Flexibility Subscale*			
WR-PS	*Perspective-Shifting Subscale*			
WR-PC	*Prediction of Change Subscale*			
WR-SC	*Search for Compromise Subscale*			
WR-SCR	*Search for Conflict Resolution Subscale*			
WR-URLK	*Uncertainty/Recognition of Limits of Knowledge Subscale*			
	Fluid Intelligence			
	Advanced Progressive Matrices Test—Short Version	4 (15)	3 (30)	Raven, 1941
	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	7 (27)	2 (20)	Weiss, 2008
	HAWIE Digit-Symbol Subtest	1 (4)	1 (10)	Wecshler, 1982
	Index Score (WAIS Digit Span and Processing Speed)	7 (27)	1 (10)	Wecshler, 1982
	Raven's Progressive Matrices	1 (4)	1 (10)	Raven, 1941
	Trail Making Test	1 (4)	1 (10)	Reitan, 1958
	WAIS-III Digit Span	4 (15)	1 (10)	Wecshler, 1982
	WAIS Digit Symbol Substitution	1 (4)	1 (10)	Wecshler, 1982

Results of the point-estimate for the aggregate effect of fluid intelligence on wisdom were indicative of a significant positive association between fluid cognitive abilities and wisdom, d = .27, 95% CI [.0939, .444], SE = .077, t(8.82) = 3.49, p = .007. A summary of these effect size estimates is provided in a forest plot in Figure 2.3. Analyses revealed a moderate degree of heterogeneity among effect sizes across included studies (I^2 = 68.55%, τ^2= .0565), which suggests that there is variability across the extracted effect sizes and additional moderator analyses are indicated. Accordingly, we explored the potential influence of the type of wisdom examined on the relationship between fluid capacities and wisdom.

The results of the moderation regression analysis did not yield significant results for either personal (B = -.033, SE = .194, p = .88) nor general (B = .033, SE = .194, p = .88) wisdom as the moderator. Post-hoc analyses further corroborated the observed null effect of wisdom type on effect size. We did not observe a significant difference in mean effect sizes for general (M = .17, SD = .34) and personal wisdom (M = .14, SD = .25), t(23) = -.229, p = .41 (see Appendix D for boxplots). Given the lack of variability in the age demographics of the included outcomes (i.e., 76% examined the adult lifespan), age cohort was not explored as a moderator in the current meta-analysis.

Figure 2.3

Forest Plot of Effect Sizes and Point-Estimate of Aggregate Effect Size for the Relationship Between Fluid Intelligence and Wisdom



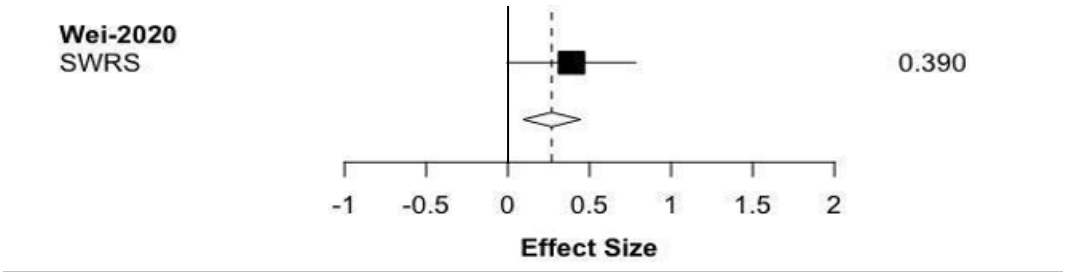


Figure 2.3. All figure details as described in Figure 2.1.

Regarding publication bias, Egger's regression analysis did not yield significant results, (B = 18.959, SE = 11.386, p = .18). Consistent with these findings, qualitatively, visual inspection of the funnel plot in Figure 2.4 is indicative of relative symmetry of the observed effects around the point-estimate of the aggregate effect size. This suggests that there is limited potential of publication bias.

Figure 2.4

Funnel Plot of the Effect of Publication Bias on the Observed Relationship Between Fluid Intelligence and Wisdom

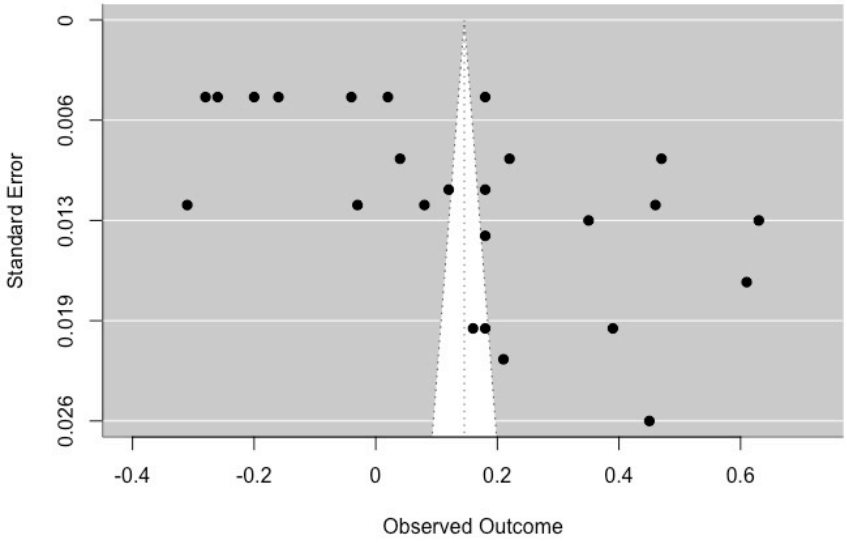


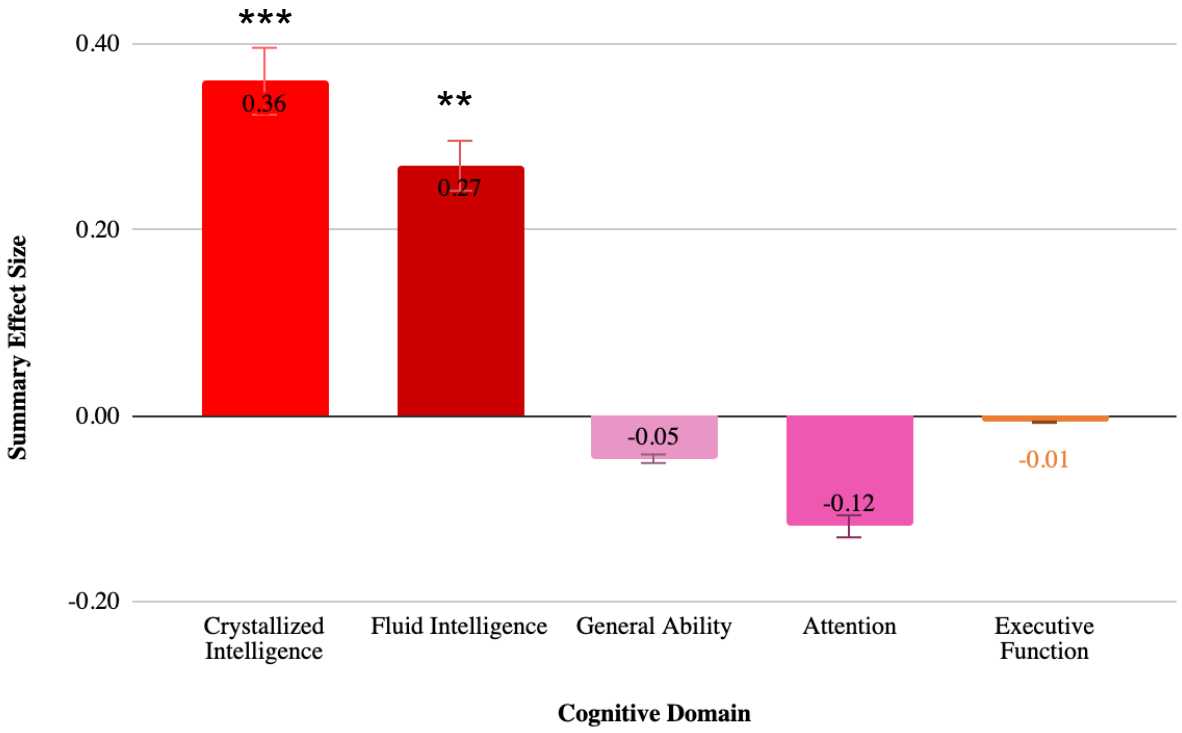
Figure 2.4. All figure details as described in Figure 2.2. Funnel plot of the effect of publication bias on the relationship between fluid intelligence and wisdom reveals symmetrical distribution of observed effects around the meta effect-size.

Summary of Study 1: Cognitive Correlates of Wisdom

While we report the significant models here in the main text, the relative summary effect sizes and corresponding confidence intervals across each of the six cognitive domains are illustrated in Figure 2.5. Overall, crystallized and fluid capacities demonstrated a positive association with wisdom, with the largest point-estimate reported for crystallized intelligence. There was no moderation effect observed by wisdom type, though there was notable observed publication heterogeneity to consider. Given the limited variability in the age cohort characteristics examined across reported outcomes, the potential moderating effect of the age cohort of the sample was not explored for neither crystallized or fluid intelligence. The summary effect sizes of general intellectual functioning, attention, and executive function were not significant (see Supplementary Appendices B to E). The point-estimate of aggregate effect size for memory was deemed unreliable due to the limited number of empirical studies, violating a core assumption of the RVE framework (see Supplementary Appendix C).

Figure 2.5

Bar Chart of Point-Estimates of Aggregate Effect Sizes Across Cognitive Domains



Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$.

Figure 2.5. Bar chart of the summary effect sizes across cognitive domains included in the review. This includes null point-estimates for which findings were not presented in the main text (see Supplementary Appendices B to E for details). The summary effect size was not computed for the memory domain due to a violation of a core assumption of the RVE meta-analysis framework (i.e., insufficient number of empirical studies).

2.4 RESULTS OF STUDY 2: RELATIONSHIP BETWEEN AGE AND WISDOM

Table 2.5 outlines the 52 unique studies that met inclusion criteria for the quantitative review for the relationship between wisdom and age. Supplementary Appendix F provides an overview of additional study characteristics and available quantitative statistics. The meta-analysis included a total of 195 outcomes (M = 3.75 outcomes per study; *Range* = 1 to 20). The majority of included observations explored personal wisdom (84%), utilizing the Three-

Dimensional Wisdom Scale (40%), in an adult lifespan sample (63%). Outcome measures of wisdom and their respective frequencies across studies are outlined in Table 2.6.

Table 2.5

Studies Included in Aging Meta-Analysis

Study Title	Author
Wisdom-related knowledge: Age/cohort differences in responses to life planning problems	Smith & Baltes, 1990
Wisdom-related knowledge in a life review task: Age differences and the role of professional specialization	Staudinger et al., 1992
Interactive minds: A facilitative setting for wisdom-related performance?	Staudinger & Baltes, 1996
Wisdom and life satisfaction in old age	Ardelt, 1997
Antecedents and effects of wisdom in old age—A longitudinal perspective on aging well	Ardelt, 2000a
Do advanced moral reasoners also show wisdom? Linking moral reasoning and wisdom-related knowledge and judgement	Pasupathi & Staudinger, 2001
Wisdom: A culturally inclusive developmental perspective	Takahashi & Overton, 2002
Wisdom-related knowledge: Affective, motivational, and interpersonal correlates	Kunzmann & Baltes, 2003
Correlates of wisdom-related performance in adolescence and adulthood: Age-graded differences in paths toward desirable development	Staudinger & Pasupathi, 2003
An exploratory analysis of a Self-Assessed Wisdom Scale	Webster, 2003
Combat exposure, perceived benefits of military service, and wisdom in later life: Findings from the Normative Aging Study	Jennings et al., 2006
Personal wisdom: Validation and age-related differences of a performance measure	Mickler & Staudinger, 2008
How similar are wise men and women? A comparison across two age cohorts	Ardelt, 2009
Are older adults wiser than college students? A comparison of two age cohorts	Ardelt, 2010
Reasoning about social conflicts improves into old Age	Grossmann et al., 2010
Narrating traumas and transgressions: Links between narrative processing, wisdom, and well-being	Mansfield et al., 2010
Identity styles and wisdom during emerging adulthood: Relationships with mindfulness and savoring	Beaumont, 2011

Comparing the psychometric properties of two measures of wisdom: Predicting forgiveness and psychological well-being with the Self-Assessed Wisdom Scale (SAWS) and the Three-Dimensional Wisdom Scale (3D-WS)	Taylor et al., 2011
Aging and wisdom: culture Matters	Grossmann et al., 2012
The Wise Thinking and Acting Questionnaire: The cognitive facet of wisdom and its relation with memory, affect, and hope	Moraitou & Efklides, 2012
Wisdom and ego-identity for Korean and American late adolescents	Bang & Montgomery, 2013
How to measure wisdom: Content, reliability, and validity of five Measures	Glück et al., 2013
A route to well-being: Intelligence versus wise reasoning	Grossmann et al., 2013
Effects of self-reported wisdom on happiness: Not much more than emotional intelligence?	Zacher et al., 2013
The role of reflection of difficult life experiences on wisdom	Sahrani et al., 2014
Time to flourish: The relationship of temporal perspective to well-being and wisdom across adulthood	Webster et al., 2014a
Wisdom and mental health across the lifespan	Webster et al., 2014b
African American undergraduate students' wisdom and ego-identity development: Effects of age, gender, self-esteem, and resilience	Bang, 2015
Gender as a moderator of the relation between age cohort and three-dimensional wisdom in Iranian culture	Cheraghi et al., 2015
Wise reasoning in the face of everyday life challenges	Grossmann et al., 2016
The relationship between mental and somatic practices and wisdom	Williams et al., 2016
Hard-earned wisdom: Exploratory processing of difficult life experience is positively associated with wisdom	Weststrate & Glück, 2017
Wisdom and hard times: The ameliorating effect of wisdom on the negative association between adverse life events and well-being	Ardelt & Jeste, 2018
The relation between age and three-dimensional wisdom: Variations by wisdom dimensions and education	Ardelt et al., 2018b
Validating the "Centering for Wisdom Assessment": Assessing the role of contemplative practices in the cultivation of practical wisdom	Bushlack & Bock, 2018
Exploring the wisdom structure: Validation of the Spanish new short Three-Dimensional Wisdom Scale (3D-WS) and its explanatory power on psychological health-related variables	García-Campayo et al., 2018
Theory of mind and wisdom: The development of different forms of perspective-taking in late adulthood	Rakoczy et al., 2018
Wisdom and meaning in emerging adulthood	Webster et al., 2018
Effects of causal attribution and implicit mindset on wisdom development	Alhosseini & Ferrari, 2019

Three-dimensional wisdom and perceived stress among college students	Ardelt & Bruya, 2020
Elderly customers' reactions to service failures: The role of future time perspective, wisdom, and emotional intelligence	Chaouali et al., 2020
Study of loneliness and wisdom in 482 middle-aged and oldest-old adults: A comparison between people in Cilento, Italy and San Diego, USA	Jeste et al., 2020
Age patterns in subjective well-being are partially accounted for by psychological and social factors associated with aging	Stone et al., 2020
HIV and three dimensions of wisdom: Association with cognitive function and physical and mental well-being	Vásquez et al., 2020
The examined life is wise living: The relationship between mindfulness, wisdom, and the moral foundations	Verhaeghen, 2020
Effect of Zhongyong thinking in the relationship of crystallized intelligence and wisdom	Wei & Wang, 2020
Validating the Self-Assessed Wisdom Scale (SAWS) in an Iranian Sample: Psychometric and developmental findings	Cheraghi et al., 2021
Cognitive and neural correlates of loneliness and wisdom during emotional bias	Grennan et al., 2021
Association of loneliness and wisdom with gut microbial diversity and composition	Nguyen et al., 2021
An evaluation of the factor structure of the Self-Assessed Wisdom Scale (SAWS) and the creation of the SAWS-15 as a short measure for personal wisdom	Leeman et al., 2022
Wisdom and fluid intelligence are dissociable in healthy older adults	Lindbergh et al., 2022
Emotional intelligence predicts wise reasoning	Schneider et al., 2023

Table 2.6

Frequencies of Outcome Measures of Included Observations in Aging Meta-Analysis

			n (%)		
Code	Outcome Measure	Type	Outcomes	Studies	Reference
AR-WS	Abstract Reasoning: WAIS-R Similarities Subtest	G	1 (1)	1 (2)	Wechsler, 1982
ASTI	Adult Self-Transcendence Inventory	P	3 (2)	2 (4)	Levenson et al., 2005
ASTI-A	*Alienation Subscale*	P			
ASTI-ST	*Self-Transcendence Subscale*	P			
A-TD-WS or TD-WS-12	Abbreviated Three-Dimensional Wisdom Scale	P	3 (2)	2 (4)	Thomas et al., 2017
BWP	Berlin Wisdom Paradigm	G	15 (9)	9 (17)	Baltes & Staudinger, 2000
BWP-I	*Insight Subscale*	G			
BWP-RF-RP	*Rich Factual and Rich Procedural Composite*	G			

BWP-LR	*Life Review Composite*	G			
BWP-VR	*Value-Relativism Subscale*	G			
PWT	Bremen Wisdom Paradigm (Personal Wisdom Task)[a]	P	6 (3)	1 (2)	Mickler & Staudinger, 2008
PWT-GSR	*Growth and Self-Regulation Subscale*	P			
PWT-IS	*Interrelating the Self Subscale*	P			
PWT-SK	*Self-Knowledge Subscale*	P			
PWT-SR	*Self-Relativism Subscale*	P			
PWT-TA	*Tolerance of Ambiguity Subscale*	P			
BWSS	Brief Wisdom Screening Scale	P	2 (1)	2 (4)	Glück et al., 2013
DDWR-WR	Daily Diary Study of Wise Reasoning	P	4 (2)	1 (2)	Grossmann et al., 2016
DDWR-IH	*Intellectual Humility Subscale*	P			
DDWR-PC	*Perspective/Compromise Subscale*	P			
DDWR-ST	*Self-Transcendence Subscale*	P			
EE-EC	Emotional Empathy: Empathic Concern Subscale of the Interpersonal Reactivity Index	P	1 (1)	1 (2)	Davis, 1980
ER-NMR	Emotional Regulation: Negative Mood Regulation Scale	P	1 (1)	1 (2)	Cantanazaro & Mearns, 1990
KD-WV	Knowledge Database: WAIS-R Vocabulary Subtest	G	1 (1)	1 (2)	Wechsler, 1982
M-WR-PT	Modified Wise Reasoning Task: Perspective-Taking Subscale	G	1 (1)	1 (2)	Kross & Grossmann, 2012
RU-SISA	Reflective Understanding: Short Index of Self-Actualization	P	1 (1)	1 (2)	Jones & Crandall, 1986
SAWS	Self-Assessed Wisdom Scale	P	13 (8)	7 (13)	Webster, 2003
SAWS-E	*Experience Subscale*	P			
SAWS-ER	*Emotional Regulation Subscale*	P			
SAWS-H	*Humor Subscale*	P			
SAWS-O	*Openness Subscale*	P			
SAWS-R	*Reminiscence Subscale*	P			
SAWS-F	*Self-Assessed Wisdom Scale (Farsi Version)*	P			
SAWS-15	Self-Assessed Wisdom Scale—15	P	3 (2)	1 (2)	Leeman et al., 2022
SD-WISE	San Diego Wisdom Scale	P	18 (10)	3 (6)	Thomas et al., 2019
SD-WISE-D	*Decisiveness Subscale*	P			
SD-WISE-ER	*Emotional Regulation Subscale*	P			
SD-WISE-PB	*Pro-Social Behaviors Subscale*	P			
SD-WISE-SA	*Social Advising Subscale*	P			
SD-WISE-SR	*Self-Reflection Subscale*	P			
SRC	Self-Report Composite (TD-WS, SAWS, ASTI)	P	1 (1)	1 (2)	Weststrate & Glück, 2017
SSI	Semi-Structured Interview	G	5 (3)	2 (4)	Grossmann et al., 2013
TD-WS	Three-Dimensional Wisdom Scale	P	81 (47)	21 (40)	Ardelt, 2003
TD-WS-A	*Affective Subscale*	P			
TD-WS-C	*Cognitive Subscale*	P			

TD-WS-R	*Reflective Subscale*	P			
TD-WS-F	*Three-Dimensional Wisdom Scale (Farsi Version)*	P			
TD-WS-A-F	*Affective Subscale (Farsi Version)*	P			
TD-WS-C-F	*Cognitive Subscale (Farsi Version)*	P			
TD-WS-R-F	*Reflective Subscale (Farsi Version)*	P			
TD-WS-SSI	*Three-Dimensional Wisdom Scale (Semi-Structured Interview)*	P			
WAS	Wisdom About the Self Composite (ASTI & SAWS)	P	2 (1)	1 (2)	Verhaeghen, 2020
WASW	Wisdom About the Social World Composite (TD-WS Composite)	P	2 (1)	1 (2)	Verhaeghen, 2020
WITHAQ	Wise Thinking and Acting Questionnaire	P	1 (1)	1 (2)	Moraitou & Efklides, 2012
WITHAQ-IDT	*Integrated Dialectical Thinking Subscale*	P			
	Wise Reasoning Composite (Semi-Structured Interview)	G	8 (5)	2 (4)	Grossmann et al., 2010
WR-AF	*Attentional Flexibility Subscale*	G			
WR-PT	*Perspective-Taking Subscale*	G			
WR-PS	*Perspective-Shifting Subscale*	G			
WR-PC	*Prediction of Change Subscale*	G			
WR-SC	*Search for Compromise Subscale*	G			
WR-SCR	*Search for Conflict Resolution Subscale*	G			
WR-URLK	*Uncertainty/Recognition of Limits of Knowledge Subscale*	G			

Table 2.6. Wisdom measures administered for the studies included in the review. All personal wisdom instruments used self-report approaches, except for the performance-based Bremen Wisdom Paradigm[a]. All general wisdom measures were performance-based tools. 'Type' denotes wisdom type examined by a given measure, where 'P' = personal wisdom and 'G' = general wisdom. Plain font represents composite score level of a given instrument. Italic font represents subscales or alternate language versions of instruments.

The results of the point-estimate for the relationship between wisdom and age revealed a significant positive association, $d = .13$, 95% CI [.034, .227], $SE = .048$, $t(50) = 2.72$, $p = .01$, suggesting that increasing age is associated with higher wisdom scores. A summary of these effect size estimates is provided in a forest plot in Figure 2.6. Effect sizes were characterized by a high degree of heterogeneity among studies ($I^2 = 91.03\%$, $\tau^2 = .096$), indicating that there is

substantial variability across the extracted effect sizes. Accordingly, moderator analyses were conducted to examine the potential influence of wisdom type and age cohort examined on the relationship between wisdom and age.

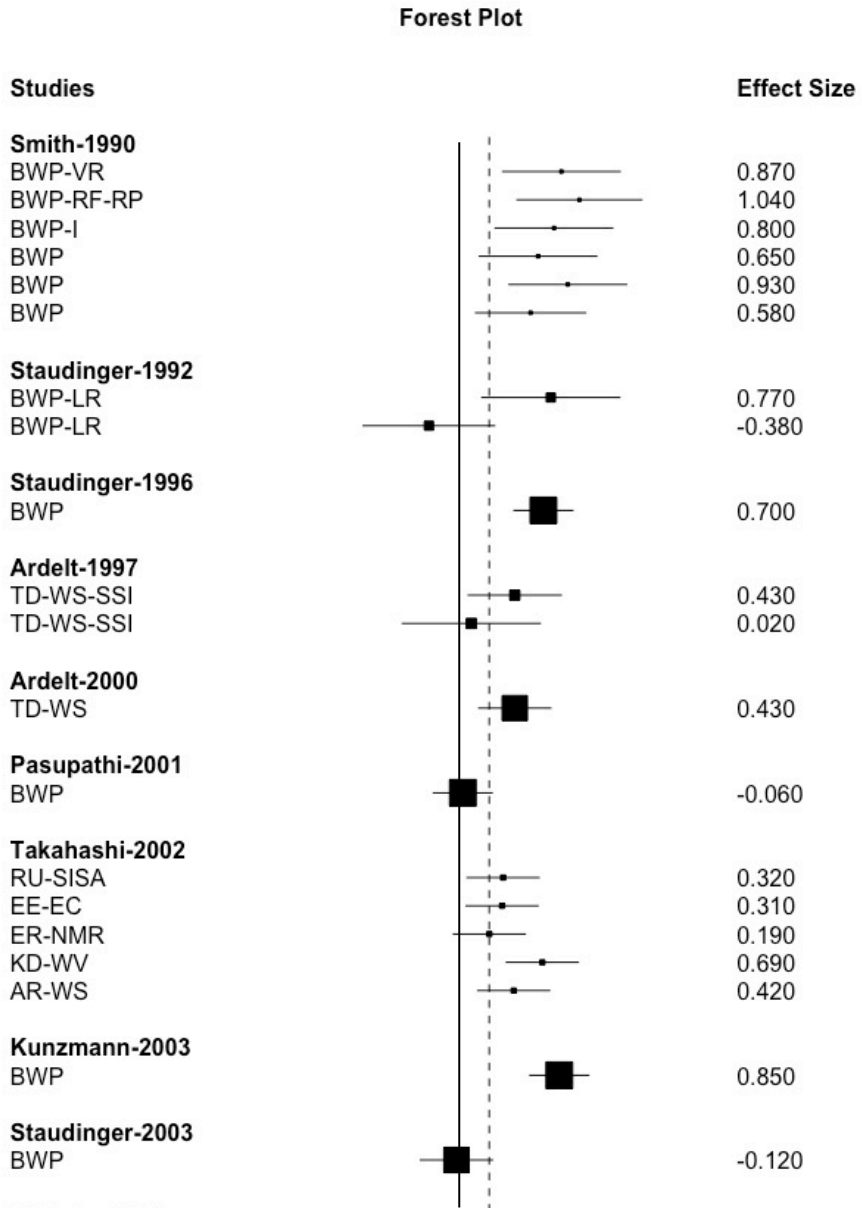
The regression results revealed that general wisdom demonstrated a significant positive moderating effect on the relationship between wisdom and age (B = .350, SE = .135, p = .02), while personal wisdom exhibited a negative effect (B = -.350, SE = .135, p = .02). This suggests that the observed positive summary effect size may be driven by the individual outcomes related to general rather than personal wisdom. The moderating effect of examining an older adult (B = -.236, SE = .116, p = .06), adult lifespan (B = .16, SE = .091, p = .09), and younger adult (B = -.002, SE = .082, p = .98) sample were not significant.

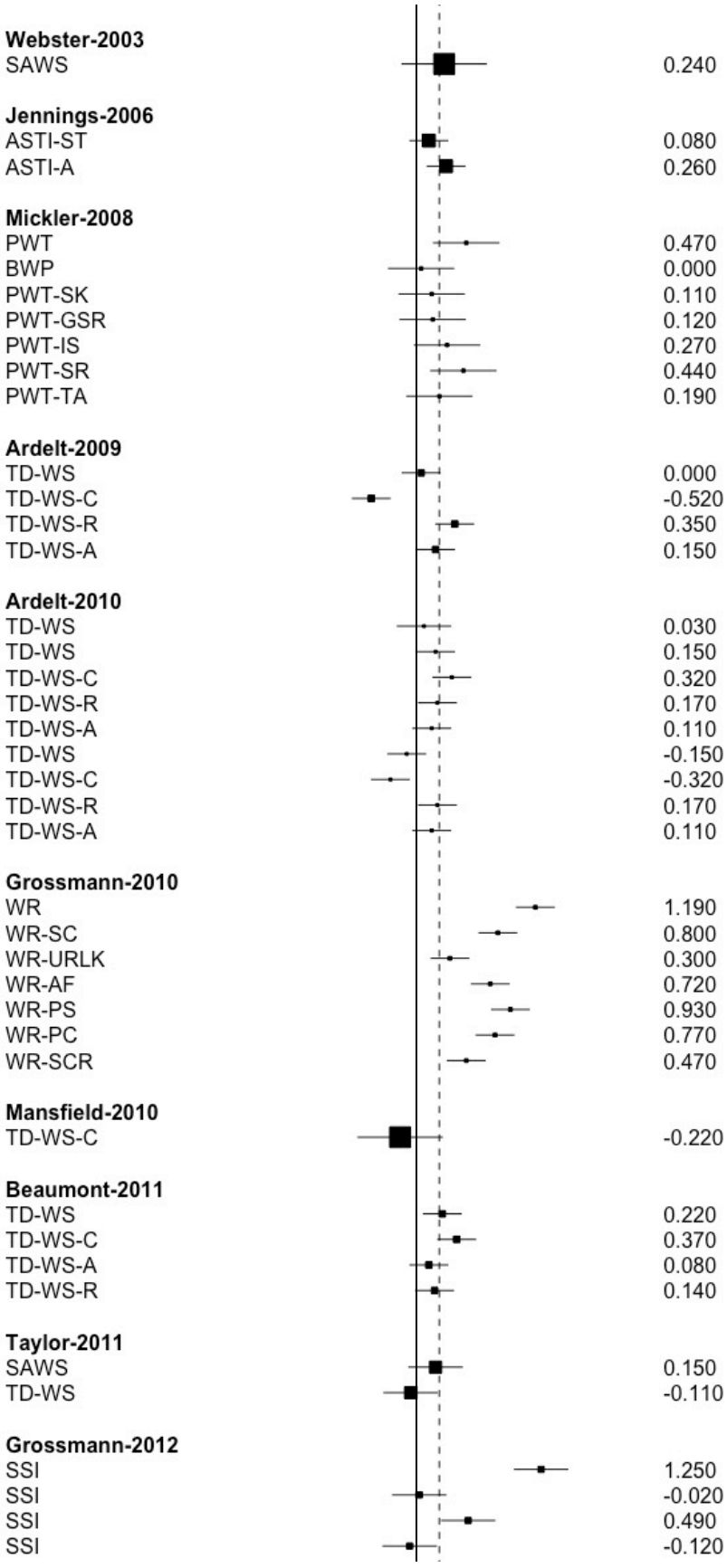
In line with these results, follow-up analyses revealed that the mean effect size for general wisdom (M = .44, SD = .51) was significantly higher than personal wisdom (M = .05, SD = .34), t(36.43) = -407, p < .001. The mean effect sizes of included outcomes that examined general (n = 32) versus personal (n = 163) are illustrated in Figure 2.7. It is noteworthy that among included effect sizes for personal wisdom, there were multiple negative outliers that may have attenuated the observed mean effect size. An analysis of variance (ANOVA) was conducted to examine the difference in mean effect sizes across the three levels of age cohorts. The results of the ANOVA revealed a significant main effect of group type, F(2, 192) = 13.19, n^2 = .12, p < .001. To identify specific group differences, comparisons were performed using the Tukey HSD test. The results indicated that effect sizes derived from older adult samples (M = -.18, SD = .48) were significantly lower than those obtained from an adult lifespan sample (M = .18, SD = .38), p < .001. Additionally, effect sizes from older adult samples were significantly lower than younger adult samples (M = .16, SD = .18), p < .001. There was no significant difference in effect sizes

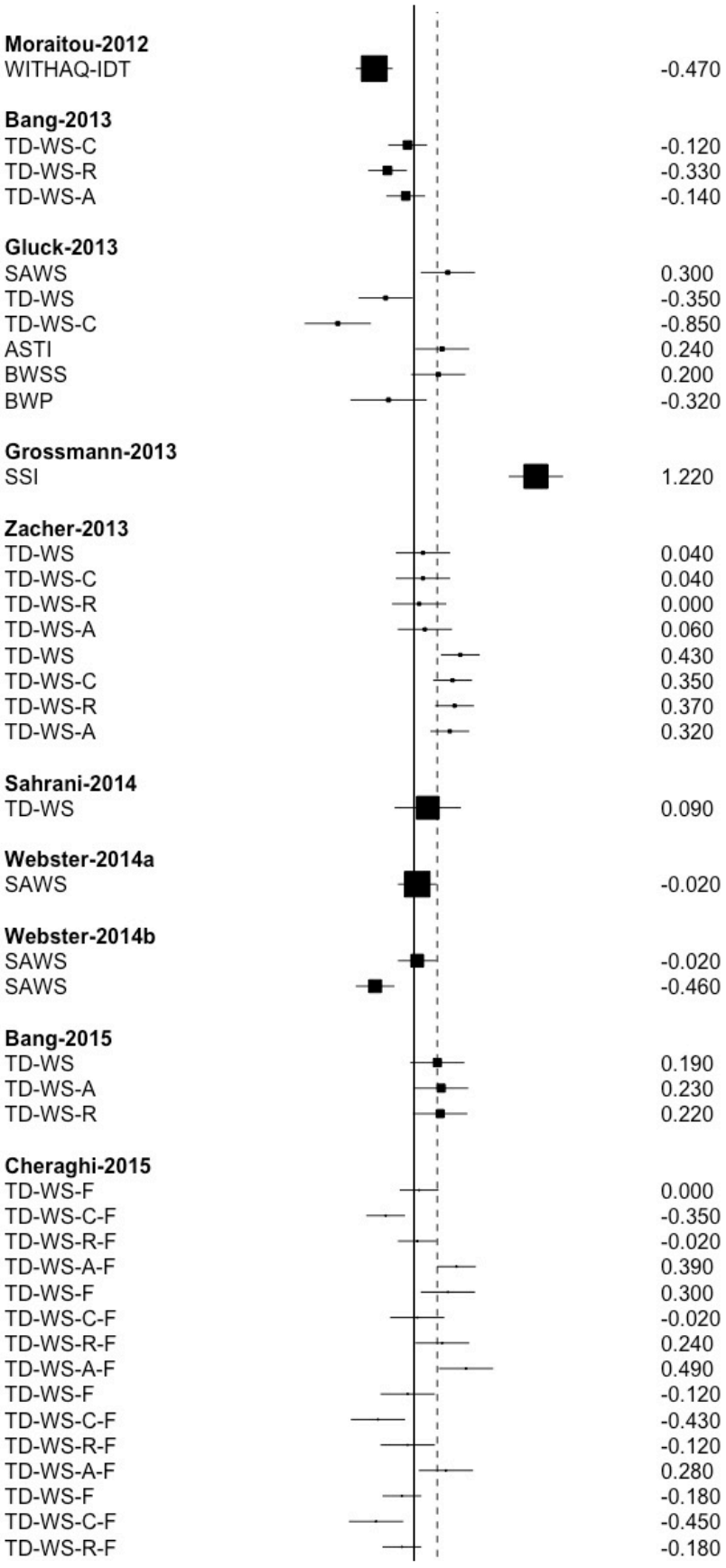
derived from adult lifespan compared to younger adult samples. The average effect sizes of included outcomes that examined an adult lifespan (n = 123), older adult (n = 34), and younger adult (n = 38) sample are illustrated in Figure 2.8.

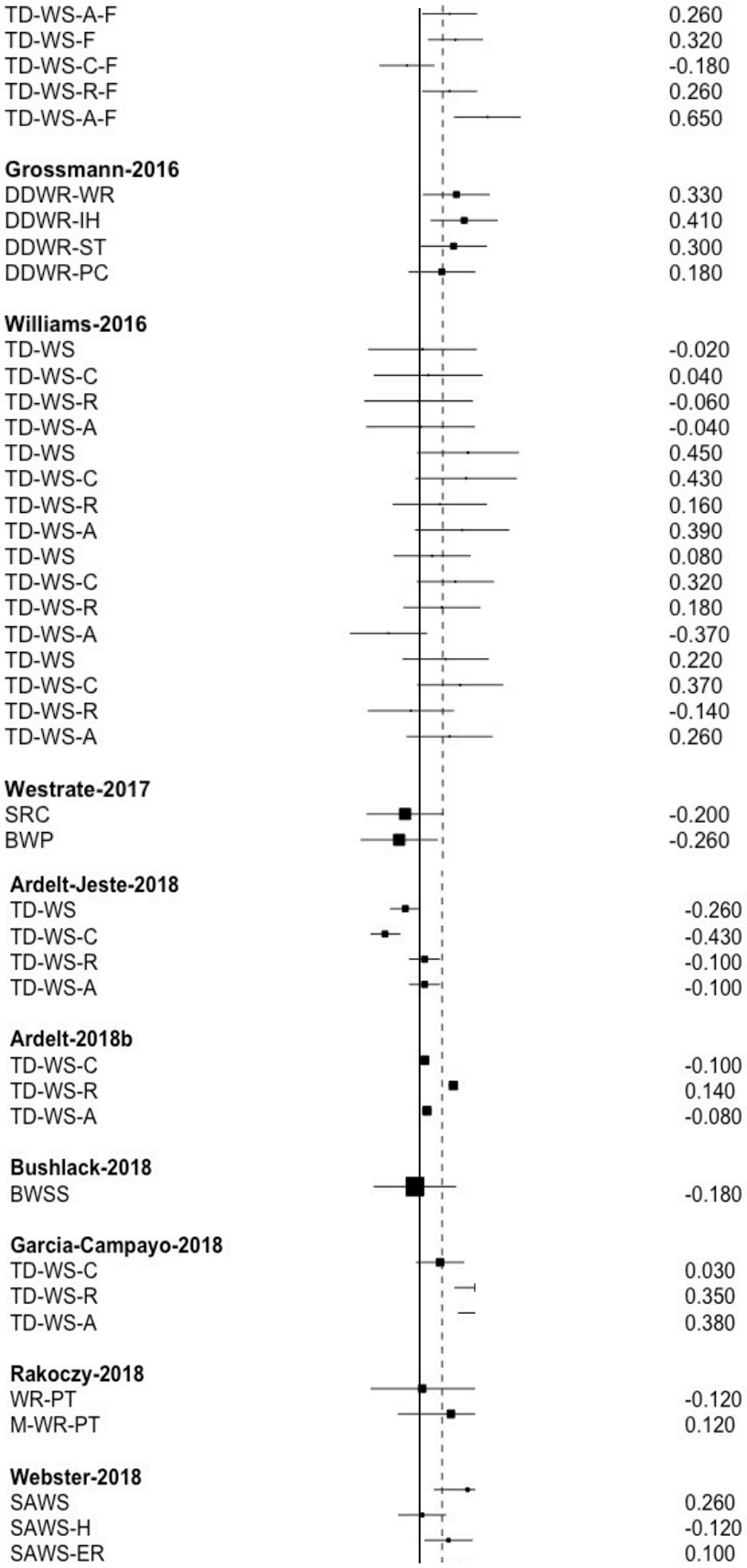
Figure 2.6

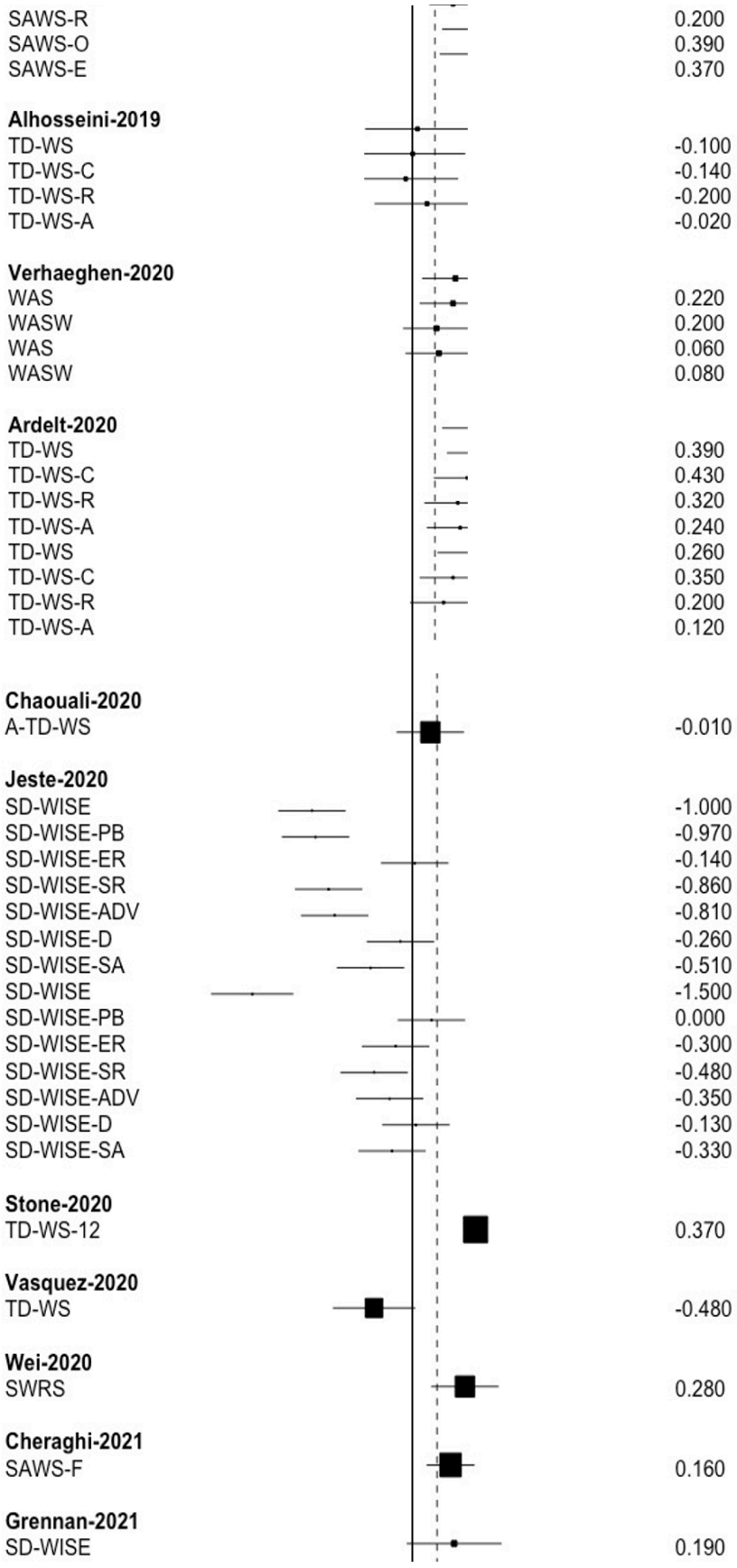
Forest Plot of Effect Sizes and Point-Estimate of Aggregate Effect Size for the Relationship Between Age and Wisdom




Webster-2003
SAWS 0.240
Jennings-2006
ASTI-ST 0.080
ASTI-A 0.260
Mickler-2008
PWT 0.470
BWP 0.000
PWT-SK 0.110
PWT-GSR 0.120
PWT-IS 0.270
PWT-SR 0.440
PWT-TA 0.190
Ardelt-2009
TD-WS 0.000
TD-WS-C -0.520
TD-WS-R 0.350
TD-WS-A 0.150
Ardelt-2010
TD-WS 0.030
TD-WS 0.150
TD-WS-C 0.320
TD-WS-R 0.170
TD-WS-A 0.110
TD-WS -0.150
TD-WS-C -0.320
TD-WS-R 0.170
TD-WS-A 0.110
Grossmann-2010
WR 1.190
WR-SC 0.800
WR-URLK 0.300
WR-AF 0.720
WR-PS 0.930
WR-PC 0.770
WR-SCR 0.470
Mansfield-2010
TD-WS-C -0.220
Beaumont-2011
TD-WS 0.220
TD-WS-C 0.370
TD-WS-A 0.080
TD-WS-R 0.140
Taylor-2011
SAWS 0.150
TD-WS -0.110
Grossmann-2012
SSI 1.250
SSI -0.020
SSI 0.490
SSI -0.120


Moraitou-2012
WITHAQ-IDT -0.470
Bang-2013
TD-WS-C -0.120
TD-WS-R -0.330
TD-WS-A -0.140
Gluck-2013
SAWS 0.300
TD-WS -0.350
TD-WS-C -0.850
ASTI 0.240
BWSS 0.200
BWP -0.320
Grossmann-2013
SSI 1.220
Zacher-2013
TD-WS 0.040
TD-WS-C 0.040
TD-WS-R 0.000
TD-WS-A 0.060
TD-WS 0.430
TD-WS-C 0.350
TD-WS-R 0.370
TD-WS-A 0.320
Sahrani-2014
TD-WS 0.090
Webster-2014a
SAWS -0.020
Webster-2014b
SAWS -0.020
SAWS -0.460
Bang-2015
TD-WS 0.190
TD-WS-A 0.230
TD-WS-R 0.220
Cheraghi-2015
TD-WS-F 0.000
TD-WS-C-F -0.350
TD-WS-R-F -0.020
TD-WS-A-F 0.390
TD-WS-F 0.300
TD-WS-C-F -0.020
TD-WS-R-F 0.240
TD-WS-A-F 0.490
TD-WS-F -0.120
TD-WS-C-F -0.430
TD-WS-R-F -0.120
TD-WS-A-F 0.280
TD-WS-F -0.180
TD-WS-C-F -0.450
TD-WS-R-F -0.180


TD-WS-A-F 0.260
TD-WS-F 0.320
TD-WS-C-F -0.180
TD-WS-R-F 0.260
TD-WS-A-F 0.650
Grossmann-2016
DDWR-WR 0.330
DDWR-IH 0.410
DDWR-ST 0.300
DDWR-PC 0.180
Williams-2016
TD-WS -0.020
TD-WS-C 0.040
TD-WS-R -0.060
TD-WS-A -0.040
TD-WS 0.450
TD-WS-C 0.430
TD-WS-R 0.160
TD-WS-A 0.390
TD-WS 0.080
TD-WS-C 0.320
TD-WS-R 0.180
TD-WS-A -0.370
TD-WS 0.220
TD-WS-C 0.370
TD-WS-R -0.140
TD-WS-A 0.260
Westrate-2017
SRC -0.200
BWP -0.260
Ardelt-Jeste-2018
TD-WS -0.260
TD-WS-C -0.430
TD-WS-R -0.100
TD-WS-A -0.100
Ardelt-2018b
TD-WS-C -0.100
TD-WS-R 0.140
TD-WS-A -0.080
Bushlack-2018
BWSS -0.180
Garcia-Campayo-2018
TD-WS-C 0.030
TD-WS-R 0.350
TD-WS-A 0.380
Rakoczy-2018
WR-PT -0.120
M-WR-PT 0.120
Webster-2018
SAWS 0.260
SAWS-H -0.120
SAWS-ER 0.100


SAWS-R 0.200
SAWS-O 0.390
SAWS-E 0.370
Alhosseini-2019
TD-WS -0.100
TD-WS-C -0.140
TD-WS-R -0.200
TD-WS-A -0.020
Verhaeghen-2020
WAS 0.220
WASW 0.200
WAS 0.060
WASW 0.080
Ardelt-2020
TD-WS 0.390
TD-WS-C 0.430
TD-WS-R 0.320
TD-WS-A 0.240
TD-WS 0.260
TD-WS-C 0.350
TD-WS-R 0.200
TD-WS-A 0.120
Chaouali-2020
A-TD-WS -0.010
Jeste-2020
SD-WISE -1.000
SD-WISE-PB -0.970
SD-WISE-ER -0.140
SD-WISE-SR -0.860
SD-WISE-ADV -0.810
SD-WISE-D -0.260
SD-WISE-SA -0.510
SD-WISE -1.500
SD-WISE-PB 0.000
SD-WISE-ER -0.300
SD-WISE-SR -0.480
SD-WISE-ADV -0.350
SD-WISE-D -0.130
SD-WISE-SA -0.330
Stone-2020
TD-WS-12 0.370
Vasquez-2020
TD-WS -0.480
Wei-2020
SWRS 0.280
Cheraghi-2021
SAWS-F 0.160
Grennan-2021
SD-WISE 0.190

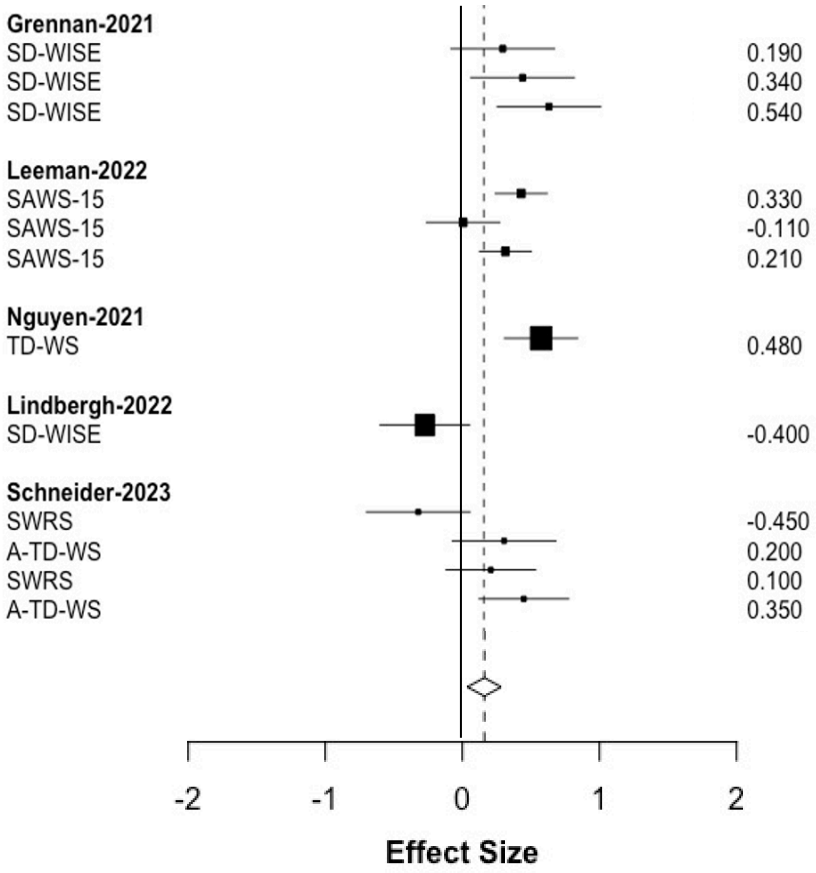


Figure 2.6. All figure details as described in Figure 2.1.

Figure 2.7

Boxplot of Effect Sizes for the Relationship Between Age and General Versus Personal Wisdom

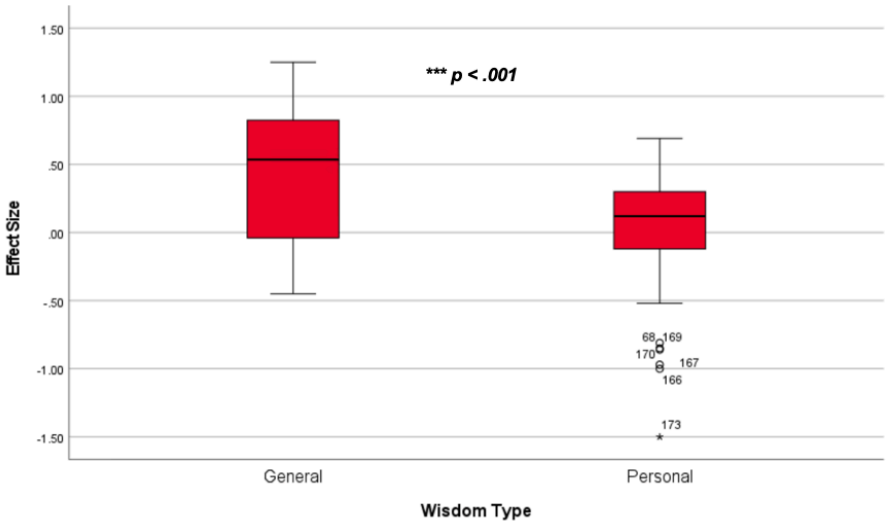


Figure 2.7. The y-axis displays the effect size, as measured by Cohen's d. The box for each group represents the range of individual effect sizes between the first quartile (25th percentile) and third quartile (75th percentile) (i.e., interquartile range). The height of the box is indicative of the spread of the middle 50% of the data, with larger boxes indicating greater variability of the distribution. The horizontal black midline of each box depicts the median (i.e., 50th percentile). The whiskers extending from the box represent 1.5x the interquartile range at the minimum and maximum data points within a defined range respectively. Data points outside of the whiskers are potential outliers. Studies investigating general wisdom reported significantly higher mean effect sizes than studies examining personal wisdom ($p < .001$).

Figure 2.8

Boxplot of Effect Sizes for the Relationship Between Age and Wisdom by Age Cohort

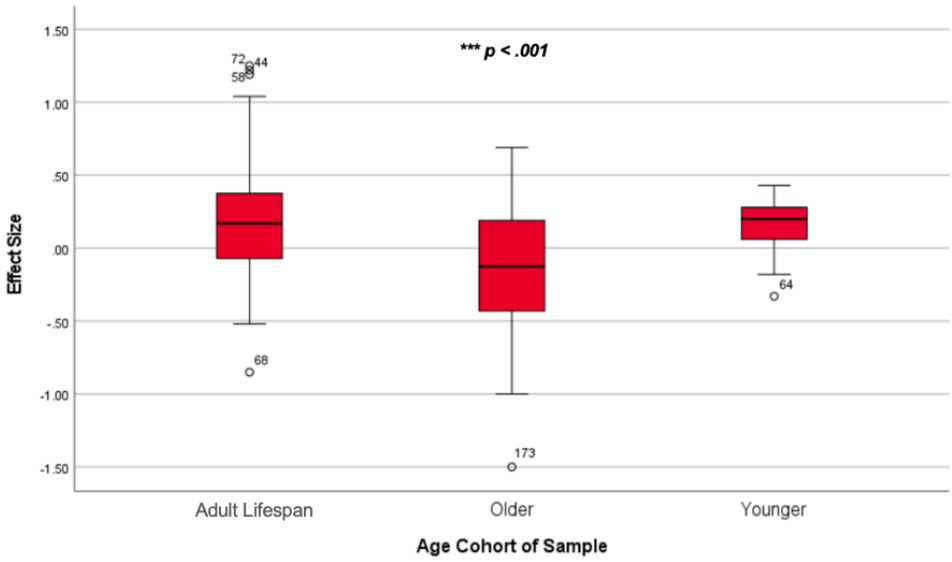


Figure 2.8. Figure details as described in Figure 2.7. Significant main effect of group type. Studies which examined an older adult sample reported significantly lower mean effect sizes than studies investigating an adult lifespan sample ($p < .001$) or younger adult sample ($p < .001$). There were no significant differences in mean effect sizes of studies examining an adult lifespan sample versus younger adult sample.

Egger's regression test for publication bias was not significant, $B = .177$, $SE = .102$, $p = .32$, indicating limited potential of publication bias. Consistent with this interpretation, visual inspection of the funnel plot in Figure 2.9 suggests relative symmetry of the observed effects around the point-estimate of the aggregate effect size.

Figure 2.9

Funnel Plot of the Effect of Publication Bias on the Observed Relationship Between Age and Wisdom

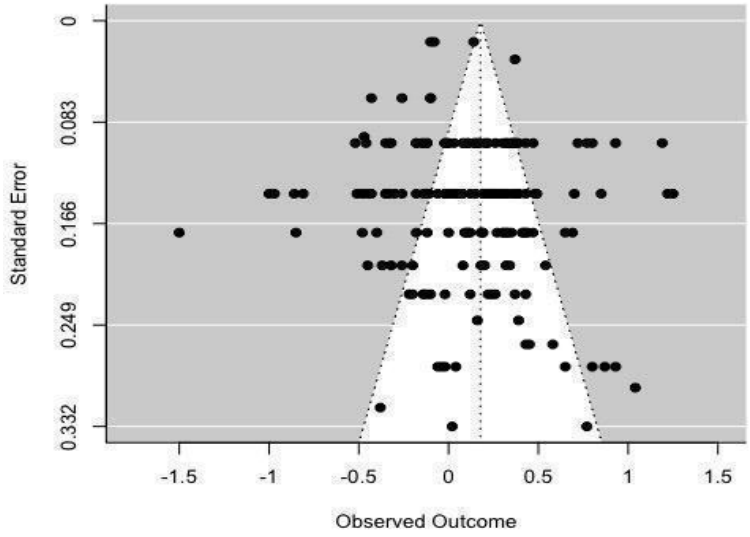


Figure 2.9. All figure details as described in Figure 2.2. Funnel plot reveals symmetrical distribution of observed effects around the meta effect-size.

Summary of Study 2: Age and Wisdom

Age demonstrated a significant positive association with wisdom. This effect was positively moderated by studies examining general rather than personal wisdom. In line with these findings, mean general wisdom effect sizes were larger than personal wisdom effect sizes.

The age cohort of the sample under examination did not significantly moderate the aggregate effect size. However, post-hoc analyses provide support for the most robust effect sizes in studies that examine an adult lifespan, rather than older or younger adult sample. This suggests that the effect of increasing age on wisdom is most pronounced when the age cohort of the sample under examination is more heterogeneous.

2.5 INTEGRATED DISCUSSION FOR STUDIES 1 & 2

Here, we present the results of a systematic review and meta-analysis of the cognitive and age-related correlates of wisdom. Overall, the findings provide evidence that wise reasoning depends on both crystallized and fluid cognitive abilities, and that older is indeed wiser. Examining associations between wisdom and cognitive abilities (Study 1) demonstrated that wisdom was positively associated with indices of crystallized and fluid intelligence, but not with general intellectual functioning or with domain-specific indices of episodic memory, attention, or executive function. Observed associations were vulnerable to publication heterogeneity, which is not unexpected given the variability in the conceptualization and measurement of wisdom across studies. The meta-analysis in Study 2 also revealed that aging was reliably associated with wisdom, with the aggregate effect size indicating that higher wisdom scores with increasing age. Age-related increases in general wisdom (insight into life in general from an observer's point of view) were larger than those observed for personal wisdom (insight into oneself). The effect of age was most robust in studies that examined a wider age range (i.e., adult lifespan sample) than those examining more homogeneous age cohort samples (i.e., younger or older adult samples).

Crystallized and Fluid Cognition and the Emergence of Wisdom

Wise nominees have long been characterized in folk, lay, and theoretical discourse as individuals who possess an abundant knowledge base (Glück & Bluck, 2011), as well as high levels of analytical (logical reasoning) and practical (application of acquired knowledge and skills to everyday problems) intelligence (Denney et al., 1995; Glück et al., 2009; Lyster, 1996; Oh, 2013; Osbeck & Robinson, 2005; Sternberg, 2018). Indeed, intelligence is the characteristic most frequently associated with wise nominees by laypersons (Ardelt, 2003; Krafcik, 2011). However, intelligence is an umbrella term that comprises a multitude of cognitive processes that support one's overall ability to learn, comprehend, reason, and adapt effectively in daily life (Sternberg, 1980, 1985), suggesting the need for empirical research to further tease apart the specific nature of the relationship between wisdom and intelligence. While we did not observe an effect of general intellectual functioning in the current meta-analysis (global cognitive ability encompassing various cognitive processes; discussed further in Section 2.6), the results do provide support for positive associations between crystallized and fluid intelligence with both general and personal wisdom. To this end, the results of the current review advance our understanding of the specific nature of the relationship between intelligence and wisdom.

Crystallized and fluid cognitive abilities are two discrete components of human intellectual functioning (Cattell, 1963; Craik & Bialystok, 2006). Crystallized, or semantic, abilities encompass the general knowledge about oneself and the world that individuals acquire throughout their lifetime, reflecting accumulated experience, education, and culture (e.g., vocabulary, general facts, financial knowledge; Cattell, 1963). In contrast, fluid, or cognitive control, abilities are characterized by the capacity to engage in abstract thinking and flexibly problem-solve in novel contexts (e.g., working memory, processing speed, cognitive flexibility;

Cattell, 1963, 1971). While the current study has provided support for the role of both crystallized and fluid modes of processing in wise reasoning, we observed a more robust link between crystallized intelligence and wisdom. This finding is in line with the earliest held notions of wisdom, which emphasize expertise in the fundamental pragmatics of life (i.e., a wealth of crystallized knowledge; Sternberg, 1985). While one's capacity to flexibly adapt to novel contexts contributes, in part, to the expression of wisdom, adults have a greater propensity towards drawing on semantic knowledge stores to facilitate wise reasoning. Consistent with this theory, we did not observe a significant aggregate effect of processing speed nor executive function on wisdom—a cluster of higher-order cognitive capacities that recruit fluid abilities to facilitate goal-directed behaviour (e.g., mental flexibility, inhibition, set-shifting) (Baggetta & Alexander, 2016).

Is Older Really Wiser?

Based on our findings in Study 2, it does appear that wisdom is associated with increasing age across the adult lifespan. Further, this age association appears to be more robust for general than personal wisdom. Interestingly, this pattern was more reliably observed across adult lifespan cohorts, as opposed to within age groups (young/old). While speculative, we attribute this to the shifting cognitive architecture of aging, reflecting the growing access to and influence of prior knowledge with age in the context of declining fluid cognitive abilities. This idea is consistent with the findings from Study 1 demonstrating that crystallized cognitive abilities are the strongest cognitive determinants of wise reasoning.

With age, crystallized abilities remain relatively stable or demonstrate gains as individuals continue to cultivate new knowledge and expertise (Park et al., 2001), while fluid capacities tend to peak in younger adulthood and exhibit a gradual decline into later life (Park et

al., 2001). The shifting cognitive architecture associated with healthy aging leads to a greater reliance on semantic abilities in older adulthood in service of declining cognitive control capacities (Craik & Bialystok, 2006; Park et al., 2001; Park et al., 2003; Spreng & Turner, 2019). It is important to highlight here that we are not suggesting that younger adults cannot engage in wise reasoning. Indeed, we observed a positive effect size across all three age samples. However, it does raise the intriguing possibility that the determinants of wise reasoning may differ for younger and older adults, consistent with a recently proposed model of neurocognitive aging (Spreng & Turner, 2019).

Wisdom, Age, and the Semanticization of Cognition

General wisdom outcome measures significantly moderated the relationship between wisdom and age, suggesting that the observed positive effect may be driven by studies that examined general (insight into external life circumstances) rather than personal (insight into one's own thoughts and actions) wisdom. Consistent with these findings, post-hoc analyses revealed that mean general wisdom effect sizes were significantly larger than personal wisdom. Given the primary role of crystallized knowledge in the expression of wisdom, it is perhaps unsurprising that general wisdom demonstrates a more robust relationship with age than personal wisdom. Indeed, the nature of general wisdom (advice-giving from an observer's point of view) suggests that it may be more reliant on a rich reservoir of accumulated knowledge than is the case in personal wisdom. It has been suggested that reasoning through the complexities of one's personal problems requires a more proportional balance of cognitive, with affective and reflective capacities (Ardelt, 2003; Marcoen et al., 2007; Staudinger, 2013), thus attenuating the impact of the semanticization of cognition on personal wisdom in later life. While we are unable to directly test this idea here, it is possible that these affective and reflective dimensions of

personal wisdom exhibit stronger contributions to its expression than cognitive processes in later life, where affectively-valenced goals become increasing salient (Spreng & Turner, 2021). Critically, these findings highlight the importance of investigating both personal and general dimensions of wisdom as distinct cognitive constructs in future research.

Wisdom Trajectories Across the Adult Lifespan

While not directly tested here, a qualitative review of included studies suggests that there may be a curvilinear relationship between wisdom and age, peaking in mid-life (ages 40 – 69), and exhibiting declines thereafter into late life (Ardelt et al., 2018b; Glück, 2018; Oxman, 2018; Webster et al., 2014b). Additional insights from implicit research on lay conceptions further corroborate this perspective, suggesting that middle-aged participants comprise the largest proportion of wisdom nominees (Yang, 2008) and are typically rated higher on domains of wisdom than younger or older adults (Kwon, 1995). Similar patterns of mid-life performance peaks have been observed in other investigations of goal-directed behaviour, including economic decision-making (Agarwal et al., 2009; Samanez-Larkin, 2013). The 'economic decision-making sweet spot' proposes that middle-aged adults (late 40's and 50's), who are at the intersection of declining fluid abilities (cognitive control) and gains in semantic abilities, are able to optimally leverage cognitive control and semantics to support more adaptive financial decision-making (Agarwal et al., 2009; Samanez-Larkin, 2013; Li et al., 2015). Our findings provide support for increases in wisdom throughout the adult lifespan; however, we did not directly examine middle age as a moderator of the relationship between wisdom and age. It is possible that wise reasoning may demonstrate a similar 'sweet spot' in mid-life. Additional empirical examinations are needed to investigate mean differences in wisdom scores between younger, middle-aged, and older adults to further unpack the precise ontogenetic course of wisdom.

Factors Mediating the Relationship Between Wisdom and Age

The majority of studies included in the aging meta-analysis utilized cross-sectional frameworks to investigate wisdom and age. Cross-sectional examinations present a significant challenge in understanding the ontogenetic course of wisdom, primarily due to the potential influence of cohort differences on outcome measures (Mann, 2003). For example, where significant associations between wisdom and age are observed, one must also account for the degree to which covarying factors influence the observed variability (e.g., demographic factors such as sex, education) (Wang, 2020). We briefly review these potential confounding variables below.

Education. Several studies have investigated how personal lifestyle choices, including educational and occupational pursuits, impact the development of wise reasoning across the adult lifespan. One investigation into differences in self-reported personal wisdom (TD-WS) amongst college students, non-college-educated older adults, and college-educated older adults, reported that higher education facilitated greater wisdom in old age (Ardelt, 2010). Here, college-educated older adults had higher self-reported personal wisdom than college students (i.e., younger adults) and non-college educated older adults (Ardelt, 2010), corroborating the view that wisdom increases with age. However, college students had higher self-reported personal wisdom scores than non-college educated older adults. These findings suggest that wisdom is more likely to increase with age for individuals who have both the opportunity and motivation to pursue higher education (Ardelt, 2010).

Occupation. Occupational choice has also been shown to influence the expression of wisdom across the adult lifespan (Smith et al., 1994). One study examined the impact of clinical practice on the attainment of wisdom in a sample of clinical psychologists. General wisdom in

younger clinicians, older clinicians, young adult controls, and older adult controls from other professions (i.e., architecture, education, journalism, art and culture, business administration, and medical technology) was assessed using the Berlin Wisdom Paradigm. Amongst clinical psychologists, no age differences in wisdom-related knowledge were observed. However, both younger and older clinical psychologists obtained higher scores on the BWP than professionals in other careers. These findings suggest that individuals who are exposed to more wisdom-related knowledge and training in their professional careers may experience wisdom-enhancing effects (Smith et al., 1994).

Culture. There is a growing body of literature investigating the impact of culture on the development of wisdom, often drawing contrasts between Eastern collectivist and Western individualistic values (Grossmann et al., 2012). Theorists in this group have argued that Eastern conceptualizations tend to emphasize interpersonal (prowess in managing social challenges) and self-regulatory (efficiency in reflecting on and controlling one's thoughts, emotions, and behaviours) wisdom (Staudinger & Glück, 2011b). In contrast, Western philosophies of wisdom highlight cognitive features (e.g., practical intelligence, declarative knowledge) (e.g., Bleyl, 2001; Brezina, 2010; Feng et al., 2018; Grossmann et al., 2012; Lee et al., 2015; Takahashi, 2000; Weststrate et al., 2016). Empirical investigations to explore the effect of culture on wisdom further illustrate the need to distinguish between conceptualizations of wisdom in Western and Eastern contexts. Grossmann and colleagues (2012) exemplified these distinctions by examining American and Japanese participants' performance on tasks necessitating wise reasoning related to (i) intergroup conflicts (e.g., political disputes) or (ii) interpersonal conflicts (e.g., sibling arguments). The findings offered support for an increase in wisdom with age for American, but not Japanese participants (Grossmann et al., 2012), suggesting that one's cultural

environment may play a crucial role in the development and expression of wisdom across the lifespan.

Sex. There are several studies across the implicit and explicit research literature that have examined the influence of biological sex on wise reasoning. Findings from lay research have indicated that male wisdom exemplars (Westrate et al., 2016) and nominees (Sorokowski et al., 2017) significantly outnumber their female counterparts. Theorists have proposed that these lay sentiments are grounded in culturally-embedded stereotypes around traits traditionally attributed to masculinity (e.g., strength, assertiveness, emotional regulation) that are often also associated with wise exemplars (Orwoll & Achenbaum, 1993). Findings from empirical studies are mixed, with some studies offering support for a positive association between aspects of personal wisdom and female sex (e.g., Ardelt, 2009; Cheraghi et al., 2015; Jennings, 2005; Shedlock, 1998; Le, 2008) and others suggesting higher scores on dimensions of personal wisdom in males (e.g., Ardelt, 2009; Cheraghi et al., 2015). There is also support for a negligible relationship of biological sex with personal (e.g., Ardelt, 2009; Webster et al., 2014) and general (e.g., Grossmann et al., 2010) wisdom.

Taken together, these putative mediators of relationship between wisdom and age substantiate the idea that the ontogenetic course of wise reasoning is multifactorial. Indeed, seminal wisdom theorists hold that the development of wisdom over the course of a lifetime is influenced by three distinct antecedent conditions (Baltes et al., 2002; Stange & Kunzmann, 2008). These conditions include (i) expertise-specific factors, encompassing life experiences, mentorship, and professional training, (ii) person-specific attributes, comprising cognitive capabilities and styles, as well as personality features (e.g., creativity, openness to experience; Nussbaum, 2013; Orwoll & Perlmutter, 1990), and (iii) facilitative experiential factors, including

age, environment, and sociocultural context (e.g., see Staudinger & Baltes, 1996; Baltes & Smith, 2008). These factors may intersect in unique ways in a given individual to guide the evolution of wisdom across one's lifespan (Staudinger & Pasupathi, 2003). Some of these factors are modifiable (e.g., education), providing a framework for motivated individuals (should the opportunity arise) to make lifestyle choices that could translate to wisdom-enhancing effects.

2.6 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

While every effort was made in the current work to systematize and standardize the extraction and conversion of available effect sizes to include in the meta-analyses, 31% of identified studies in the cognitive search and 29% age-related search of studies in the cognition search could not be included due to the lack of publicly available data required to calculate effect sizes. Moreover, across studies, there is vast variability in study designs, contributing to concerns with publication heterogeneity. These factors include divergent sample characteristics (e.g., education, sex, culture, occupation), conceptualizations of wisdom, outcome measures of wisdom or cognition, covariates, and variability in analytic frameworks. Below we identify several strategies to overcome these limitations, thereby enhancing consistency across the field as necessary to more precisely define the determinants and ontogenetic trajectories of wise reasoning.

Enhancing Conceptual and Definitional Consistency

The current review provides one of the first attempts to not only synthesize, but quantify, the empirical understanding of the psychological construct of wisdom as it relates to cognitive abilities and age. The findings help to characterize a complex construct in terms of its underlying cognitive architecture and changes with age. Wisdom increases with age, particularly for extra-

personal problem solving. Moreover, wisdom leverages an individual's rich semantic store, recruiting accumulated knowledge and facts to navigate novel contexts effectively and pragmatically. Of note, the current findings may be skewed in certain respects given the observed publication heterogeneity resulting from variability in the conceptualization and measurement of wisdom, as well as study design. This emphasizes the critical need for greater consistency in defining wisdom as the subject of psychological inquiry. Meta-analytic methods can serve in part to overcome these definitional challenges, identifying common themes linking wisdom, cognition, and age that can serve as the basis for future, and more targeted research into the nature of wise reasoning across the lifespan.

Aligning Measurement Approaches for Personal and General Wisdom

The predominant approach for evaluating personal wisdom relies on self-report measures, while assessments of general wisdom typically employ performance-based tools (Glück et al., 2013). In our comprehensive review, we identified only one measure of personal wisdom that adopted a performance-based methodology (i.e., Bremen Wisdom Paradigm; Mickler & Staudinger, 2008). This divergence in measurement approaches for general versus personal wisdom introduces an additional layer of complexity when interpreting study findings. Self-report measures, while widely used in psychological research, have faced longstanding criticism, primarily due to their subjective nature, which can lead to inaccuracies stemming from demand characteristics and potential biases in human reporting (Nisbett & Wilson, 1977). These concerns have gained traction with the advent of advanced measurement paradigms, prompting a call for more objective, performance-based assessments of behaviour (Nesselroade & Molenaar, 2017). Of particular relevance in the context of investigations into age cohort contrasts is the 'positivity bias' associated with aging, wherein older adults tend to focus on and remember more positive

than negative information (Mather & Cartsensen, 2005). This phenomenon can skew evaluations of situations and behaviours (e.g., wisdom) towards a more positive outlook among older adults (Mather & Cartsensen, 2005). Importantly, these considerations underscore the necessity of employing performance-based assessments of personal wisdom to control for potential confounding variables when drawing meaningful conclusions.

Investigating Domain-Specific Cognitive Determinants of Wisdom

While crystallized and fluid intelligence are relatively well-studied in the literature, we identified notably few relevant articles in the remaining four cognitive domains (general intellectual functioning, memory, attention, executive function). Moreover, none of these specific cognitive domains demonstrated a significant aggregate relationship to wisdom. It is possible that the low power derived from the limited number of studies included in each of these meta-analyses contributed to the current null findings.

Relatedly, while crystallized and fluid indices of cognition were reliably related to wisdom, unexpectedly, global cognitive functioning did not show a reliable association. This may, in part, be due to the varied frameworks for conceptualizing and measuring general cognitive ability amongst included studies. Notably, the five studies of global cognition included in the current review employed disparate outcome measures, including self-report and performance-based tools. Only one investigation used an accepted gold-standard instrument, albeit a screener, to assess overall cognitive functioning (i.e., Montreal Cognitive Assessment (MoCA); Nasreddine, 2005). In this study, global cognitive ability (measured with the MoCA) was not a significant predictor of TD-WS personal wisdom composite and subscale scores in a sample of persons with HIV and HIV- controls (Vásquez et al., 2020). Overall, the current work highlights the need for future research to examine the relationship of global cognitive ability to

wisdom using standardized, comprehensive, performance-based assessment tools (e.g., IQ assessments such as the Wechsler Adult Intelligence Scale; Wechsler, 2008) in order to precisely tease apart the relation of wisdom to global cognitive ability.

Moreover, a widely held and longstanding perspective in the field of psychological research centres on the integral role of life experience in the development and subsequent manifestation of wisdom (Ardelt, 2004; Baltes & Staudinger, 2000; Bangen et al., 2013; Glück & Bluck, 2011). Wise reasoning requires one to flexibly reflect on prior experiences and dynamically apply past learnings to novel contexts (Glück & Bluck, 2011). This mechanism suggests that memory processes (recollection of one's personal past) should be implicated in wise reasoning, as one must retrieve information from past experiences in order to apply this to current contexts. Correspondingly, this framework implies that individuals recruit frontal brain functions to engage in this goal-directed behaviour, including reasoning, judgment, planning, organization, and holding information temporarily online in order to arrive at a wise decision (i.e., working memory capacity). Despite the implication of memory and executive function in many of the theoretical models of wisdom in the literature to date (e.g., Ardelt, 2008b; Brienza & Grossmann, 2017; Jeste et al., 2010; Weststrate & Glück, 2017), there have been very few investigations aimed at exploring the impact of these cognitive correlates on wisdom-related outcomes. We argue that greater research efforts are warranted to concretely disentangle the cognitive determinants of wise reasoning, and changes with age.

Investigating Interactions Among Cognition, Age and Wisdom

The current review presents robust evidence for the link between crystallized and fluid intelligence with wisdom. In parallel, we have provided evidence for a modest positive association between wisdom and age. The discrete developmental trajectories of crystallized

versus fluid abilities with age suggests that the underlying cognitive mechanisms of wisdom may vary in younger versus older adulthood. Despite this potential variability, the vast majority of studies examining the role of cognition in wisdom did not explore age contrasts. Indeed, in the current review, although more than 90% of included studies explored an adult lifespan sample (ages 18 - 90), none of these employed analyses to explicitly disentangle distinct age-related patterns in the relationship between cognition and wisdom. Future empirical efforts to comparatively investigate these determinants of wisdom at various stages of the adult lifespan will further inform our understanding of the ontogenetic course of wise reasoning.

Identifying the Neural Substrates of Wise Reasoning

Few studies have investigated the neural mechanisms associated with wise reasoning across the lifespan. However, human neuroscience investigations have fundamentally altered our understanding of cognitive, social and personality functioning, particularly as these are altered in aging, brain injury, or disease. Similarly, we suggest that *in vivo* neuroimaging studies will enable the field of wisdom research to move beyond the limitations of self-report and performance-based behavioral assays of wisdom, to more precisely characterize how wisdom is implemented in the brain over the course of human development. Preliminary theoretical notions posit that wisdom may share overlapping brain infrastructure with regions implicated in general intellectual functioning, including the anterior cingulate cortex and dorsolateral prefrontal cortex (Grennan et al., 2021; Meeks & Jeste, 2009). There is a critical need for future research to employ neuroimaging methods in order to cultivate a more fulsome understanding of the neurocognitive architecture of wisdom (see Study 4 in Chapter 3).

Promoting Individual and Collective Well-Being

An enriched understanding of the age-related and neurocognitive features of wisdom has implications for promoting the well-being of the burgeoning older adult segment. Specifically, understanding the underpinnings of wise reasoning will allow us to systematically identify ways in which to foster this positive element of late life development. Indeed, it has been demonstrated that crystallized intelligence, while relatively stable with age, can demonstrate gains with age (Park et al., 2001). For example, as an individual ages, they are exposed to a diverse and growing range of concepts and words through education, reading, interpersonal interactions, and general life experiences. Correspondingly, one's vocabulary continues to advance with age, as an individual becomes more adept at using language effectively, complex verbal information, and engaging in conceptual thinking (Park et al., 2001; Park et al., 2003; Craik & Bialystok, 2006). Certainly, there is vast potential for motivated individuals to continue to expand their semantic store, which may in turn promote gains in wisdom. Accordingly, there is a novel opportunity to develop interventions that tap into the development of relevant cognitive components (e.g., crystallized and fluid abilities) of wisdom to foster its manifestation and bolster its expression.

2.7 CONCLUSIONS (STUDIES 1 & 2)

The present study has highlighted the integral role of cognition in the expression of wisdom, across both general and personal dimensions. In line with longstanding sentiments, there is empirical evidence in support of the idea that wisdom increases with age. This relationship is especially robust when reasoning about life in general from an observer's vantage point (general wisdom). The insights gathered from the existing literature provide guidance as to directions for future efforts to further delineate the componential nature of this complex construct. While there has been a striking increase in psychological inquiry into wisdom, there

remains much work to be done. With a firm understanding of wisdom and the factors that facilitate its manifestation, there is great potential for the development of unique, innovative interventions to foster wise reasoning across the adult lifespan, towards enhancing personal and population well-being.

CHAPTER 3: INVESTIGATING THE SHIFTING COGNITIVE AND NEURAL ARCHITECTURE OF WISE REASONING ACROSS THE ADULT LIFESPAN

3.1 THE WISDOM, AGE, AND COGNITION CONUNDRUM

Wisdom, an enigmatic and multidimensional concept, has captivated multidisciplinary scholars for centuries. A longstanding and burgeoning line of inquiry in this area concerns investigations into the relationship of wisdom with increasing age, in consideration of the maxim that 'with age comes wisdom', and the corresponding Eriksonian notion of wisdom as the ideal developmental endpoint of successful aging (Simonton, 1990; Baltes & Staudinger, 1993; Kunzmann & Baltes, 2003; Staudinger, 2008). In parallel, empirical evidence has provided ample support for a correlation between wisdom and positive late-life outcomes, including increased life satisfaction (Ardelt, 1994, 1997; Grossman, 2012; Jennings, 2004), well-being (Ardelt, 2016; Ardelt & Jeste, 2018; Ardelt et al., 2018a; Cheung & Chow, 2019; Staudinger & Glück, 2011b; Webster et al., 2014a), and purpose in life (Staudinger & Glück, 2011b). In fact, self-reported personal wisdom (i.e., insight into oneself) has demonstrated more robust associations with life satisfaction than objective life conditions, including physical health, financial situation, and socioeconomic status (Ardelt, 1997). The realization of wisdom may serve as a protective mental health mechanism in aging; thus, enriching our understanding of the construct and ways to foster it may promote the development of novel frameworks to enhance well-being into late life. However, the precise nature of wisdom and how it relates to the cognitive and neural changes that occur across the adult lifespan is not well-understood and remains an active area of investigation. The current study aims to unpack the complex interplay between wise reasoning, cognition, and neural architecture, shedding light on how these factors may evolve as individuals age.

A foundational premise for the current investigation is the notion that wisdom may indeed increase with age, drawing on insights from the meta-analysis presented in Chapter 2, Study 2. Despite differences in study design and outcomes reported at the individual study level, the aggregate meta-effect of age on wisdom was observed to be positive, suggesting that older is indeed wiser. Notably, this finding was more robust for general (insight into life in general) than personal (insight into oneself) wisdom.

Despite differences in the ontogenetic course of personal versus general wisdom, there is widespread agreement in the field that wisdom (in either form) harnesses a variety of skills that may manifest cross-contextually as individuals navigate through life (Glück & Bluck, 2011). An array of associated cognitive (e.g., crystallized and fluid intelligence; see Staudinger et al., 1997, Glück et al., 2013, or Grossmann et al., 2013 for examples), personality (e.g., humility; see Krause, 2016 or Schneider et al., 2023 for examples), and psychological features (e.g., subjective well-being (Stone et al., 2020), lower anxiety in older adults (Grennan et al., 2021)) have been tied to both general and personal wisdom in the literature. Consistent with earlier views, the data in Chapter 2 offer strong support for a cognitive contribution to the expression of wisdom. Specifically, crystallized (semantics) and fluid (cognitive control) capacities demonstrated reliable associations with wise reasoning, and this effect was most pronounced for crystallized intelligence, suggesting that semantic processing may play a pivotal role in the expression of wisdom.

Among studies examining the determinants of wisdom, one of the most consistent overarching themes emphasizes the role of life experience as an integral component of wisdom (Glück, 2018). Indeed, wisdom has demonstrated positive associations with lived experiences, especially difficult, traumatic, or existential (Ardelt, 2008b, 2010, 2018; Bluck & Glück, 2004;

Brienza & Grossmann, 2017; Glück, 2011, 2018; Glück et al., 2005; Igarashi et al., 2018; Staudinger, 1999; Weststrate & Glück, 2017), openness to experience (Ardelt, 2000b; Baltes et al., 2002; Baltes & Smith, 2008; Law & Staudinger, 2016; Staudinger, 1999, 2016; Staudinger & Glück, 2011a, 2011b; Staudinger et al., 1998; Staudinger & Pasupathi, 2003), resilience and coping strategies derived from previous experiences (Jeste et al., 2010), and self-reflection on past experiences (Ardelt, 2000b; Law & Staudinger, 2016; Pascual-Leone, 2000; Weststrate & Glück, 2017). The hypothesized crucial role of life experience suggests a critical role for prior knowledge representations in the manifestation of wisdom, including both crystallized (semantic) knowledge and personal event (i.e., episodic) knowledge. Specifically, the capacity for self-reflection and application of past knowledge to novel scenarios, as necessary for wise reasoning, inherently leverages one's ability to retrieve and recall information from memory stores (Yang, 2020). Building on this idea, and drawing upon the findings of Study 1, we hypothesize that wise reasoning avails of both fluid and crystallized cognitive capacities, indexed by episodic and semantic memory capacities respectively. However, as noted above, only two empirical studies have directly explored the relationship of wisdom to memory, and the results were equivocal. While one study provided evidence for a positive association between episodic memory and personal wisdom-related knowledge (Moraitou & Efklides, 2012), the observed effect was null in a second investigation (Lindbergh et al., 2022).

Fluid and Crystallized Cognition in Aging: The 'Semanticization of Cognition' Hypothesis

Taken together, these findings raise intriguing questions about the role of cognition in the expression of wisdom in younger versus older adulthood given the well-established literature on the discrete developmental trajectories of fluid versus crystallized capacities in neurocognitive aging (Park et al., 2001; Spreng & Turner, 2019). Fluid abilities, or cognitive control, which is

characterized by one's ability to reason, problem-solve, and think flexibly (Carpenter et al., 1990; Cattell, 1971), shows marked declines from young adulthood into late life (Park et al., 2001; Verhaegen & Cerella, 2002). Conversely, crystallized abilities, or semantics, remain stable or exhibits gains with age (Park et al., 2001; Verhaegen, 2003). In the same vein, with increasing age, semantic memory (i.e., crystallized capacity drawing on general knowledge about oneself and the world) remains stable, while episodic recall (i.e., detailed recollections of specific past events relying on fluid/controlled processing) declines (Craik & Bialystok, 2006; Park et al., 2001). These diverging trajectories have recently been encapsulated within the 'semanticization of cognition' hypothesis of neurocognitive aging. Findings from our laboratory and other research groups suggest that this shift can convey both positive and negative impacts on real world functioning, and may parallel the shifting network architecture of the brain into older age (Spreng &Turner, 2019).

The 'Default to Executive Coupling Hypothesis of Aging' (DECHA)

The transition towards an increased reliance on semantic abilities as individuals age is intricately linked with a parallel shifting of the brain's network organization throughout the adult lifespan (Spreng & Turner, 2019; Turner & Spreng, 2015). In particular, the hallmark of an aging brain is a dedifferentiated network architecture marked by diminished within-network and greater between-network activity compared to younger counterparts (Geerligs et al., 2015; Wig, 2017), poorly modulated by task demands (Damoiseaux, 2017). Two prevalent patterns of functional change with age include: (i) increased bilateral recruitment of lateral prefrontal cortices (lPFC), implicated in fluid cognitive control processes and (ii) reduced suppression of the default network (DN), implicated in access to priori knowledge representations (see Spreng & Turner, 2019; Turner & Spreng, 2015 for reviews).

The 'Default to Executive Coupling Hypothesis of Aging' (DECHA) (Turner & Spreng, 2015) integrates these two fundamental neurocognitive aging patterns (i.e., greater recruitment of lPFC, reduced suppression of DN) to propose a unitary framework for understanding the shifting neural architecture of cognition with age. According to the DECHA, as older adults become increasingly reliant on access to prior knowledge (semantics) to support goal-directed action in service of declining cognitive control abilities, there is a functional and inflexible coupling between DN and lPFC brain regions.

Recent work from our laboratory has provided strong evidence directly linking DECHA to the semanticization of cognition in later life (Spreng et al., 2018). In the context of the current dissertation, wise reasoning has been associated with both semantic knowledge (Study 1) and increasing age (Study 2). Taken together, this suggests that age-related shifts in cognitive (semanticization) and brain (DECHA) function may serve as putative mechanisms of wise reasoning into older adulthood. Studies 3 and 4 will directly test these ideas.

3.2 STUDIES 3 & 4: WISDOM AND NEUROCOGNITIVE AGING

While the literature on wisdom has grown tremendously in recent decades, there remains a significant gap in our understanding of how age-related changes in cognitive and neural architecture intersect with the expression of wisdom. Building upon our findings of the reviews in Chapter 2, the two empirical studies reported below will bridge this gap by investigating wisdom (personal and general), cognition (semantic and episodic memory), and intrinsic brain network architecture in younger and older adults.

Study 3: Examining the Cognitive Architecture of Wise Reasoning in Adulthood

Study 3 investigates the relationship between wisdom, age, and crystallized and fluid cognitive abilities building from the findings of Studies 1 and 2 and our neurocognitive models of aging cognition. The first aim of Study 3 was to empirically investigate whether 'older is wiser.' Here, we examined the relationship of age to performance-based general (Berlin Wisdom Paradigm) and self-reported personal wisdom (Three-Dimensional Wisdom Scale and Self-Assessed Wisdom Scale) in younger and older adults. Consistent with previous reports and findings from Chapter 2, we predicted that older adults would score higher than younger adults on measures of both general and personal wisdom, with more robust effects for general than personal wisdom (Study 3, Hypothesis 1).

The second aim of Study 3 was to explore whether the cognitive architecture of wise reasoning differs in younger and older adulthood. Building upon previous findings from our laboratory which directly linked DECHA to the semanticization of memory functioning, here we focus on associations between wisdom and crystallized cognition (operationalized as semantic memory) and fluid cognition (operationalized as episodic memory) in young and old. Given the theorized integral role of life experience and reflection (e.g., Glück et al., 2005), we hypothesized that both semantic and episodic memory would be positively associated with wisdom, with stronger associations identified for semantic memory, reflecting the wisdom and crystallized memory associations observed in Study 1 (Study 3, Hypothesis 2). Finally, consistent with the semanticization of cognition hypothesis (i.e., increased reliance on semantic abilities with age), we also predicted that semantic memory would be a stronger predictor of wisdom in older versus younger adults (Study 3, Hypothesis 3).

The final aim of Study 3 was to investigate whether personal and general wisdom are associated with distinct cognitive mechanisms. As discussed above, one's capacity to flexibly draw on one's knowledge reservoir and apply learnings to novel contexts is purported to be crucial to the expression of performance-based general wisdom (Staudinger et al., 1998). In contrast, self-reported personal wisdom is characterized by the capacity to generate insights into one's own life (Staudinger, 2013), suggesting emphasis on inward reflection and concurrent affective regulation as well as cognition to engage in wise reasoning. In line with these themes, we predicted that cognitive ability (aggregate effect of semantic and episodic memory) would demonstrate a stronger positive association with performance-based general wisdom than self-reported personal wisdom (Study 3, Hypothesis 4).

Study 4: Examining the Neural Architecture of Wise Reasoning in Adulthood

In Study 4, we conducted a preliminary examination of associations among wisdom, memory, and the intrinsic network architecture of the brain measured at rest. This final study is considered to be exploratory as we are not aware of any previous works directly examining associations between wisdom, cognition, the network architecture of the brain, and differences with age. The findings of this study will be used to inform planned future investigations to examine the neural correlates of wise reasoning across the lifespan. Consistent with the DECHA model, we focused our analysis specifically on brain regions within the frontoparietal control (CONT) and default (DN) networks, which have been previously implicated in cognitive control and prior knowledge representations respectively (Spreng et al., 2010). We tested the prediction that consistent with the DECHA model, higher performance-based general wisdom (assessed using the Berlin Wisdom Paradigm) and memory (semantic and episodic) would be associated with greater network dedifferentiation in older than younger adults, characterized by more robust

functional connectivity between DN and CONT regions at rest (Study 4, Hypothesis 1). We anticipated that a parallel pattern would be observed for personal wisdom (Three-Dimensional Wisdom Scale and Self-Assessed Wisdom Scale), though the magnitude of the effect may be reduced relative to general wisdom, given the theorized attenuated role of semantic processing in personal wisdom (Study 4, Hypothesis 2).

3.3 INTEGRATED METHODS FOR STUDIES 3 & 4: BEHAVIOUR & BRAIN ANALYSES

Data Collection & Participants

Data for both studies were collected over a four-year period (2015 – 2019) at two research sites: York University (Toronto, Canada) and Cornell University (Ithaca, New York). Over the span of three to four days, participants underwent comprehensive cognitive, behavioural, and personality assessments prior to brain scanning. All data have been de-identified and made available for open access. The behavioural and demographic dataset is available within the Open Science Framework project "Goal-Directed Cognition in Older and Younger Adults" (http://osf.io/ufqbx). The neuroimaging dataset is available through OpenNeuro (https://openneuro.org/datasets/ds003592/versions/1.0.13). All participants were English speaking, right-handed, and had no history of unmaintained physical health issues, mental health problems, or substance abuse. All participants provided informed consent in writing and were compensated monetarily for their participation, approved by the Institutional Review Boards at York and Cornell University.

In Study 3, a total of 344 neurologically healthy younger (n = 181, M_{age} = 22.42) and older adults (n = 163, M_{age} = 69.26) were included in the behavioural analyses. In Study 4, we

examined the largest sample of wisdom and fMRI in the literature to date, consisting of 286 neurologically healthy younger (n = 157, M_{age} = 22.55) and older adults (n = 129, M_{age} = 69.09). Participants were included in the study if they were between the ages of 18 – 35 (younger adult cohort) or ≥ 55 years of age (older adult cohort) in order to capture a sample of adults that represents both ends of the adult spectrum.

Behavioural Assessment Measures

The behavioural assessment battery consisted of measures of general and personal wisdom, as well as standardized cognitive instruments (see Table 3.1). The participant details for Studies 3 and 4 are outlined in Tables 3.2 and 3.3 respectively.

Table 3.1

Behavioural Assessment Measures and Associated Domains

Domain	Measure	Reference
Wisdom		
General Wisdom	Berlin Wisdom Paradigm (BWP)	Staudinger et al., 1994
Personal Wisdom	Three-Dimensional Wisdom Scale (TD-WS)	Ardelt, 2003
	Self-Assessed Wisdom Scale (SAWS)	Webster, 2003
Cognitive Indices		
Semantic Memory	Shipley- 2 Vocabulary	Shipley et al., 2009
	NIH Toolbox Picture Vocabulary Test	Weintraub et al., 2014
	NIH Toolbox Reading Recognition Test	Weintraub et al., 2014
Episodic Memory	Verbal Paired Associates	Wechsler, 2009
	Associative Recall	Brainerd et al., 2013
	NIH Toolbox Auditory Verbal Learning Test	Weintraub et al., 2014
	NIH Toolbox Picture Sequence Memory Test	Weintraub et al., 2014

Table 3.2

Study 3—Behavioural Assessment: Participant Details

	Older Adults (n = 163)		Younger Adults (n = 181)		Full Sample (n = 344)	
	Mean	SD	Mean	SD	Mean	SD
Demographics						
Age (years)	69.26	6.50	22.42	3.29	44.62	23.97
Education (years)	17.18	2.82	14.99	1.80	16.03	2.58
Females (*n*)	92		101		193	
General Wisdom						
BWP Composite	82.27	17.76	83.95	19.32	83.16	18.59
Personal Wisdom						
TD-WS Composite	11.13	1.70	10.57	1.65	10.84	1.70
SAWS Composite	191.08	23.99	180.40	21.24	185.64	23.22
Cognitive Indices						
Semantic Memory	.34	.81	-.31	.61	-.00	.78
Episodic Memory	-.67	.61	.51	.55	-.05	.83

Table 3.2. Cognitive indices represent average of z-scores on individual measures within each domain.

Table 3.3

Study 4—Resting-State Functional Connectivity Analyses: Participant Details

	Older Adults (n = 129)		Younger Adults (n = 157)		Full Sample (n = 286)	
	Mean	SD	Mean	SD	Mean	SD
Demographics						
Age (years)	69.09	6.54	22.55	3.32	43.54	23.73
Education (years)	17.20	2.91	15.14	1.80	16.07	2.58
Females (*n*)	72		89		161	
General Wisdom						
BWP Composite	82.19	17.25	85.66	18.62	84.10	18.06
Personal Wisdom						
TD-WS Composite	11.30	1.61	10.61	1.63	10.91	1.66
SAWS Composite	190.63	24.68	180.20	20.96	185.02	23.03
Cognitive Indices						
Semantic Memory	.37	.75	-.27	.61	.02	.73
Episodic Memory	-.60	.59	.52	.50	.02	.78

Table 3.3. Table details as described in Table 3.2.

Performance-Based General Wisdom: The Berlin Wisdom Paradigm (BWP).

General wisdom was assessed with a performance-based measure. The Berlin Wisdom Paradigm (BWP) was developed as one of the first empirical assessment measures of general wisdom-related knowledge (Staudinger et al., 1994). Researchers in this group conceptualize wisdom as "expert-level performance in the fundamental pragmatics of life." (Staudinger et al., 1994, p. 9). 'Fundamental pragmatics' of life refers to the essential, practical aspects or principles that govern human existence and interactions (Staudinger et al., 1994). It encompasses the foundational elements that guide how individuals navigate various challenges and uncertainties in life, including insights and knowledge about key aspects of the human condition (e.g., finite nature of life, typical ontogenetic course of milestones) (Staudinger et al., 1994). Through this lens, Staudinger and colleagues (1994) established five criteria purported to encompass the full scope of wisdom-related knowledge, drawing from the tenets of philosophical-historical wisdom literature (e.g., Rice, 1958; Kekes, 1983; Oelmüller, 1989; Assman, 2019), lifespan developmental psychology (e.g., Baltes, 1987; Lerner, 1986), and cognitive psychology (e.g., Glaser, 1986; Salthouse, 1992; Ericsson & Smith, 1991). The five dimensions of general wisdom-related knowledge include: (i) rich factual knowledge about practical life aspects (rich factual knowledge), (ii) rich procedural knowledge for dealing with life's challenges (rich procedural knowledge), (iii) understanding of life contexts and their developmental relations (lifespan contextualism), (iv) knowledge about differences in values and life goals (value-relativism), and (v) appreciation for the relative uncertainty of life and its management (Staudinger et al., 1994) (see Table 3.4 for an expansive overview of BWP dimensions).

Additionally, Staudinger and colleagues (1994) identified three discrete life contexts which may recruit general wisdom-related knowledge: (i) life planning, (ii) life review, and (iii)

life management. In the published BWP manual (Staudinger et al., 1994), only life planning and life review tasks are included. Accordingly, the current study did not examine general wisdom-related knowledge in the context of life management. According to the BWP framework, life planning constitutes the process of setting goals, making decisions, and taking actions to support prospective goal-directed behaviour (Staudinger et al., 1994). In the context of the BWP instrument, life planning tasks involve navigating fictional characters' futures in challenging and uncertain life scenarios (Staudinger et al., 1994). In contrast, life review refers to the process of reflecting upon and evaluating one's life experiences, choices, and accomplishments, as a retrospective examination that taps into one's ability to reflect on and gain insights from lived experiences (Staudinger et al., 1994). Here, participants are tasked with reconstructing possible life events, while also providing evaluations and interpretations about a fictitious person's life (Staudinger et al., 1994).

Table 3.4

Dimensions of Wisdom on the Berlin Wisdom Paradigm

Domain	Definition
Wisdom-Related Criteria	
(i) ***'Rich Factual'*** Knowledge About the Fundamental Pragmatics of Life	General knowledge about human nature and life conditions (e.g., motives, emotions, mortality, human conduct). Specific knowledge about particular life events (e.g., accidents, job interviews) and the typical age-related occurrence of such events.
(ii) ***'Rich Procedural'*** Knowledge About the Fundamental Pragmatics of Life	Knowledge about procedures (i.e., heuristics and strategies) for dealing with the management and interpretation of life matters with regard to the past, present, and future.
Meta-Level Criteria	
(iii) ***'Lifespan Contextualism'***: Understanding of Life Contexts	People and events are not considered in isolation, rather, the various temporal (i.e., past, present, future) and

and Their Temporal (Developmental) Relations	thematic (e.g., family, friends, work) contexts of one's life are considered.
(iv) ***'Value-Relativism'***: Knowledge About the Differences in Values and Life Goals	The awareness of the relativity of individual or cultural values and life goals. The ability to distance oneself from personal values and consider alternative perspectives.
(v) Knowledge About the Relative ***'Uncertainty'*** of Life and Its Management	Knowledge that life is relatively unpredictable, and that life decisions, interpretations, and plans, will never be free from uncertainties. Insight that one never has access to all of the information and possible interventions to settle all life dilemmas beyond doubt, and that therefore, the future cannot be fully predicted or controlled.

Adapted-Berlin Protocol Administration. Examiners consisted of research assistants (undergraduate to doctoral level of study) with educational background in psychology. Examiners were systematically trained to follow a standardized protocol during administration, in accordance with Staudinger and colleagues' (1994) manual. Wisdom-related knowledge was assessed by examiner-led semi-structured interview using the "think aloud" method (Ericsson & Simon, 1984), which were audio recorded to ensure precision of scoring. Through this framework, participants verbalized their thought process to an examiner as they worked through hypothetical scenarios that present challenging and ambiguous life circumstances about a fictitious character (three life planning problems, one life review problem). While participants are informed that they are not required to reference one's own life when completing the tasks, it is anticipated that one's individual characteristics (e.g., age, sex, culture, life experiences) may influence responses to some degree. To manage these confounding variables, the tasks are framed from the perspective of different age cohorts (young, middle-aged, older) or sexes (male,

female), with examiners providing participants age and sex-matched tasks. Appendix E provides the life planning and life review problems administered. See our earlier work for a comprehensive overview of the administration protocol adopted in the current study (Darboh, 2018).

Protocol Scoring. Audio recorded interviews were transcribed into text format by a team of trained undergraduate research assistants. The transcribed protocols were subsequently assessed by trained raters along the five dimensions of general wisdom-related knowledge outlined in Table 3.4. Two cohorts of healthy adults were recruited as raters, including 11 older adults (M_{age} = 67, *SD* = 3.1, 82% female) and 13 younger adults (M_{age} = 24, *SD* = 2.2, 77% female). All raters were English-speaking and neurologically healthy individuals recruited from the York University campus and surrounding community. Raters underwent a thorough training protocol prior to beginning scoring, ranging from three to six hours spread across two separate sessions. Training of raters was led by the author (BSD) and occurred over a three-year period (2017 – 2020).

The first session, 'general training', introduces raters to the evaluation of texts, including orientation to and practice with the seven-point scale used in the study. General training occurred in both individual and group-based formats in the current study, depending on participant availability. In the second session, 'specific training', raters were randomly assigned to one of the five wisdom criterion variables while remaining blind to the remaining four dimensions. This group-based session (two raters) consists of an in-depth and collaborative exploration of the assigned criterion variable. It begins with a trainer-led explanation of the criterion, coupled with a group discussion about the learnings to ensure sufficient understanding amongst raters. Subsequently, while receiving support from the trainer, raters engage in group discussion to

apply the criteria to a specific problem, aiming to formulate an ideal response. Finally, raters independently score practice protocols derived from a pilot study to ensure calibration with the manual's evaluation standards, as gauged by the trainer. Upon completion of training, raters were provided de-identified, electronic transcripts to be scored at home or at York University, if preferred. Raters scored a minimum of 100 transcripts to a maximum of 200, with the total scoring time per rater ranging from 24 – 32 hours over 8 weeks. See our earlier work for a comprehensive overview of the scoring protocol implemented in the current study (Darboh, 2018).

To account for potential disparities in perceptions of wisdom between younger and older adults in the lay population (Glück & Bluck, 2011), one younger adult and one older adult were assigned to evaluate each criterion variable per transcript. Specifically, for any given task (e.g., life review), the response was scored by ten different raters (i.e., 1 younger adult + 1 older adult x 5 criterion variables) to derive a composite score of general wisdom-related knowledge. To assess interrater reliability, we conducted two-way random effects intraclass correlation (ICC) analyses following the methods outlined by Koo and Li (2016). ICC coefficients values range from 0 to 1, with 1 corresponding to perfect agreement, and 0 indicating no agreement beyond what would be expected by chance (Koo & Li, 2016). The typical convention for classifying the magnitude of ICC coefficients in the literature is outlined in Table 3.5 (Koo & Li, 2016). There was good reliability amongst raters in the full sample (r = .85) and when examining ratings of transcripts of younger (r = .85) or older adult (r = .84) participants.

Table 3.5

Levels of Interrater Reliability Based on Intraclass Correlation Coefficient

Coefficient (*r*)	Interpretation
< .5	Poor Reliability
.5 to .75	Moderate Reliability
.75 to .9	Good Reliability
> .9	Excellent Reliability

Note. Guidelines proposed by Koo & Li, 2016.

Deriving BWP Composite Scores. In the current study, each participant completed four tasks: three life planning and one life review task. The derivation of composite general wisdom scores required multiple steps. Firstly, for each of the four tasks, responses were assessed along the five dimensions of general wisdom-related knowledge by two raters (1 young, 1 older) to yield ten domain-specific scores per task. Mean scores were derived from younger and older adult ratings in each wisdom dimension and used in the calculations to follow (i.e., 5 domain-specific scores). Subsequently, scores from each of the five dimensions of wisdom were summed to derive a total score of general wisdom for each task. Finally, the total scores for the four tasks (3 life planning, 1 life review) were summed to derive an overall composite score of general wisdom-related knowledge ('BWP composite score'), encompassing both prospective (life planning) and retrospective (life review) capacities. A response is considered wise when it is allocated high scores on all five criteria (i.e., ≥ 5 in each domain per task, ≥ 100 overall) (Staudinger et al., 1994).

Self-Reported Personal Wisdom: The Three-Dimensional Wisdom Scale (TD-WS). The Three-Dimensional Wisdom Scale is a self-reported instrument used to assess personal wisdom along three key dimensions that encompass its componential nature: (i) cognitive (rich

life knowledge), (ii) reflective (adopting multiple perspectives), and (iii) affective (empathic understanding) (Ardelt, 2003). It consists of 39 items rated on a 5-point Likert scale (1= strongly agree, 5= strongly disagree). Personal wisdom is represented as a single latent variable derived from the sum of scores from each dimension (maximum score = 195). See Appendix F for the full instrument.

Self-Reported Personal Wisdom: The Self-Assessed Wisdom Scale (SAWS). The Self-Assessed Wisdom Scale is a self-report measure designed to evaluate personal wisdom according to five domains purported to contribute to the expression of wisdom: (i) emotion regulation (effective recognition, expression, and management of emotions), (ii) critical life experiences (challenging life experiences), (iii) reflectiveness/reminiscence (ability to critically evaluate one's past and present), (iv) openness to experience (tolerance for diverse perspectives, information, and solutions), and (v) humour (recognition and skillful use of humour across contexts) (Webster, 2003). The SAWS consists of 40 items that are rated on a 6-point Likert scale (1 = strongly disagree, 6 = strongly agree). A composite score of personal wisdom is derived from the sum of scores from each domain, for a maximum score of 240. See Appendix G for the full instrument.

Cognitive Measures (Semantic and Episodic Memory)

The cognitive assessment battery was comprised of standardized and experimental performance-based measures. Semantic memory ability was examined with the following measures: Shipley-2 Vocabulary Test (Shipley et al., 2009), NIH Picture Vocabulary Test, and NIH Reading Recognition Test (Weintraub et al., 2014). Episodic capacity was assessed with the following tools: Verbal Paired Associates (Wechsler, 2009), Associative Recall Task (Brainerd

et al., 2013), Auditory Verbal Learning Test, and NIH Picture Sequence Memory Test (Weintraub et al., 2014).

To create amalgamated metrics within each domain and to simplify analyses, raw scores on individual measures were z-scored and averaged within each domain to yield index scores of semantic and episodic memory. Participant data on each individual measure were converted to a z-score. Z-scores were computed across the full sample of participants (n = 344), rather than within groups (i.e., younger and older adults separately). Z-scores were calculated by applying the standard formula to raw scores for each measure in R Studio—(i) the difference between the observed value and the sample mean were tabulated; (ii) the value produced in (i) was divided by the sample standard deviation. Subsequently, z-scores of each variable within a given domain were averaged to produce cognitive index scores for each participant. Higher scores are indicative of better performance.

Resting-State Functional Connectivity (RSFC) Protocol

MRI Acquisition. Neuroimaging data were collected at two sites (York University and Cornell University) and scanning protocols were closely matched. The York University Neuroimaging Centre in Toronto utilized a 3T Siemens Tim Trio MRI scanner with a 32-channel head coil (Spreng et al., 2022). The Cornell Magnetic Resonance Imaging Facility in New York employed a 3T GE750 Discovery series MRI scanner and 32-channel head coil (Spreng et al., 2022).

Resting-State Functional MRI Scan. Two resting-state runs lasting 10 minutes and 6 seconds each were conducted for each participant (Spreng et al., 2022). The runs used a multi-echo (ME) EPI sequence at York University (TR=3000ms; TE1=13.7ms, TE2=30ms, TE3=47ms; 83° flip angle; matrix size=64x64; FOV=216mm; 43 axial slices; 3.4x3.4x3mm

voxels; 200 volumes, 3x acceleration and GRAPPA encoding) and Cornell University (TR=3000ms; TE_1=13.7ms, TE_2=30ms, TE_3=47ms; 83° flip angle; matrix size=72x72; field of view (FOV)=210mm; 46 axial slices; 3mm isotropic voxels; 204 volumes, 2.5x acceleration with sensitivity encoding) (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023; Spreng et al., 2022). During scans, participants were instructed to keep their eyes open and remain still within a darkened scanner environment, breathing and blinking naturally (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023).

Resting-State Functional MRI Processing. Functional images underwent multi-echo independent components analysis (ME-ICA; version 3.2 beta; https://github.com/ME-ICA/me-ica; Kundu et al., 2012, 2013). Critically, ME-ICA leverages the TE-dependence model of the BOLD signal to better estimate T2* for each voxel and distinguish BOLD signal from non-BOLD sources of noise (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023; Setton et al., 2023). Time series data were minimally pre-processed before TE-dependent de-noising, including (i) discarding the first 4 volumes, (ii) de-obliquing, (iii) motion correction, (iv) and anatomical-functional coregistration (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). Spatial alignment was achieved for each TE. Anatomical-functional coregistration relied on the T2* map for more precise elucidation of grey matter and cerebrospinal fluid compartments than raw EPI images (Kundu et al., 2017; Speck et al., 2001)—a crucial consideration in aging research due to structural changes in which enlarged ventricles and greater subarachnoid space tend to blur these boundaries (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). Subsequently, volumes were optimally amalgamated across TEs and denoised (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023).

We then performed post-processing quality assessment on de-noised time series in native space. Here, participants were excluded according to one or more of the following criteria: (i) unsuccessful coregistration, (ii) residual noise (in-scanner motion or absolute displacement in any direction > 3 mm coupled with de-noised time series showing DVARS >1; Power et al., 2012), (iii) poor temporal signal to noise ratio (tSNR; < 50), or (iv) fewer than 10 retained BOLD-like components (Kantarovich et al., 2022). The de-noised BOLD component coefficient sets in native space were optimized for functional connectivity analyses (Kundu et al., 2013) and used in the analyses to follow. These are referred to as multi-echo functional connectivity (MEFC) data in the current study, in line with earlier work (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023).

Individualized Resting-State Functional Connectivity (RSFC) Parcellation. We initiated whole-brain RSFC matrices using the 200-parcel Schaefer atlas (Schaefer et l., 2018), representing the 7 RSFC-defined networks identified by Yeo and colleagues (2011) (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). Participant-specific functional connectomes were then computed using the Group Prior Individual Parcellation (GPIP; Chong et al., 2017) approach to investigate unique variations in functional brain network organization (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). To achieve this, MEFC data were mapped to a common cortical surface for each participant using FreeSurfer (Fischl, 2012; Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). We maximized alignment between structural and functional data intensity gradients (Greve & Fischl, 2009) by first linearly registering MEFC data to the T1-weighted image on a run-by-run basis (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). Next, the inverse of this registration was used to project the T1-weighted image into native space and resample the MEFC data onto a cortical surface (fsaverage5) using trilinear

volume-to-surface interpolation (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). Once on the surface, runs were concatenated, and MEFC data at each vertex were normalized to zero mean and unit variance (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). Notably, GPIP offers more precise participant-specific functional area estimates and enhances sensitivity in detecting RSFC associations with behaviour in the literature (e.g., Kong et al., 2021; Mwilambwe-Tshilobo et al., 2023). This approach retains consistency in parcel labels across participants while allowing parcel boundaries to adapt to each individual's unique functional network organization (Mwilambwe-Tshilobo et al., 2023). It begins with an initial predefined group parcellation atlas and refines individual parcel boundaries based on their RSFC data (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). GPIP has demonstrated greater improvements in the homogeneity of BOLD signal within parcels and the distinction between functionally specialized regions than other group-based parcellation approaches (Chong et al., 2017). Through this approach, we divided the cortex into 400 functionally defined regions using MEFC data (Kantarovich et al., 2022; Mwilambwe-Tshilobo et al., 2023). Each parcel was matched to a corresponding network in the 7-network parcellation (Yeo et al., 2011). Subsequently, we extracted the MEFC data resulting from each parcel and computed the Pearson correlation coefficient for each pair (Kantarovich et al., 2022). In the current study, as described in Section 3.2, we focused the analyses on the frontoparietal control (CONT) and default networks (DN) given their reliable associations with goal-directed behaviour across the neuroimaging literature (e.g., Andrews-Hanna et al., 2014; Gerlach et al., 2014; Spreng et al., 2010).

Partial Least Squares (PLS) Analyses. Behavioural Partial Least Squares (PLS) was conducted to ascertain RSFC patterns associated with individual differences in wisdom (personal

and general wisdom scores). PLS is a multivariate statistical method that relies on a data-driven approach to analyze complex, high dimensional datasets, including neuroimaging data (McIntosh & Lobaugh, 2004; McIntosh & Mišić, 2013). This approach can be applied to identify associations between functional connections and behavioural measures to derive distinct latent variables (LVs) that maximally covary together in a given sample of participants (McIntosh & Lobaugh, 2004). In the current study, we used PLS to examine patterns of RSFC that were directly correlated to wisdom (general and personal) and cognition (semantic and episodic memory) in the full sample (younger and older adults combined). We then employed PLS to identify age-related differences and similarities in RSFC related to wisdom and memory. We investigated the network-level functional connectivity relationships between the frontoparietal control network and default network associated with wisdom and memory. Following the approach detailed in Mwilambwe-Tshilobo and colleagues (2019), we examined both between- and within-network contributions to the observed relationships.

Network Contribution Analysis. In addition to examining the contribution of interregional connections to the group differences, we also assessed the extent to which network-level RSFC within and between functional networks contributed to group differences (Mwilambwe-Tshilobo et al., 2023). We summarized the network and subnetwork contributions (defined as the salience weights emerging from the singular value decomposition) (Mwilambwe-Tshilobo et al., 2023). Two separate weighted matrices were constructed from the positive and negative salience weights by quantifying the network-level contributions to the PLS-derived RSFC pattern (Mwilambwe-Tshilobo et al., 2023). For both matrixes, nodes represent parcels defined by the individual parcellation (Mwilambwe-Tshilobo et al., 2023). Edges correspond to the squared salience weights of each pairwise connection (Mwilambwe-Tshilobo et al., 2023). A

summary of the network-level effects was estimated by assigning each parcel of the Schaefer atlas according to their respective network label based on the assignment reported by Yeo and colleagues (2011) and subsequently taking the average of all the squared saliences in a given network, generating a 6 x 6 matrix (Mwilambwe-Tshilobo et al., 2023).

To statically assess the network and subnetwork-level effects, we adopted a similar approach as described above; however, we used the bootstrap ratios from the PLS-derived RSFC pattern (Mwilambwe-Tshilobo et al., 2023). The edges of the positive and negative adjacency matrices correspond to the threshold bootstrap ratios of each pairwise connection of the RSFC pattern (Mwilambwe-Tshilobo et al., 2023). Permutation tests were employed for statistical analysis of the pairwise networks (Mwilambwe-Tshilobo et al., 2023). During permutation, network labels for each node were randomly reordered and the mean intra- and internetwork bootstrap ratio were recalculated (Mwilambwe-Tshilobo et al., 2023). This process was repeated 1,000 times to generate an empirical null sampling distribution indicating no relationship between network assignments and RSF pattern (Mirchi et al., 2019; Mwilambwe-Tshilobo et al., 2023). The significance of the pairwise connections to the network matrix was determined by estimating the proportion of times the value of the sampling distribution was greater than or equal to the original value (Mwilambwe-Tshilobo et al., 2023).

3.4. RESULTS OF STUDY 3: DEMOGRAPHIC AND COGNITIVE CORRELATES OF WISDOM

Before testing the behavioural hypotheses, we first examined associations among all wisdom measures across the full, younger, and older adult samples. A Pearson product-moment correlation was computed to assess the relationship among the three outcome measures of wisdom: the Berlin Wisdom Paradigm (BWP), the Three-Dimensional Wisdom Scale (TD-WS),

and the Self-Assessed Wisdom Scale (SAWS). In the full sample, there was a significant small positive correlation between the BWP and TD-WS, $r = .14$, $p = .01$. There was also a significant small positive correlation amongst the personal wisdom outcome measures (TD-WS and SAWS), $r = .21$, $p < .001$. No significant relationship was observed between the BWP and the SAWS (see Table 3.6 for the full correlation matrix).

In the younger adult sample, there was a significant small positive correlation between BWP and SAWS scores ($r = .16$, $p = .04$), while the relationship between the BWP and TD-WS was null ($r = .12$, $p = .13$). Again, there was also a significant small positive correlation between the TD-WS and SAWS, $r = .23$, $p = .004$ (see Table 3.7 for the full correlation matrix). In the older adult sample, there was a positive association between BWP and TD-WS scores ($r = .16$, $p = .05$), but the correlation between BWP and SAWS ($r = .02$, $p = .85$) was not significant. Consistent with observed effects in the adult lifespan and younger adult samples, the association between TD-WS and SAWS scores in older adults was also positive and significant, $r = .15$, $p = .04$ (see Table 3.8 for the full correlation matrix).

Overall, the patterns of associations among the outcome measures of general (BWP) and personal (TD-WS and SAWS) wisdom varied depending on the age group of the sample under examination. The two measures of personal wisdom were positively correlated in all three age groups, though this relationship was most robust in younger adults. General wisdom demonstrated a positive association with different measures of personal wisdom in younger versus older adulthood.

Table 3.6

Bivariate Associations Among Outcome Measures of Wisdom in the Full Sample

	BWP	TD-WS	SAWS
BWP	-		
TD-WS	**.14***	-	
SAWS	.08	**.21****	-

Note. *$p < .05$; ** $p < .01$.

Table 3.6. General wisdom: BWP = Berlin Wisdom Paradigm. Personal wisdom: TD-WS = Three-Dimensional Wisdom Scale; SAWS = Self-Assessed Wisdom Scale.

Table 3.7

Bivariate Associations Among Outcome Measures of Wisdom in the Younger Adult Sample

	BWP	TD-WS	SAWS
BWP	-		
TD-WS	.12	-	
SAWS	**.16***	**.23****	-

Note. *$p < .05$; ** $p < .01$.

Table 3.7. Table details as described in Table 3.6.

Table 3.8

Bivariate Associations Among Outcome Measures of Wisdom in the Older Adult Sample

	BWP	TD-WS	SAWS
BWP	-		
TD-WS	**.16***	-	
SAWS	.02	**.15***	-

Note. *$p < .05$; ** $p < .01$.

Table 3.8. Table details as described in Table 3.6.

Wisdom and Age

Next, we examined whether 'older is wiser'. An independent samples t-test was conducted to compare mean performance-based BWP general wisdom scores in younger versus

older adults. We did not observe significant differences in BWP composite scores in younger (M = 83.95, SD = 19.32) and older (M = 82.27, SD = 17.76) adults, $t(342) = .84$, $p = .20$ (Figure 3.1).

Figure 3.1

Boxplot of Mean Berlin Wisdom Paradigm Composite Scores in Younger and Older Adults

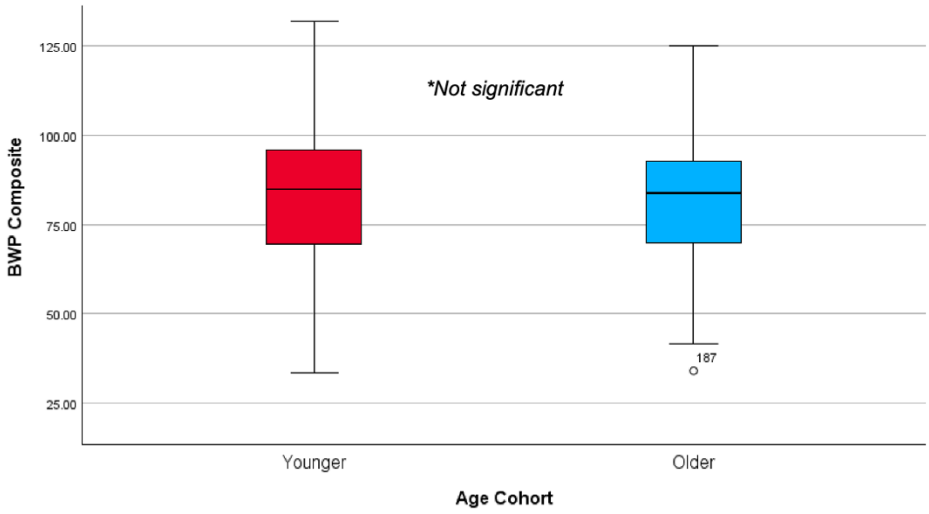


Figure 3.1 The y-axis displays the wisdom score. The box for each age group represents the range between the first quartile (25th percentile) and third quartile (75th percentile) of wisdom scores (i.e., interquartile range). The height of the box is indicative of the spread of the middle 50% of the data, with larger boxes indicating greater variability of the distribution. The horizontal black midline of each box depicts the median (i.e., 50th percentile). If there are more data points clustered around the median of a variable, the horizontal black midline within a given box may appear thicker, indicating that the median value is more densely populated with data points. The whiskers extending from the box represent 1.5x the interquartile range at the minimum and maximum data points within a defined range respectively. Data points outside of the whiskers are potential outliers. No significant difference in mean general wisdom scores in younger versus older adulthood.

Independent samples t-tests were also employed to examine the relationship between age and the two outcome measures of personal wisdom: TD-WS and SAWS. Older adults (M = 11.13, SD = 1.70) self-reported significantly higher personal wisdom than younger (M = 10.57, SD = 1.65) adults on the TD-WS, $t(328) = -3.01$, $p = .001$ (Figure 3.2). Older adults (M = 191.08, SD = 23.99) also scored significantly higher than younger (M = 180.40, SD = 21.24) adults on the SAWS, $t(318) = -4.22$, $p < .001$ (Figure 3.3).

Figure 3.2

Boxplot of Mean TD-WS Composite Scores in Younger and Older Adults

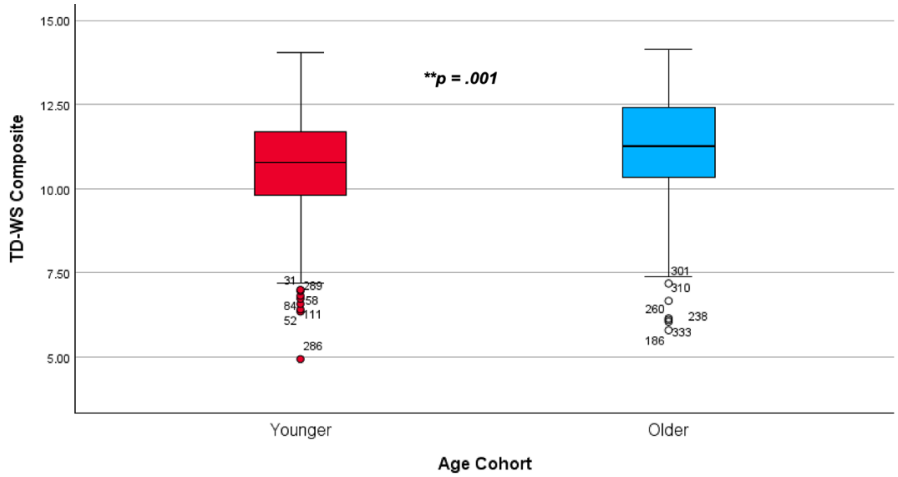


Figure 3.2. Figure details as described in Figure 3.1. Older adults reported significantly higher personal wisdom than younger adults (p = .001).

Figure 3.3

Boxplot of Mean SAWS Composite Scores in Younger and Older Adults

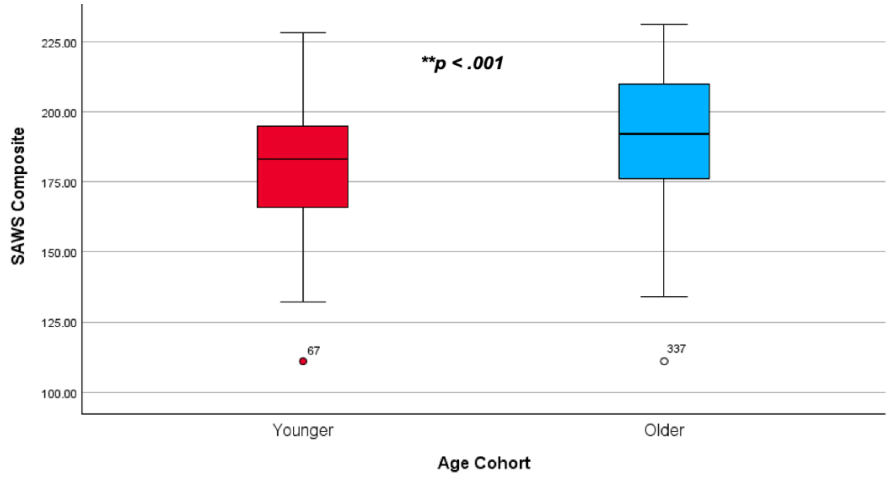


Figure 3.3. Figure details as described in Figure 3.1. Older adults reported significantly higher personal wisdom than younger adults (p < .001).

Wisdom and Memory in the Full Sample

Hierarchical linear regression was conducted on the full sample (younger and older adults combined) to examine associations of wisdom scores with indices of semantic and episodic

memory. Demographic variables (age cohort, education, sex) were included as covariates in each of the hierarchical regression models to follow (stage one). Wisdom scores were then regressed onto indices semantic and episodic memory, while controlling for demographic variables (stage two). The results of each hierarchical regression model are presented in turn. For the full correlation matrices see Supplementary Appendices G and H.

General Wisdom. Education, sex, and age cohort accounted for a significant proportion of variance in BWP general wisdom scores in stage one, $F(3, 338) = 3.59$, $p = .01$, $R^2 = .031$. Education ($B = 1.28$, $p = .00$) and age cohort ($B = -4.71$, $p = .03$) emerged as significant predictors, while sex demonstrated a null effect ($B = -2.29$, $p = .25$). In stage two, cognitive indices were added to the model, which produced a significant change of 7.8% in R^2, $F(5, 336) = 8.18$, $p < .001$. This indicates that cognition explains a significantly greater proportion of variance in BWP general wisdom scores than the demographic variables alone. After controlling for covariates, semantic memory was the only significant predictor of BWP general wisdom scores, $B = 6.29$, $p < .001$. Table 3.9 includes the full regression model and the ANOVA for model comparisons.

Table 3.9

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on General Wisdom (BWP Composite Scores) in the Full Sample

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Age Cohort	**-4.71**	**-.13**	**2.19**	**-9.02**	**-.39**	**.03***	***F*(3, 338) = 3.59, R^2 = .031%, *p* = .01**
Education	**1.28**	**.18**	**.43**	**.43**	**2.12**	**.00****	
Sex	-2.29	-.06	2.00	-6.23	1.65	.25	
Model 2							
Age Cohort	-3.70	-.10	3.34	-20.27	2.86	.27	***F*(5, 336) = 8.18, R^2 = .109%, *p* < .001**
Education	.68	.09	.43	-.17	1.52	.12	
Sex	-1.15	-.03	2.03	-5.14	2.84	.57	
Semantic	**6.29**	**.26**	**1.50**	**3.34**	**9.25**	**< .001****	**ΔR^2 = .078****
Episodic	3.19	.14	1.86	-.48	6.85	.09	

Note. *$p < .05$; ** $p < .01$.

Table 3.9. Dummy coding to create binary age cohort and sex variables, where younger = 0, older = 1; female = 0, male = 1.

Personal Wisdom and Memory: Three-Dimensional Wisdom Scale. The proportion of variance in TD-WS personal wisdom scores explained by the combined effect of education, sex, and age cohort was significant, $F(3, 324) = 4.08$, $p = .01$, $R^2 = .036$. At this stage, none of the individual demographic variables were significant predictors of TD-WS scores. The addition of the cognitive variables in stage two did not produce a significant change in R^2; however, the model was significant, $F(5, 322) = 3.19$, $p = .01$, $R^2 = .047$. Neither the individual demographic covariates or cognitive indices emerged as significant predictors of TD-WS personal wisdom scores in stage two (see Table 3.10 for the full regression model and ANOVA for model comparisons).

Table 3.10

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on Personal Wisdom (TD-WS Composite Scores) in the Full Sample

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Age Cohort	.38	.11	.21	-.03	.78	.07	**$F(3, 324) = 4.08, R^2 = .036, p = .01$**
Education	.07	.11	.04	-.00	.15	.06	
Sex	-.10	-.03	.19	-.47	.27	.60	
Model 2							
Age Cohort	.50	.15	.33	-.14	1.15	.13	**$F(5, 322) = 3.19, R^2 = .047, p = .01$**
Education	.06	.09	.04	-.02	.14	.16	
Sex	-.04	-.01	.20	-.43	.34	.83	$\Delta R^2 = .011$, *ns*
Semantic	.18	.08	.15	-.11	.47	.23	
Episodic	.18	.09	.18	-.18	.54	.33	

Note. *$p < .05$; ** $p < .01$.

Table 3.10. Table details as described in Table 3.9.

Personal Wisdom and Memory: Self-Assessed Wisdom Scale. The proportion of variance in SAWS personal wisdom scores explained by education, sex, and age cohort was 5.8% and the model was significant, $F(3, 314) = 6.45$, $p < .001$. Age cohort emerged as a significant positive predictor at this stage, $B = 11.30$, $p < .001$, while education and sex did not. With the addition of the cognitive variables in stage two, the model remained significant, $F(5, 312) = 4.55$, $p < .001$, $R^2 = .068$; however, the 1.0% change in the proportion of variance in SAWS scores explained by the predictors was not significant. At this stage, none of the individual demographic covariate or cognitive variables emerged as significant predictors of SAWS personal wisdom scores (see Table 3.11 for the full regression model and ANOVA for model comparisons).

Table 3.11

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on Personal Wisdom (SAWS Composite Scores) in the Full Sample

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Age Cohort	**11.30**	**.24**	**2.78**	**5.83**	**16.77**	**< .001****	***F*(3, 314) = 6.45, R^2 = .058,**
Education	-.20	-.02	.54	-1.26	.87	.72	***p* < .001**
Sex	-2.22	-.05	2.56	-7.24	2.81	.39	
Model 2							
Age Cohort	5.08	.11	4.45	-3.68	13.83	.26	***F*(5, 312) = 4.55, R^2 = .068,**
Education	-.36	-.04	.56	-1.47	.74	.52	***p* < .001**
Sex	-3.64	-.08	2.69	-8.94	1.66	.18	
Semantic	2.50	.09	1.95	-1.34	6.35	.20	ΔR^2 = .01, *ns*
Episodic	-4.19	-.15	2.50	-9.12	.74	.10	

Note. *$p < .05$; ** $p < .01$.

Table 3.11. Table details as described in Table 3.9.

Summary: Full Sample. Regression analyses were conducted to investigate whether memory was associated with wisdom in the combined sample of younger and older adults. When examining performance-based general wisdom (BWP composite scores), the addition of semantic and episodic memory to the model produced a significant change in the proportion of shared variance. This suggests that cognition (crystallized and fluid memory abilities) explains a significantly greater proportion of variance in general wisdom than the demographic covariates (age cohort, education, sex) alone in the combined sample, consistent with our hypotheses. Semantic memory was a significant positive predictor of BWP composite scores, while episodic memory was not.

The effect of memory on measures of personal wisdom (TD-WS composite scores, SAWS composite scores) was negligible. It is noteworthy that while neither semantic nor episodic memory emerged as significant predictors of personal wisdom, the aggregate-level effect of the demographic and cognitive variables explained a significant, albeit small proportion

of variance in both TD-WS and SAWS composite scores in the combined sample of younger and older adults.

Wisdom and Memory in Young Adults

Hierarchical regression was employed to examine the contributions of semantic and episodic memory to general and personal wisdom scores in younger adults. Education and sex were treated as covariates in each of the regression models to follow (stage one). In stage two, wisdom scores were then regressed onto indices of semantic and episodic memory. For the full correlational matrices see Supplementary Appendices I and J.

General Wisdom. The proportion of variance in BWP general wisdom scores explained by education and sex was 3.5% and the model was significant, $F(2, 177) = 3.20$, $p = .04$. At this stage, education was the only significant predictor of BWP scores, $B = 1.97$, $p = .01$. The addition of memory ability in stage two produced a significant change in the shared variance, $F(4, 175) = 4.68$, $p = .001$, $R^2 = .097$. Here, education persisted as a significant positive predictor ($B = 1.60$, $p = .04$) of BWP general wisdom scores. Semantic memory emerged as the only significant cognitive predictor of BWP scores, $B = 6.83$, $p = .01$. Table 3.12 provides the full regression model and the ANOVA for model comparisons.

Table 3.12

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on General Wisdom (BWP Composite Scores) in Younger Adults

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Education	**1.97**	**.18**	**.79**	**.41**	**3.54**	**.01***	***F*(2, 177) = 3.20, R^2 = .035, *p* = .04**
Sex	-.95	-.02	2.87	-6.60	4.71	.74	
Model 2							
Education	**1.60**	**.15**	**.78**	**.05**	**3.14**	**.04***	***F*(4, 175) = 4.68, R^2 = .097, *p* = .001**
Sex	-1.48	-.04	2.95	-7.31	4.34	.62	

Semantic	**6.83**	**.22**	**2.56**	**1.79**	**11.88**	**.01***	**$\Delta R^2 = .062$****
Episodic	2.59	.07	2.84	-3.02	8.20	.36	

Note. *$p < .05$; ** $p < .01$.

Table 3.12. Dummy coding to create binary sex variable, where female = 0, male = 1.

Personal Wisdom (TD-WS, SAWS). The hierarchical regression analyses did not yield a significant model in predicting TD-WS nor SAWS personal wisdom scores at any level. Moreover, none of the individual variables emerged as isolated significant predictors of personal wisdom. This suggests that the demographic and cognitive variables collectively failed to explain a substantial proportion of variance in personal wisdom in younger adulthood. See Tables 3.13 and 3.14 for the full regression models and the ANOVAs for model comparisons.

Table 3.13

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on Personal Wisdom (TD-WS Composite Scores) in Younger Adults

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Education	.06	.07	.07	-.07	.20	.36	$F(2, 170) = .70$, $R^2 = .008$, $p = .50$
Sex	-.18	.26	.26	-.68	.33	.49	
Model 2							
Education	.06	.07	.07	-.08	.20	.42	$F(4, 168) = .50$, $R^2 = .012$, $p = .73$
Sex	-.14	.27	.27	-.67	.40	.67	$\Delta R^2 = .004$, *ns*
Semantic	.01	.23	.23	-.41	-.45	.48	
Episodic	.19	.27	.27	-.29	-.35	.72	

Note. *$p < .05$; ** $p < .01$.

Table 3.13. Table details as described in Table 3.12.

Table 3.14

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on Personal Wisdom (SAWS Composite Scores) in Younger Adults

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Education	.08	.01	.92	-1.75	1.90	.93	$F(2, 159) = .01$, $R^2 = 0$, $p = .99$
Sex	-.45	-.01	3.40	-7.16	6.25	.89	
Model 2							
Education	-.08	-.01	.94	-1.93	1.77	.93	$F(4, 157) = .43$, $R^2 = .011$, $p = .79$
Sex	-1.95	-.05	3.60	-9.06	5.15	.59	$\Delta R^2 = .011$, *ns*
Semantic	3.53	.10	3.07	-2.54	9.59	.25	
Episodic	-3.75	-.10	3.57	-10.80	3.30	.30	

Note. *$p < .05$; ** $p < .01$.

Table 3.14. Table details as described in Table 3.12.

Summary: Young Adults. We examined the relationship between wisdom and memory (semantic, episodic) in a sample of younger adults using hierarchical regression. Consistent with the pattern observed in the combined sample, memory ability explained a significantly greater proportion of variance in BWP general wisdom composite scores than education and sex alone. In line with expectations, semantic memory was a significant positive predictor of general wisdom in younger adults. Again, in contrast to our initial hypotheses, we did not identify episodic memory as a significant predictor of BWP general wisdom in younger adults. For personal wisdom, we did not find evidence for a significant effect of cognitive nor demographic variables on TD-WS and SAWS composite scores at both the aggregate (i.e., combined effect of independent variables) and individual (i.e., isolated predictive effects of an independent variable nested within a multivariate model) level in younger adults.

Wisdom and Memory in Older Adults

Hierarchical regression was employed to examine the contribution of semantic and episodic memory to performance-based general and self-reported personal wisdom in older adults. Education and sex were treated as covariates in each of the regression models to follow (stage one). In stage two, wisdom scores were then regressed onto indices of memory ability (semantic, episodic). The results of each hierarchical regression model are presented in the sections to follow. For the full correlation matrices see Supplementary Appendices K and L.

General Wisdom. In stage one, the model including education and sex was not significant, $F(2, 159) = 2.43$, $p = .09$, $R^2 = .03$. However, education emerged as a significant positive predictor of BWP general wisdom scores at this stage, $B = 1.0$, $p = .05$. In stage two, the model that included memory ability was significant and accounted for 13.5% of the variance in wisdom scores, $F(4, 157) = 6.11$, $p < .001$. Consistent with the findings in the combined and younger adult samples, semantic memory was a significant positive predictor of BWP composite scores ($B = 6.32$, $p < .00$), while episodic memory did not demonstrate a significant predictive relationship with wisdom. Table 3.15 provides the full regression model and ANOVA for model comparisons.

Table 3.15

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on General Wisdom (BWP Composite Scores) in Older Adults

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Education	**1.00**	**.16**	**.50**	**.01**	**1.98**	**.05***	$F(2, 159) = 2.43$, $R^2 = .03$, $p = .09$
Sex	-3.41	-.10	2.81	-8.96	2.14	.23	
Model 2							
Education	.21	.03	.51	-.80	1.22	.68	**$F(4, 157) = 6.11$, $R^2 = .135$ $p < .001$**

Sex	-.19	-.01	2.88	-5.87	5.49	.95	**ΔR^2 = .105****
Semantic	**6.92**	**.29**	**1.84**	**2.69**	**9.95**	**< .001***	
Episodic	3.82	.13	2.45	-1.02	8.66	.12	

Note. **p* < .05; ** *p* < .01.

Table 3.15. Table details as described in Table 3.12.

Personal Wisdom (TD-WS, SAWS). Consistent with the observations in the younger adult sample, the hierarchical regression analyses did not yield a significant model in predicting TD-WS or SAWS personal wisdom scores at any level. Moreover, none of the individual variables emerged as isolated significant predictors of wisdom. This suggests that the demographic and cognitive variables collectively failed to explain a substantial proportion of variance in self-reported personal wisdom in older adulthood. See Tables 3.16 and 3.17 for the full regression models and the ANOVAs for model comparisons.

Table 3.16

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on Personal Wisdom (TD-WS Composite Scores) in Older Adults

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Education	.07	.11	.05	-.03	.16	.17	$F(2, 149) = 1.02$, $R^2 = .014$, $p = .36$
Sex	-.14	-.04	.27	-.67	.39	.60	
Model 2							
Education	.03	.05	.05	-.07	.13	.60	$F(4, 147) = 1.67$, $R^2 = .044$, $p = .16$
Sex	-.01	-.00	.29	-.58	.55	.97	$\Delta R^2 = .03$, *ns*
Semantic	.35	.17	.19	-.03	.73	.07	
Episodic	.15	.05	.25	-.34	.63	.54	

Note. **p* < .05; ** *p* < .01.

Table 3.16. Table details as described in Table 3.12.

Table 3.17

Hierarchical Regression Results: The Effect of Demographic Covariates and Cognitive Indices on Personal Wisdom (SAWS Composite Scores) in Older Adults

	Estimate			95% CI			
	B	*β*	*SE(B)*	*LL*	*UL*	*p*	ANOVA
Model 1							
Education	-.26	-.03	.69	-1.63	1.10	.71	$F(2, 153) = .65$, $R^2 = .008$, $p = .52$
Sex	-3.94	-.08	3.88	-11.60	3.73	.31	
Model 2							
Education	-.35	-.04	.75	-1.82	1.12	.64	$F(4, 151) = .83$, $R^2 = .021$, $p = .51$
Sex	-5.92	-.12	4.20	-14.22	2.39	.16	$\Delta R^2 = .013$, *ns*
Semantic	1.69	.06	2.64	-3.53	6.91	.52	
Episodic	-5.03	-.13	3.61	-12.16	2.09	.17	

Note. *$p < .05$; ** $p < .01$.

Table 3.17. Table details as described in Table 3.12.

Summary: Older Adults. We used hierarchical regression to investigate associations between memory (semantic, episodic) and wisdom in older adults. In line with the findings observed in the combined and younger adult samples, memory accounted for a significant proportion of the variance in BWP general wisdom composite scores over and above education and sex. In accordance with our predictions, semantic memory emerged as the most robust significant positive predictor of performance-based general wisdom in older adults. The effect of semantic memory on wisdom scores was more robust in older than younger adults. The amount of shared variance in BWP scores explained by cognition, education, and sex was greater in older than younger adults. We did not observe a significant effect of the memory indices or demographic variables on TD-WS and SAWS personal wisdom scores at the aggregate nor individual level in older adults, consistent with findings in the younger adult sample.

3.5 RESULTS OF STUDY 4: NEURAL CORRELATES OF WISDOM

As illustrated in Section 3.4, we observed distinct age-related and cognitive associations with performance-based general (BWP composite scores) and self-reported personal wisdom (TD-WS and SAWS composite scores) in Study 3, with increases in personal, but not general wisdom with age (Study 3, Hypothesis 1). We identified a significant contribution of memory (semantic, episodic) ability to BWP general wisdom in the combined, younger, and older adult samples, with a primary contribution of semantic ability across distinct age cohorts (Study 3, Hypothesis 2). Memory ability, education, and sex accounted for a greater proportion of variance in BWP general wisdom scores in older than younger adulthood, suggesting a relatively larger contribution of memory to general wisdom in older adulthood. Moreover, semantic memory was a stronger predictor of general wisdom in older than younger adults (Study 3, Hypothesis 3). The effect of cognition on personal wisdom was notably weaker. Memory ability and demographic variables (education, sex), when considered as an aggregate, predicted TD-WS and SAWS scores in the combined, but not older or younger adult samples, and no isolated cognitive predictors emerged (Study 3, Hypothesis 4).

The implications of the findings from Study 3 are two-fold. Firstly, the results indicate that there is a distinct cognitive architecture underlying wise reasoning in younger and older adulthood (Study 4, Hypothesis 1). Secondly, the behavioural results suggest an integral role of cognition in the expression of general but not personal wisdom, indicating that the accompanying neural architecture of wisdom may vary depending on the type of wisdom being examined (Study 4, Hypothesis 2). See Table 3.16 for an overview of findings from the regression models exploring the cognitive correlates of personal and general wisdom.

In consideration of the findings from Study 3, we examined RSFC patterns associated with general (BWP composite scores) and personal (TD-WS and SAWS composite scores) wisdom in the full sample. To support these analyses, we employed behaviour PLS to identify patterns of RSFC in the combined sample that covaried with wisdom scores. Next, to investigate whether age-contrasts observed at the behavioural level parallel a shifting brain architecture in older adulthood, we directly tested the relationship between wisdom, memory (semantic and episodic), and patterns of RSFC in younger and older adults (treated as separate age cohorts). Overall, PLS was carried out in pairwise connections between 140 parcels that spanned subnetworks of the frontoparietal control network (CONT) and the default network (DN) (see Table 3.19 for specific regions explored).

Table 3.18

Summary of Cognitive Associations with Metrics of Wisdom

	Significant Cognitive Model (Predictors)					
	Full Sample		Younger Adult		Older Adult	
General Wisdom						
BWP Composite	✓	(Semantic)	✓	(Semantic, Education)	✓	(Semantic)
Personal Wisdom						
TD-WS Composite	✓	-	X	-	X	-
SAWS Composite	✓	-	X	-	X	-

Table 3.18. Regarding significance of regression model containing cognitive indices (controlling for demographic variables i.e., stage two), ✓ = significant model, X = not a significant model.

Table 3.19

Regions of Interest and Subnetwork Affiliations

Subnetwork	Regions
Default Network A (DN-A; Core Regions)	Left and right inferior parietal lobule (IPL), dorsal prefrontal cortex (dPFC), medial prefrontal cortex (mPFC), precuneus and posterior cingulate cortex (Prec/PCC), and right inferior temporal cortex (iT)
Default Network B (DN-B; Dorsal Medial Subnetwork)	Left and right lateral temporal cortex (IT), anterior temporal cortex (aT), anterior inferior parietal lobule (aIPL), dorsal medial prefrontal cortex (dmPFC), lateral prefrontal cortex (lPFC), and ventral prefrontal cortex (vPFC)
Default Network C (DN-C; Medial Temporal Subnetwork)	Left and right posterior inferior parietal lobule (pIPL), retrosplenial cortex (RSC), and parahippocampal cortex (PHC)
Frontoparietal Control Network A (CONT-A)	Posterior temporal cortex (PTC), intraparietal sulcus (IPS), dorsal medial prefrontal cortex (dmPFC), lateral prefrontal cortex (lPFC), lateral ventral prefrontal cortex (lvPFC), and middle cingulate (MC).
Frontoparietal Control Network B (CONT-B)	Middle temporal, inferior parietal lobe (IPL), dorsal medial prefrontal cortex (dmPFC), lateral prefrontal cortex (lPFC), and ventral prefrontal cortex (vPFC)
Frontoparietal Control Network C (CONT-C)	Precuneus and posterior cingulate cortex (Prec/PCC)

Network Connectivity and Wisdom in the Full Sample

We tested for RSFC patterns that correlated with general (BWP composite) and personal (TD-WS composite, SAWS composite) wisdom in the combined sample of younger and older adults. One significant pattern emerged at this stage, in which general (BWP) and personal wisdom (TD-WS, SAWS) covaried with each other in adulthood (16.79% covariance explained, permuted $p = .01$) (Figure 3.4 A). In the combined sample, higher general and personal wisdom scores were associated with greater (i) CONTa connectivity with DNc, (ii) CONTc connectivity

with DNa, and (iii) DNa connectivity with DNc (Figure 3.4 B and C, warmer colours). This effect was stronger for personal than general wisdom.

Figure 3.4

Converging Patterns, But Distinct Magnitudes of RSFC Associated with General and Personal Wisdom in Adulthood

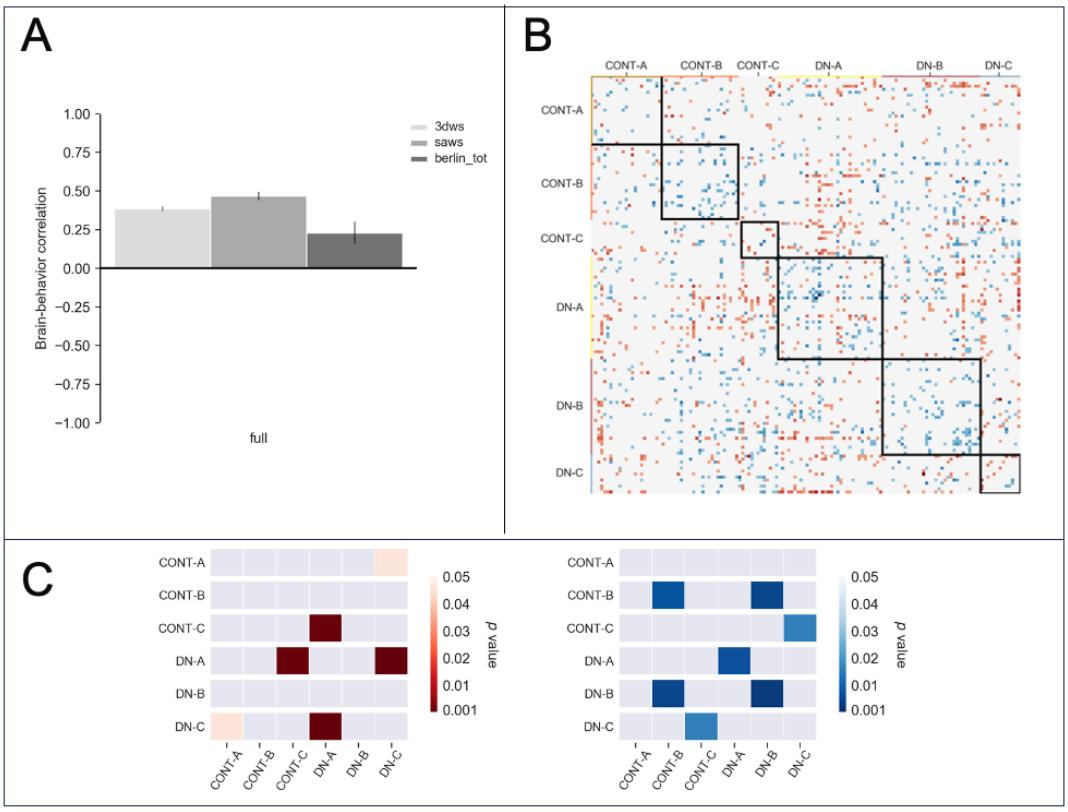


Figure 3.4. Associations between brain network connectivity and wisdom measures in the full sample. **Panel A.** Correlations between wisdom scores and network connectivity. **Panel B.** Correlation matrix of the reliable pairwise functional connections associated with wisdom. Colour scale: warm colours bootstrap ratio 0 to +3; cool colours bootstrap ratio 0 to -3. **Panel C.** Network (and subnetwork) connectivity patterns. Left matrix (warm colours) indicates network connections that are reliably and positively correlated with wisdom scores. Right matrix (cool colours) indicates network connections that are reliably and negatively correlated with wisdom scores.

Age Differences in Network Connectivity, Wisdom, and Memory

General Wisdom. To explore potential age-contrasts in brain network organization that may parallel the observed behavioural findings (i.e., distinct magnitudes of crystallized versus

fluid cognitive contributions to general wisdom in younger versus older adulthood), we also conducted behaviour PLS to identify patterns of RSFC related to wisdom and memory in younger and older adults, treated as separate cohorts.

We observed three distinct patterns of RSFC that distinguished younger from older adults. In the first significant pattern, BWP general wisdom and memory (semantic, episodic) in older adults covaried with memory in younger adults (4.82% covariance explained, permuted $p <$ .001) (Figure 3.5 A). General wisdom in younger adults did not contribute to this pattern. BWP composite and memory scores in older adults along with memory scores in younger adults were positively associated with greater internetwork connectivity between CONT and DN subnetworks, as well as within-network DN connectivity (Figure 3.5 B and C, cooler colours): (i) greater CONTa connectivity with DNb and DNc, and (ii) DNa connectivity with DNb. This effect was stronger for episodic memory than semantic ability in older adults.

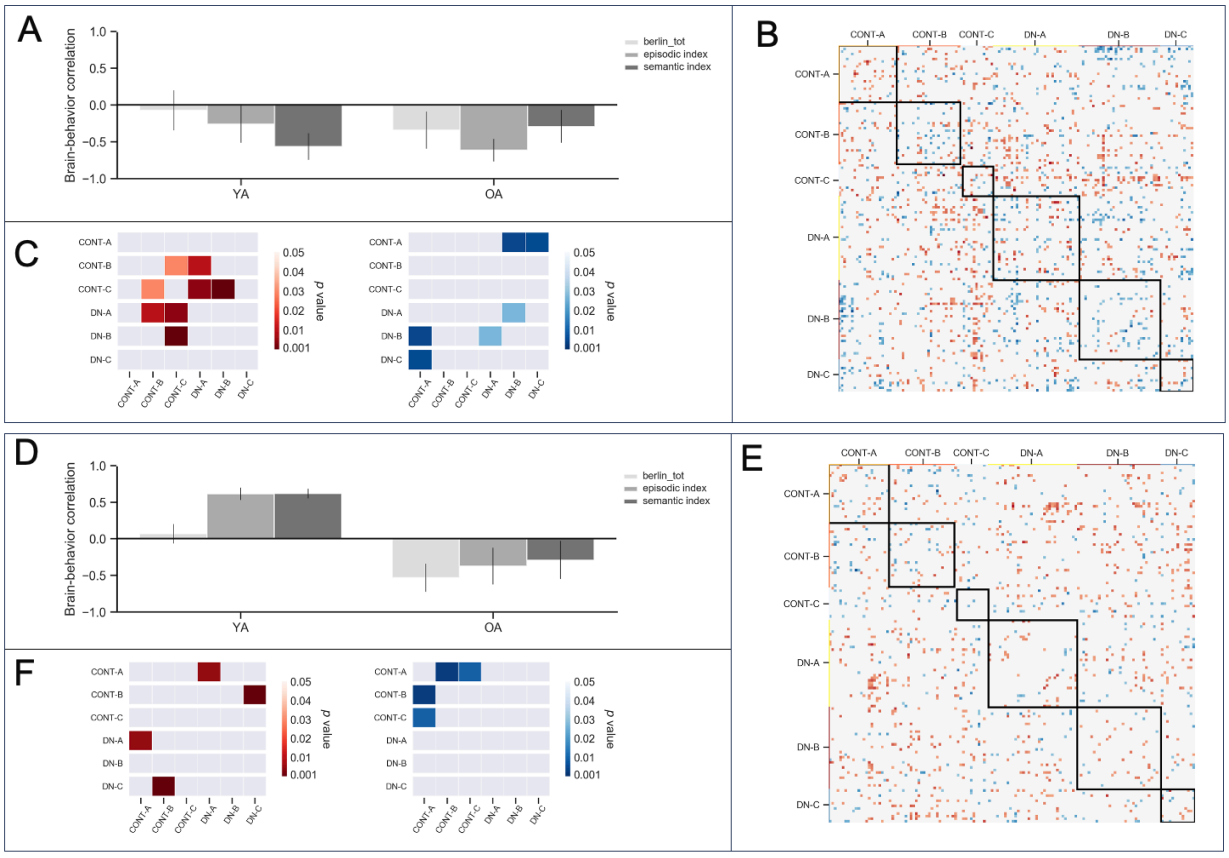
The second significant pattern separated general wisdom and memory (semantic, episodic) in older adults from memory in younger adults (3.62% covariance explained, permuted $p < .001$) (Figure 3.5 D). Again, general wisdom in younger adults did not contribute to this pattern. In older adults, higher BWP general wisdom and memory were associated with greater connectivity of CONT subnetworks, including CONTa connectivity with CONTb and CONTc (Figure 3.5 E and F, cooler colours). In contrast, higher semantic and episodic memory in younger adults were related to a distinct pattern of RSFC between CONT and DN subnetworks (Figure 3.5 E and F, warmer colours). Here, higher memory scores were associated with (i) CONTa connectivity with DNa and (ii) CONTb connectivity with DNc.

A third significant pattern emerged in which BWP general wisdom in younger and older adults covaried together, distinct from semantic and episodic memory in older adults (2.66%

covariance explained, permuted p = .04) (Figure 3.5 G). Memory performance in younger adults did not contribute to this pattern. In both younger and older adults, greater BWP general wisdom was associated with higher RSFC between the following CONT and DN subnetworks: (i) CONTa connectivity with CONTc and DNc and (ii) DNa-DNc connectivity (Figure 3.5 H and I, cooler colours). Regarding semantic and episodic memory in older adults (Figure 3.5 H and I, warmer colours), higher memory performance was related to (i) greater CONTb connectivity with DNb, (ii) CONTc connectivity with DNb, (iii) within DNb connectivity, and (iv) within DNa connectivity.

Figure 3.5

RSFC Patterns Associated with BWP General Wisdom and Memory Ability in Younger and Older Adulthood



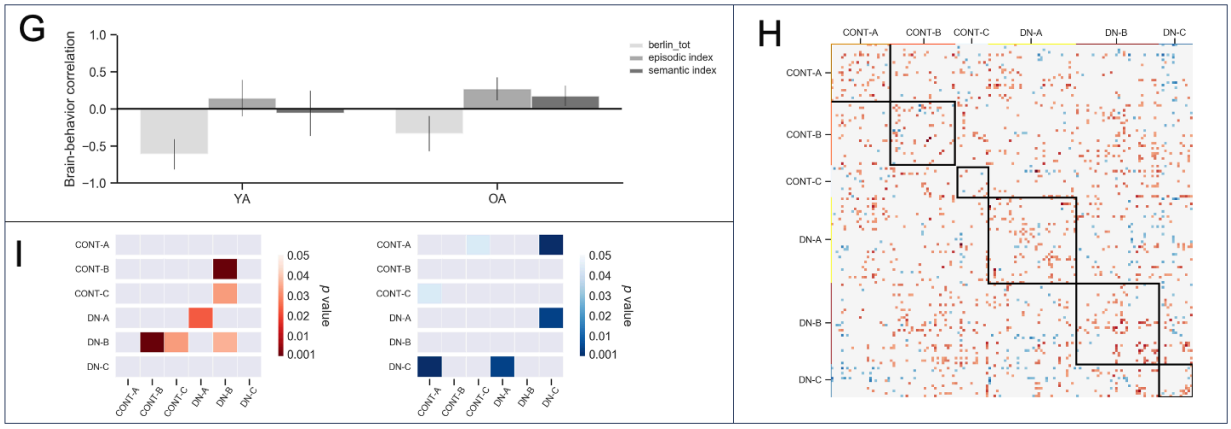


Figure 3.5. Associations between brain network connectivity, general wisdom (BWP), semantic and episodic memory. **Panels A, D, and G.** Correlations between wisdom scores, memory scores, and network connectivity. Patterns observed in younger adults are on the left-most aspect of the graph. Patterns observed in older adults are on the right-most aspect of the graph. **Panels B, E, and H.** Correlation matrix of the reliable pairwise functional connections associated with behaviour. Colour scale: warm colours bootstrap ratio 0 to +3; cool colours bootstrap ratio 0 to -3. **Panels C, F, and I.** Network (and subnetwork) connectivity patterns. Left matrix (warm colours) indicates network connections that are reliably and positively correlated with wisdom and memory scores. Right matrix (cool colours) indicates network connections that are reliably and negatively correlated with wisdom and memory scores.

Personal Wisdom. Given the varied cognitive structure of general (BWP) and personal wisdom (TD-WS, SAWS) observed in Study 3, we also tested for RSFC patterns associated with personal wisdom. As TD-WS and SAWS have demonstrated distinct patterns of associations with BWP general wisdom (see Tables 3.6 to 3.8 in Study 3); we explored brain-behaviour correlates with each measure independently to account for any differences due to the operationalization and measurement of personal wisdom in the current study. The results of each RSFC PLS analysis are presented in the sections to follow.

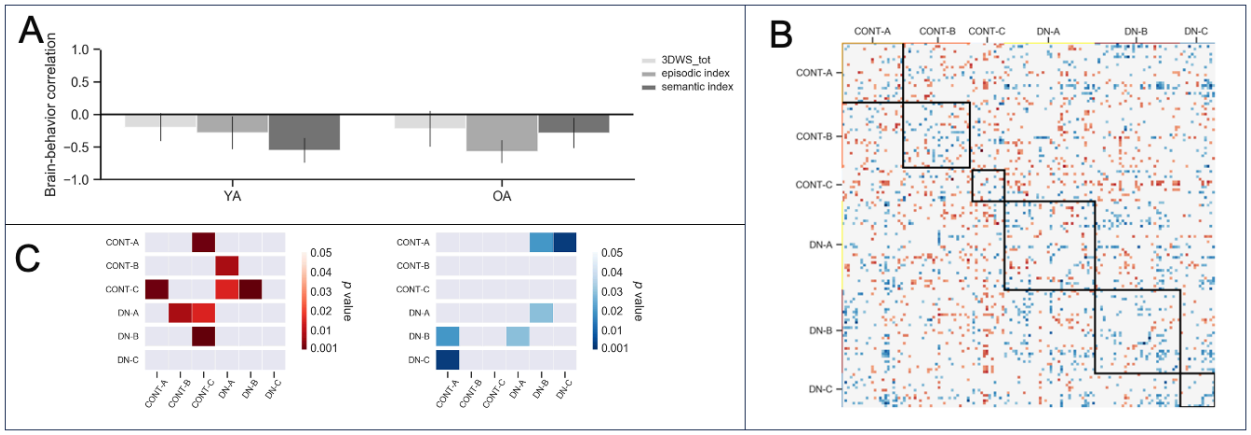
TD-WS. We observed two distinct patterns of RSFC in younger and older adults associated with TD-WS personal wisdom scores and memory (semantic, episodic). In the first pattern, TD-WS and memory in younger adults covaried with memory in older adults (4.82% covariance explained, permuted $p < .001$) (Figure 3.6 A). These were associated with (i) greater

CONTa connectivity with DNb and DNc, and (ii) DNa-DNb connectivity (Figure 3.6 B and C, cooler colours). TD-WS personal wisdom in older adults did not contribute to the pattern.

The second significant pattern of RSFC differentiated younger adults from older adults (3.60% covariance explained, permuted p = .004) (Figure 3.6 D). Memory (semantic, episodic) in younger adults was associated with between network connectivity of CONT and DN regions. Specifically, greater semantic and episodic memory in younger adults was related to greater CONTb connectivity with DNb and DNc (Figure 3.6 E and F, cooler colours). There were no significant brain-behaviour correlations observed for personal wisdom in younger adults. In contrast, personal wisdom and memory in older adults was associated with greater (i) CONTa-CONTb connectivity and (ii) DNa-DNc connectivity (Figure 3.6 E and F, warmer colours).

Figure 3.6

RSFC Patterns Associated with TD-WS Personal Wisdom and Memory Ability in Younger and Older Adulthood



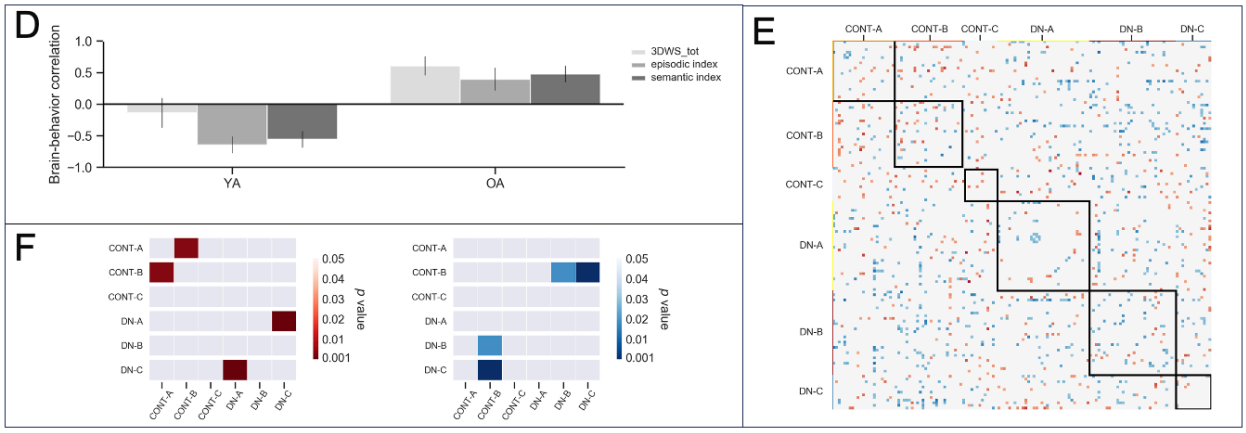


Figure 3.6. Associations between brain network connectivity, personal wisdom (TD-WS), semantic and episodic memory. **Panels A and D.** Correlations between wisdom scores, memory scores, and network connectivity. **Panels B and E.** Correlation matrix of the reliable pairwise functional connections associated with behaviour. **Panels C and F.** Network (and subnetwork) connectivity patterns. All figure details as described in Figure 3.5.

SAWS. Two significant patterns of RSFC in younger and older adults associated with SAWS personal wisdom and memory (semantic, episodic) emerged from the PLS analyses. In the first significant pattern, semantic and episodic memory in younger and older adults covaried together and were distinct from SAWS in younger adults (4.70% covariance explained, permuted $p < .001$) (Figure 3.7 A). There was no significant pattern of RSFC observed for SAWS personal wisdom in older adults. Here, greater memory in younger and older adults was associated with (i) greater CONTa connectivity with DNb and DNc, (ii) DNa-DNb connectivity, and (iii) within DNb connectivity (Figure 3.7 B and C, cooler colours). In contrast, SAWS in younger adults was associated with (i) greater CONTb connectivity with DNa, (ii) CONTc connectivity with DNa and DNb, and (iii) CONTa connectivity with CONTc (Figure 3.7 B and C, warmer colours).

The second significant pattern of RSFC differentiated memory in younger adults from older adults (3.27% covariance explained, permuted $p < .001$) (Figure 3.7 D). For younger adults, memory was related to (i) greater CONTa-CONTb connectivity and (ii) DNa-DNc connectivity (Figure 3.7 E and F, warmer colours). In older adults, higher memory scores were

related to greater between network connectivity of CONTb with DNb and DNc (Figure 3.7 E and F, cooler colours). The observed effects were stronger for episodic than semantic memory scores in both younger and older adults. Moreover, personal wisdom did not demonstrate any significant brain-behaviour correlations at this level in young nor old.

Figure 3.7

RSFC Patterns Associated with SAWS Personal Wisdom and Memory Ability in Younger Versus Older Adulthood

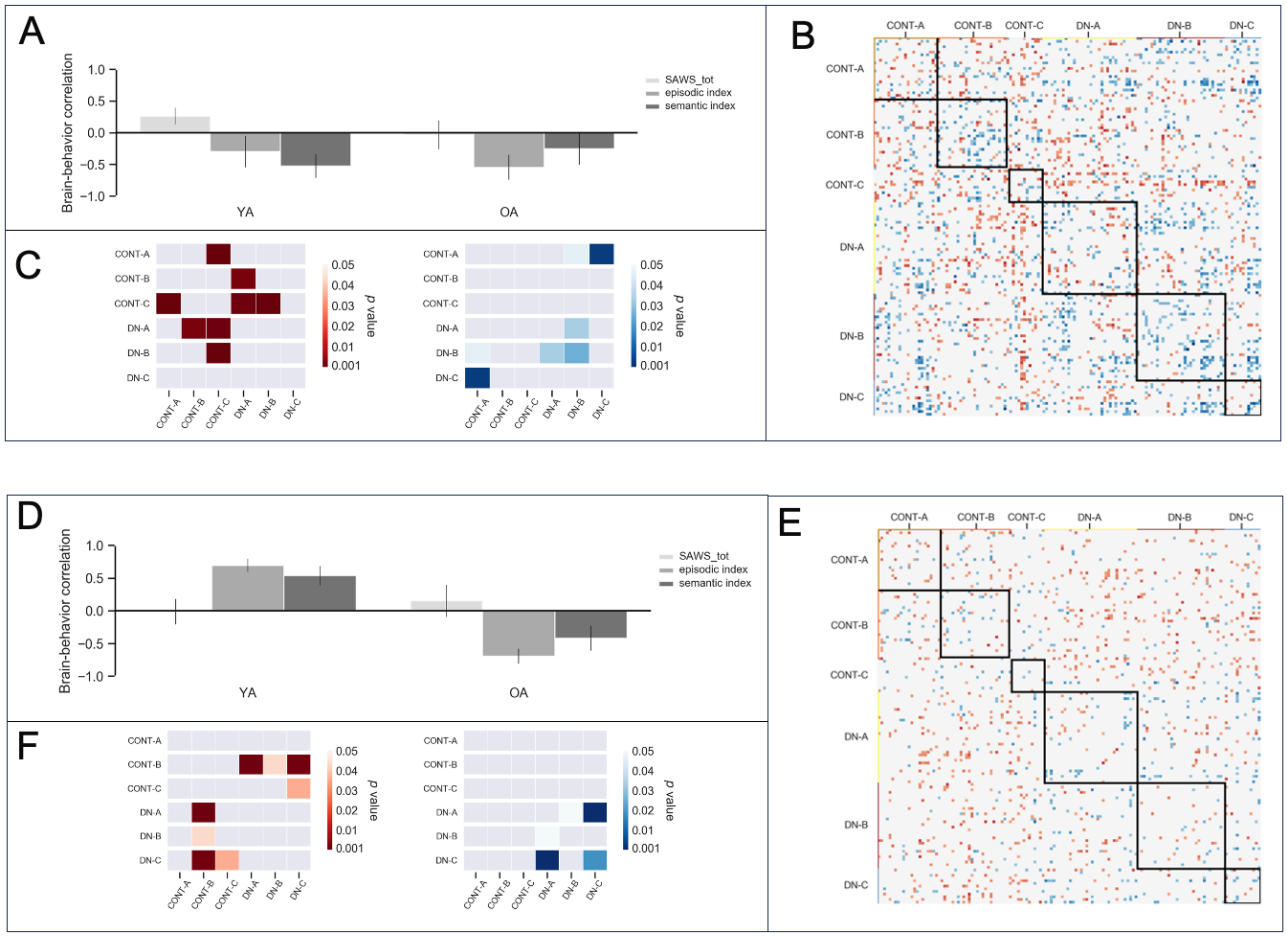


Figure 3.7. Associations between brain network connectivity, personal wisdom (SAWS), semantic and episodic memory. **Panels A and D.** Correlations between wisdom scores, memory scores, and network connectivity. **Panels B and E.** Correlation matrix of the reliable pairwise functional connections associated with behaviour. Colour scale: warm colours bootstrap ratio 0 to +3; cool colours bootstrap ratio 0 to -3. **Panels C and F.** Network (and subnetwork) connectivity patterns. All figure details as described in Figure 3.5.

3.6 RESULTS SUMMARY (STUDIES 3 & 4)

We examined the relationship between wisdom (personal and general), memory ability (semantic and episodic, Study 3), and RSFC (Study 4) in combined (young and old), younger, and older adult samples to identify associations between wisdom, crystallized and fluid memory capacities, and brain function. We investigated contrasts in identified patterns related to the type of wisdom (personal or general) and age cohort (young or old) examined. We conducted separate behaviour (Study 3) and resting-state functional connectivity (Study 4) investigations to explore *a priori* predictions. At both the behaviour and brain network organization level, we observed distinctions in the underlying mechanisms of personal and general wisdom in younger and older adults.

Consistent with predictions, older adults self-reported higher personal wisdom than young; however, performance-based general wisdom did not differ between younger and older adults (Study 3, Hypothesis 1). Memory ability was a robust positive predictor of general wisdom in the combined, younger, and older adult samples, in line with predictions (Study 3, Hypothesis 2). This effect was more pronounced in older than younger adulthood, though in both cases there was a primary semantic contribution to general wisdom (Study 3, Hypothesis 3). While there was a modest contribution of memory to self-reported personal wisdom in the combined sample, we did not observe a significant cognitive contribution to personal wisdom in the younger or older adult samples (Study 3, Hypothesis 4).

In our examination of brain network organization, personal and general wisdom in the combined age sample covaried together and were characterized by greater connectivity between frontoparietal and default network regions, as well as greater connectivity between default subnetworks. While both forms of wisdom shared an overlapping brain network organization in

the combined sample, the magnitude of the effect was more robust for personal than general wisdom, suggesting differences in intrinsic network architecture that parallel the diverging cognitive structure of personal and general wisdom.

Predicted age differences were observed in the association between general and personal wisdom, semantic and episodic memory, and RSFC. The most robust pattern observed for older adults indicates that general wisdom and memory are associated with RSFC related to between-network connectivity of frontoparietal and default network regions, consistent with the DECHA model (see Figure 3.5 A). A similar, though less robust, pattern of RSFC and general wisdom was also observed for younger adults, distinct from memory ability (Study 4, Hypothesis 1; see Figure 3.5 G). The intrinsic network organization associated with personal wisdom and memory also varied by age cohort, as well as measurement tool. In older adults, personal wisdom and memory were related to greater connectivity within CONT and DN core and subnetworks on one instrument (TD-WS), while no significant patterns were identified on another (SAWS). Findings for younger adults were mixed, with personal wisdom and memory covarying with default to frontoparietal coupling and connectivity across DN subnetworks on one measure (TD-WS). On a second measure, personal wisdom was also associated with default to executive coupling, as well as stronger connectivity among CONT subnetworks (SAWS) (Study 4, Hypothesis 2).

Taken together, these findings provide evidence that personal and general wisdom are distinct abilities with distinct age-related trajectories, cognitive determinants, and underlying neural architecture. We provide the first empirical evidence that wisdom, memory, and RSFC associations differ for young and older adults. Our findings also show that age differences involve cortical association networks related to internally-directed cognition and cognitive control.

3.7 INTEGRATED DISCUSSION FOR STUDIES 3 & 4

Older is Wiser - in Certain Contexts

Consistent with previous reports, older adults self-reported greater personal wisdom (insight into oneself) than young, while performance-based general wisdom (insight into life in general) did not increase with age (Staudinger, 1989; Baltes et al., 1995; Staudinger et al., 1992; Staudinger & Baltes, 1996). These findings are in contrast to the results of the meta-analysis in Chapter 2, Study 2, where the positive effect of aging on wise reasoning was more robust for general than personal wisdom. This discrepancy may be attributed to several factors associated with the substantial heterogeneity in outcomes observed in Study 2, including methodological differences in measurement and sample characteristics. Notably, the majority of individual effect sizes that investigated general wisdom utilizing the Berlin Wisdom Paradigm in the meta-analysis reported a negligible association with age (e.g., see Pasupathi & Staudinger, 2001, Staudinger & Pasupathi, 2003, Mickler & Staudinger, 2008, or Glück et al., 2013 for examples), consistent with the present findings from Study 3. The current approach in which a single measure of performance-based general wisdom was employed (i.e., BWP), presents a more controlled context than the meta-analysis, capturing a more precise picture of the age-related course of wisdom within the specific conceptual framework of the Berlin Wisdom Paradigm.

The findings from Study 3 provide strong support for the long-held notion that older is wiser, at least in personally-relevant contexts; however, this does not suggest that increasing age and the capacity to generate astute insights about impersonal challenging life circumstances are orthogonal (i.e., general wisdom). Importantly, our sample was a typically aging cohort of younger (18 – 30 years) and older (≤ 55 years) adults, but did not include a middle-aged cohort. However, theoretical frameworks and empirical investigations into the developmental course of

wisdom have argued that the relationship between wise reasoning and age may be an inverse U-shape—demonstrating gains into mid-life and gradually declining thereafter into older adulthood (e.g., Ardelt et al., 2018b; Glück, 2018). The current findings, in which young and old perform comparably on tasks of general wisdom, may reflect the levelling-out of wise reasoning capacity in younger and older adulthood, in line with the theorized notion that wisdom peaks in mid-life. While not examined directly here, this may suggest that general wisdom is a feature of mid-life.

Critically, the distinct developmental trajectories of self-reported personal (TD-WS, SAWS) and performance-based general wisdom underscore the importance of explicitly differentiating between these two forms of wisdom in the aging literature. While personal and general wisdom are conventionally accepted as essential features of the broader latent variable of wisdom (Staudinger, 2013), evidence from the current study suggests that neither form of wisdom is a sufficient condition to ensure the realization of the other. Specifically, while we identified a weak positive correlation between BWP general wisdom and TD-WS personal wisdom scores in the full and older adult samples, the association of BWP with SAWS was negligible. Following a similar pattern of nuanced associations of BWP with the two personal wisdom outcome measures, in younger adults, BWP was correlated with SAWS, but not TD-WS. Put simply, these results indicate that demonstrating strong wise reasoning in personally-relevant contexts (personal wisdom) will not necessarily guarantee similar wise reasoning skills in extra-personal contexts (general wisdom).

The Semanticization of Wise Reasoning Hypothesis

Memory ability significantly predicted general wisdom scores in the combined, young, and older adult groups. Consistent with the semanticization of aging hypothesis, which suggests that older adults recruit more semantic processes to support goal-directed action in service of

declining cognitive control capacities, the role of semantic memory in general wisdom was more pronounced in older than younger adulthood. While the semanticization of aging can be associated with a number of costs, research has provided evidence that its benefits are context dependent, considering the congruency between task demands and the application of semantic store (Spreng & Turner, 2019). The empirical findings from the present study, coupled with insights from prior research, consistently point towards the pivotal role of semantic or crystallized abilities in the manifestation of general wisdom-related knowledge (e.g., Grossmann et al., 2010; Mickler & Staudinger, 2008; Pasupathi & Staudinger, 2001). This implies that wise reasoning operates within a context that is congruent with the application of semantic memory resources. Correspondingly, we suggest that wise reasoning may benefit from the semanticization of cognition that occurs with increasing age. While speculative, these findings suggest that older adults may be at an advantage over their younger adult counterparts when engaging in wise reasoning, given the inherent shift towards increasingly semanticized cognitive processing with age.

Consistent with predictions, cognition, especially semantics, contributed more to general than personal wisdom. While not examined here, it is possible that personal wisdom leverages a more nuanced balance of multiple modes of processing with cognition contributing less to its psychometric structure than is the case for general wisdom. Indeed, theoretical notions of personal wisdom have purported that it exists across multiple modes of processing extending beyond the cognitive domain (e.g., strong decision-making ability, balanced judgement), including affective (e.g., emotional sensitivity, acceptance of others' values, sense of a higher purpose) and metacognitive (e.g., knowledge of one's limits, good insight, curiosity) capacities (Ardelt, 2003,2004; Kunzmann & Baltes, 2005; Wei & Wang, 2020). Future work would benefit

from exploring affective and metacognitive correlates of wise reasoning, and how these vary by age group and wisdom type (personal and general). Collectively, these findings accentuate the multidimensional nature of wisdom, shedding light on the shifting developmental course and cognitive architecture of wise reasoning, intricately shaped by the context at play.

A Shifting Neural Architecture of Wise Reasoning Across the Adult Lifespan

Paralleling the diverging cognitive structure of general and personal wisdom, we identified distinct patterns of RSFC for each form of wisdom in the combined sample of younger and older adults. Notably, the current findings suggest a difference in intrinsic brain network organization in wise aging. Specifically, we observed that wisdom in older adulthood is associated with large-scale reorganization of frontoparietal and default brain networks, with network dedifferentiation being the most prominent and generalized pattern of functional reorganization observed. Broadly, in the most robust pattern observed, greater general wisdom in older adulthood covaried with semantic and episodic memory, and was associated with increased between-network connectivity of these networks. Greater general wisdom and memory in older adults were also associated with higher connectivity among default subnetworks. In younger adulthood, a similar, albeit less robust, pattern of RSFC was associated with general wisdom, also characterized by higher between-network connectivity of frontoparietal and default networks, as well as connectivity of default subnetworks. Notably, this younger adult pattern did not include associations with memory. This finding is consistent with the behavioural results presented in Study 3, where the effect of memory ability on general wisdom was stronger for older than younger adults.

One possible explanation for the age differences in RSFC associated with general wisdom and memory is that healthy aging is characterized by brain network dedifferentiation

(i.e., greater between-network connectivity) (Chan et al., 2014; Malagurski et al., 2020; Setton et al., 2023). Dedifferentiation in older adulthood may, in part, compensate for the functional reorganization of the aging brain (Reuter-Lorenz & Cappell, 2008). In line with expectations for neurotypical aging, our findings in wise older adults indicate greater between-network connectivity of frontoparietal and default network regions, and greater connectivity among default network regions, previously implicated in goal-directed behaviour that would recruit controlled cognitive processes in younger adulthood (Chan et al., 2014; Geerligs et al., 2015; Varangis et al., 2019; Stumme et al., 2020; Setton et al., 2021). Through this lens, while not directly tested here, it is speculated that wise reasoning in older adulthood, at least for general wisdom contexts, theoretically may compensate for age-related functional changes by increasing between-network connectivity of cognitive control (frontoparietal) regions and regions implicated in self-referential processing (default network), in line with the Default to Executive Coupling Hypothesis of Aging (Turner & Spreng, 2015; Spreng & Turner, 2019).

Regarding self-reported personal wisdom, we observed different patterns of RSFC depending on the wisdom instrument used; however, broadly speaking, the most robust patterns in either case were indicative of greater network dedifferentiation associated with personal wisdom and/or memory in young, versus greater network integration among frontoparietal and default core and subnetworks in older adults. The emphasis on between-network connectivity to support personal wisdom in young further lends to the balance of multiple modes of processing that may be especially characteristic of personal wisdom, wherein cognitive processing is not the primary underlying mechanism. These findings are in line with our previous work demonstrating similar patterns of altered functional connectivity from younger to older adulthood (Setton et al., 2021).

3.7 CONCLUSIONS (STUDIES 3 & 4)

Wisdom is a long-sought after attribute often characterized in theoretical and colloquial discourses as demonstrating a linear relationship to age (Glück & Bluck, 2011; Staudinger & Glück, 2011b). It has been reliably associated with positive psychosocial outcomes across the adult lifespan (e.g., life satisfaction; Ardelt 2016), with particular benefits observed in older adulthood (Ardelt & Ferrari, 2018; Staudinger & Glück, 2011b). Emerging evidence has begun to provide support for the plasticity of wisdom over the adult lifespan, and the potential cross-domain ameliorating effects that wisdom may have on health and well-being in late life (e.g., Ardelt & Jeste, 2018; Grossmann, 2012; Grossmann et al., 2013; Webster et al., 2014a).

Here, we build on theoretical notions and previous reports to offer empirical support for the notion that older is wiser, particularly when reasoning about personally-relevant contexts (personal wisdom). General wisdom (insight into life in general from an observer's perspective) was relatively stable with did not increase with age. In parallel, distinctions were also identified regarding the cognitive and neural underpinnings of personal versus general wisdom, and accompanying age-variant patterns. We observed that general wisdom is more reliant on memory functioning than personal wisdom. Semantic memory plays a particularly critical role in the realization of general wisdom, and this pattern is more evident in older adulthood. The shifting cognitive architecture of wisdom depends on the form of wisdom being assessed (personal or general) and age cohort under examination (young or older), and these differences occur in the context of a shifting neural architecture across the adulthood.

CHAPTER 4: CLOSING REMARKS—FUTURE DIRECTIONS AND BROADER IMPLICATIONS OF THE CURRENT WORK

In this dissertation, we presented empirical evidence for the notion of 'wise aging', substantiated by a meta-analysis of available literature and novel empirical findings from cross-sectional research on younger and older adults. Empirical findings from the current work suggest that gains in wise reasoning with age may be especially characteristic of personally-relevant (personal wisdom), rather than extra-personal (general wisdom) contexts. We identified that memory ability, across the realm of both crystallized and fluid capacities, contributes to the underlying mechanisms of wisdom, in its personal (insight into oneself) and general (insight into life in general) forms. In particular, general wisdom is characterized by a robust cognitive contribution to its expression, with semantics playing a primary role, especially in older than younger adulthood, and this age difference was reflected in a parallel neural shift towards greater dedifferentiation of brain networks to support general wisdom in late life. The current work has a number of broader implications, beginning with guidance for future research directions, and extending to the societal level, including the restructuring of normative attitudes towards aging, as well as innovations to support population health and bolster leadership.

4.1 A DEEPER EXAMINATION OF THE NEURAL SUBSTRATES OF WISDOM

The present work is the largest aging investigation of the cognitive (Study 3) and neural (Study 4) correlates of wise reasoning in the literature to date. Leveraging multivariate fMRI methods, we were able to examine individual differences in the functional brain network organization associated with wisdom and memory in younger and older adults, identifying age contrasts in the neural architecture of wise reasoning at rest. While resting-state data provides valuable insights into the intrinsic functional architecture of the brain, future examinations of

structural data (e.g., gray matter volume, white matter integrity) will offer critical information about the anatomical substrates that support these functions. Investigations into structural brain correlates of wisdom are especially valuable in the context of elucidating our understanding of 'wise aging', as structural changes (e.g., volumetric loss, ventricular enlargement) of the brain are hallmark of healthy aging (Andrews-Hanna et al., 2012). This suggests that there may be structural brain differences associated with wise reasoning in younger and older adulthood. Additionally, the current findings offer testable hypotheses for future task-based fMRI studies (Geerligs et al., 2017) of wise reasoning and age, which will allow for a more precise understanding of the brain networks recruited to support the expression of wisdom in younger versus older adulthood. Integrating these diverse data sources will enable a more multifaceted approach to explore the intricate relationship between brain function, structure, and behaviour; thus, facilitating a deeper understanding of the underlying mechanisms of this complex construct and more precise models of human cognition.

4.2 REFRAMING THE AGEIST ZEITGEIST IN WESTERN SOCIETY

Ageism, the discrimination or prejudice against individuals based on their age, is a pervasive issue in Western society (Ayalon & Tesch-Römer, 2018; Levy & Macdonald, 2016; Palmore, 2005). This ideal perpetuates stereotypes that associate aging with a decline in function, rather than a time for celebration or gains (Ayalon & Tesch-Römer, 2018; Palmore, 2005; Levy & Macdonald, 2016; WHO, 2021). Addressing ageism requires a concerted collective effort, and recent research offers a compelling pathway to challenge ageist stereotypes by substantiating the view that older is indeed wiser, in certain contexts. The notion of 'wise aging' serves to reframe the perception of aging as a period of continued growth and development, debunking stereotypes associated with loss in function and inviting a more nuanced understanding of the aging process.

Moreover, the pivotal role of semantics in wise reasoning, a capacity that can demonstrate gains with age (Park et al., 2001), underscores the idea that one's arsenal of cognitive and emotional strengths continues to expand in concert with the acquisition of knowledge across life experiences (semantics) into late life, further challenging these stereotypes.

Demystifying the widely held ageist views with the support of current empirical evidence also has significant implications for optimizing interpersonal interactions and societal harmony. Embracing the unique value that older adults can offer (i.e., wisdom) may promote intergenerational exchange and knowledge-sharing. This dynamic can lead to more enriched and cohesive communities (Zeldin et al., 2005), where younger generations benefit from the insights and guidance of their older counterparts (Pillemer et al., 2022; Zeldin et al., 2005). This greater cohesion can extend to the workplace environment—a setting in which ageism can be particularly detrimental and prevalent (Levy & Macdonald, 2016). In the wake of the most diverse intergenerational workforce in history, where employees may range from Baby Boomers (ages 56 to 75) to Gen Z (maximum age of 24 years) (Kelly, 2023), combatting age-related discrimination is critical to promote organizational harmony (Kelly, 2023; Knight, 2014; Levy & Macdonald, 2016). Highlighting the concept of 'wise aging' may facilitate the recognition that older employees bring valuable insights and experience that can serve to improve inter-organizational team dynamics, and also facilitate more inclusive hiring and promotion practices. This ultimately poses a benefit at the organizational level as well, as research has indicated that age-diverse teams can foster greater innovation and better decision-making (Gerhardt et al., 2022).

Evidently, the empirical finding that wisdom tends to increase with age provides a fascinating framework for challenging ageism and redefining societal views on aging. Embracing

the wisdom that comes with age can lead to more inclusive, equitable, and age-friendly societies where the contributions of older adults are celebrated and leveraged for the greater good. The primary crystallized cognitive capacities (accrued knowledge and facts over one's life) in wise reasoning suggests that learning and personal development should be encouraged to further enhance the acquisition of wisdom with age.

4.3 AN INNOVATIVE INTERVENTION TO ENHANCE WISDOM

The current findings reveal opportunities to augment wisdom across the adult lifespan. Notably, certain factors associated with heightened wisdom realization, such as education and occupation (e.g., Ardelt, 2010; Smith et al., 1994), suggest promising avenues for bolstering the extensive reservoir of semantic knowledge that underpins wisdom, thereby fostering gains in wise reasoning. Despite these opportunities, there remains a scarcity of interventions aimed at enhancing wisdom. Mindfulness is a well-established psychological intervention that supports individuals in cultivating a present-minded awareness of one's thoughts, feelings, and sensations without judgment (Davis & Hayes, 2011). One of the overarching goals of mindfulness is to help individuals strengthen their capacity to recognize when they are experiencing emotions ('emotional mind') in the absence of rational thinking ('rational mind') (Kounidas & Kastora, 2021). The optimal integration of these dualistic states of mind is characterized as the 'wise mind'—the middle ground in which individuals can make balanced and effective decisions (Kounidas & Kastora, 2021). Despite the well-documented relationship between wisdom and positive psychosocial (e.g., life satisfaction; Ardelt, 1994, 1997) and socioemotional (e.g., mitigating effects on depression; Staudinger & Glück, 2011b) outcomes, as it currently stands, mindfulness is the only intervention to date that aims to bolster one's capacity to engage in wise

reasoning. As such, there is great promise for promoting population well-being should innovative interventions be developed to foster wisdom.

We propose that the role of semantics in the expression of wisdom presents a unique avenue to develop cognitive interventions that train participants to cultivate and/or access semantic knowledge to promote wise reasoning. Cognitive intervention refers to a range of therapeutic techniques and strategies that are designed to target and improve cognitive abilities in individuals experiencing subjective cognitive decline or who are motivated to optimize cognition (Buschert et al., 2010). Participation in cognitive intervention programs has been reliably correlated with positive cognitive (e.g., improved memory (Memory and Aging Program; Vandermorris et al., 2020) or executive function (e.g., Goal Management Training; Stamenova & Levine, 2019)), practical (e.g., functional independence), and psychosocial (e.g., enhanced confidence, self-esteem, and well-being; Clare & Woods, 2004; Gates & Valenzuela, 2010) outcomes. Notably, benefits are especially robust in group-based delivery formats, which allow for additional gains in peer learning (Vandermorris et al., 2017) and feelings of community (Baker et al., 2022).

Through this lens, innovators may consider developing group-based interventions that encourage individuals to engage in wise reasoning, with the aim of expanding semantic knowledge, broadening perspectives, and fostering critical thinking. Borrowing from the framework of the Berlin Wisdom Paradigm (Baltes & Staudinger, 2000), a cognitive intervention designed to enhance wisdom may involve hypothetical or real-life vignettes of challenging and uncertain life scenarios necessitating the thoughtful analysis and integration of accumulated knowledge and experience. This will offer participants a guided opportunity to apply crystallized intelligence to resolving complex and multifaceted situations, which we anticipate would

translate to greater wise reasoning in one's daily life. Moreover, we predict improved psychosocial and socioemotional outcomes resulting inherently from participation in the intervention, and gains in wisdom due to learnings from the program. Given the contemporary trends in healthcare centered on increased patient engagement, empowerment, and health literacy (Deloitte, 2021), it is anticipated that the demand for services that can support individuals in optimizing their well-being, including cognition, will continue to rise in the coming years (Canadian Institute for Health Information, 2022).

4.4 THE WISE LEADER IN AN ERA OF UNPRECEDENTED CHANGE

Investigations into real-world manifestations of wisdom indicate that laypersons commonly associate wisdom with the ability to apply prior learnings to real-world contexts (Sternberg, 1985). Theorists have proposed strong positive ties between wisdom and leadership ability (Sternberg, 2005b), suggesting that effective leaders' decision-making processes and outputs demonstrate wise judgement and a concomitant ability to examine all available information prudently (Kilburg, 2006; Sternberg, 2005a). Indeed, wise reasoning by managers in the workplace has been conceptualized as the act of synthesizing intuitive and rational modes of processing (Evans, 2012; Intezari & Pauleen, 2018)—a form of integrated dialectical thinking often implicated in models of wise reasoning (e.g., Ardelt, 2003; Levenson et al., 2005). The notion of the 'wise leader' has pervaded multidisciplinary formal and informal discourse, often marked by sound judgment and decision-making prowess, humility, and a clear purpose or vision (Urrutia, 2022).

The 21st century has been an era marked by rapid and unprecedented change that has disrupted all industries (Braley, 2021). Change has become the new norm in healthcare and beyond, creating a context in which effective change management, spearheaded by strong

leadership, is paramount to organizational success (Braley, 2021; Jaleha & Machuki, 2018). Environmental pressures have necessitated wise leadership and adaptability—most notably, a global pandemic in the wake of the COVID-19 virus that resulted in health systems worldwide incurring a significant burden (WHO, 2021). The ever-evolving contemporary healthcare sector calls for organizational leadership characterized by tactful and dynamic adaptation. Emerging evidence suggests that strategic thinking is paramount to effective leadership, including consideration of future outcomes, awareness and sensitivity to people and trends, and the capacity to flexibly apply these insights to current context (Parker et al., 2022)—all attributes which have been implicated in theories of wise reasoning (e.g., Baltes & Staudinger, 2000; Kunzmann & Baltes, 2005; Staudinger, 1999; Sternberg, 2005).

In the current context, there are a variety of robust environmental (e.g., COVID-19), economic (e.g., rising costs), social (e.g., patient empowerment), technological (e.g., digitization), and demographic (e.g., aging population, women in leadership) trends that present both risks and tremendous opportunity for positive patient and societal outcomes (Braley, 2021; Parker et al., 2022). Evidently, the need for the 'wise leader' is more crucial now than ever before in this ever-changing healthcare landscape. Critically, the current work has further elucidated the underlying mechanisms of wise reasoning from a cognitive development perspective, shining light on potential targets for intervention in service of augmenting wise reasoning in contemporary and future leaders. Borrowing from the tenets discussed in Section 4.3, insights from the current work may lend to the development of executive training programs to equip leaders with robust wise reasoning skills to navigate the complex contemporary environment, which may lend to positive effects at the societal level.

4.5. GENERAL CONCLUSION

The current work sheds light on the dynamic nature of wisdom across the adult lifespan and its complex interplay with aging and cognition, contributing to our collective understanding of an ancient construct. We have acknowledged the distinct paths and structures of personal versus general wisdom, the cognitive advantages to general wisdom in older adulthood, and the age and context-variant neural underpinnings of wise reasoning. As we continue to unravel the complexities of wisdom, its developmental trajectories, and neurocognitive profile, we unlock novel avenues for promoting successful aging.

References

Adnan, A., Beaty, R., Silvia, P., Spreng, R. N., & Turner, G. R. (2019). Creative aging: functional brain networks associated with divergent thinking in older and younger adults. *Neurobiology of Aging*, *75*, 150-158.

Agarwal, S., Driscoll, J. C., Gabaix, X., & Laibson, D. (2009). *Age of reason: Financial decisions over the life cycle and implications for regulation*. Washington, D.C.: Brookings Institute.

Alhosseini, F., & Ferrari, M. (2020). Effects of causal attribution and implicit mind-set on wisdom development. *The International Journal of Aging and Human Development*, *90*(4), 319-336.

Andrews-Hanna, J. R. (2012). The brain's default network and its adaptive role in internal mentation. *The Neuroscientist*, *18*(3), 251-270.

Andrews-Hanna, J. R., Smallwood, J., & Spreng, R. N. (2014). The default network and self-generated thought: component processes, dynamic control, and clinical relevance. *Annals of the New York Academy of Sciences*, *1316*(1), 29.

Ardelt, M. (1994). *Wisdom in the later years: A life course approach to successful aging*. The University of North Carolina at Chapel Hill.

Ardelt, M. (1997). Wisdom and life satisfaction in old age. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *52B*(1), P15–P27. https://doi.org/10.1093/geronb/52B.1.P15

Ardelt, M. (1998). Social crisis and individual growth: The long-term effects of the Great Depression. *Journal of Aging Studies*, *12*(3), 291-314.

Ardelt, M. (2000a). Antecedents and effects of wisdom in old age: A longitudinal perspective on

aging well. *Research on aging*, *22*(4), 360-394.

Ardelt, M. (2000b). Intellectual versus wisdom-related knowledge: The case for a different kind of learning in the later years of life. Educational Gerontology, 26(8), 771-789.

Ardelt, M. (2003). Empirical assessment of a three-dimensional wisdom scale. *Research on Aging*, *25*(3), 275–324.

Ardelt, M. (2004). Wisdom as expert knowledge system: A critical review of a contemporary operationalization of an ancient concept. *Human Development*, *47*(5), 257–285. https://doi.org/10.1159/000079154

Ardelt, M. (2008a). Being wise at any age. In S. J. Lopez (Ed.), *Positive psychology: Exploring the best in people, vol 1: Discovering human strengths* (pp. 81-108). Praeger Publishers/Greenwood Publishing Group, Westport, CT.

Ardelt, M. (2008b). Self-development through selflessness: The paradoxical process of growing wiser. In H. A. Wayment, & J. J. Bauer (Eds.), *Transcending self-interest: Psychological explorations of the quiet ego* (pp. 221-233). American Psychological Association, Washington, DC.

Ardelt, M. (2009). How similar are wise men and women? A comparison across two age cohorts. *Research in Human Development, 6*(1), 9-26.

Ardelt, M. (2010). Are older adults wiser than college students? A comparison of two age cohorts. *Journal of Adult Development*, *17*, 193-207.

Ardelt, M. (2016). Disentangling the relations between wisdom and different types of well-being in old age: Findings from a short-term longitudinal study. *Journal of happiness studies*, *17*(5), 1963-1984.

Ardelt, M., & Bruya, B. (2020). Three-dimensional wisdom and perceived stress among college

students. *Journal of Adult Development*, *28*, 93-105.

Ardelt, M., & Ferrari, M. (2019). Effects of wisdom and religiosity on subjective well-being in old age and young adulthood: Exploring the pathways through mastery and purpose in life. *International psychogeriatrics*, *31*(4), 477-489.

Ardelt, M., Gerlach, K. R., & Vaillant, G. E. (2018a). Early and midlife predictors of wisdom and subjective well-being in old age. *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *73*(8), 1514–1525.

Ardelt, M., & Jeste, D. V. (2018). Wisdom and hard times: The ameliorating effect of wisdom on the negative association between adverse life events and well-being. *The Journals of Gerontology: Series B*, *73*(8), 1374-1383.

Ardelt, M., & Oh, H. (2016). Correlates of Wisdom. In S. K. Whitbourne (ed.), *The Encyclopedia of Adult and Aging* (1st ed., pp. 1 - 5). doi:10.1002/9781118528921.wbeaa184

Ardelt, M., Pridgen, S., & Nutter-Pridgen, K. L. (2018b). The relation between age and three-dimensional wisdom: Variations by wisdom dimensions and education. *The Journals of Gerontology: Series B*, *73*(8), 1339-1349.

Arif, A. H., Khattak, Z. S., & Din, M. (2021). Exploration of the Effect of Wisdom on the Academic Performance of College Students. *Quarterly Social & Religious Research Journal NOOR-E-MARFAT*, *12*(1), 170-186.

Aristotle, & Henry-Lewes, G. (1890). Book VI. In *The ethics of Aristotle: With introductory essay by George Henry-Lewes (The Nichomachean Ethics, Chase's translation, newly revised)* (pp. 173–200). Walter Scott Publishing.

Armbruster, D. J., Ueltzhöffer, K., Basten, U., & Fiebach, C. J. (2012). Prefrontal cortical

mechanisms underlying individual differences in cognitive flexibility and stability. *Journal of cognitive neuroscience*, *24*(12), 2385-2399.

Assmann, A. (2019). Wholesome knowledge: Concepts of wisdom in a historical and cross-cultural perspective. In *Life-span development and behavior* (pp. 187-224). Routledge.

Ayalon, L., & Tesch-Römer, C. (2018). *Contemporary perspectives on ageism*. Springer Nature.

Baggetta, P., & Alexander, P. A. (2016). Conceptualization and operationalization of executive function. *Mind, Brain, and Education*, *10*(1), 10-33.

Baltes, P. B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology, 23,* 611-626.

Baltes, P. B., & Kunzmann, U. (2003). Wisdom. *The Psychologist*, *16*(3), 131–133.

Baltes, P. B., & Smith, J. (2008). The fascination of wisdom: Its nature, ontogeny, and function. *Perspectives on Psychological Science*, *3*(1), 56–64. https://doi.org/10.1111/j.1745-6916.2008.00062.x

Baltes, P. B., Staudinger, U. M., Maercker, A., Smith, J. (1995). People nominated as wise: A comparative study of wisdom-related knowledge. *Psychol Aging, 10*, 155-166.

Baltes, P. B., & Staudinger, U. M. (1993). The search for a psychology of wisdom. *Current Directions in Psychological Science*, *2*(3), 75–80. https://doi.org/10.1111/1467-8721.ep10770914

Baltes, P. B., & Staudinger, U. M. (2000). Wisdom: A metaheuristic (pragmatic) to orchestrate mind and virtue toward excellence. *American Psychologist*, *55*(1), 122–136. https://doi.org/10.1037/0003-066X.55.1.122

Baltes, P. B., Glück, J., & Kunzmann, U. (2002). *Wisdom: Its structure and function in*

regulating successful life span development. In C. R. Snyder, & S. J. Lopez (Eds.), Handbook of positive psychology (pp. 327-347, Chapter xviii, 829 Pages). Oxford University Press, New York, NY.

Bang, H. (2015). African American undergraduate students' wisdom and ego-identity development: Effects of age, gender, self-esteem, and resilience. *Journal of Black Psychology*, *41*(2), 95-120.

Bang, H., & Montgomery, D. (2013). Wisdom and ego-identity for Korean and American late adolescents. *Journal of Cross-Cultural Psychology*, *44*(5), 807-831.

Bangen, K. J., Meeks, T. W., & Jeste, D. V. (2013). Defining and assessing wisdom: A review of the literature. *The American Journal of Geriatric Psychiatry*, *21*(12), 1254–1266. https://doi.org/10.1016/j.jagp.2012.11.020

Bar, M., Aminoff, E., Mason, M., & Fenske, M. (2007). The units of thought. *Hippocampus, 17*(6), 420-428.

Beaumont, S. L. (2011). Identity styles and wisdom during emerging adulthood: Relationships with mindfulness and savoring. *Identity: An International Journal of Theory and Research*, *11*(2), 155-180.

Blanco, N. J., Love, B. C., Ramscar, M., Otto, A. R., Smayda, K., & Maddox, W. T. (2016). Exploratory decision-making as a function of lifelong experience, not cognitive decline. *J Exp Psychol Gen, 145*(3), 284-297.

Bleyl, M. F. (2000). *The wise ones: A multi-cultural perspective*. The University of New Mexico.

Bluck, S., & Glück, J. (2004). Making things better and learning a lesson: Experiencing wisdom across the lifespan. *Journal of personality*, *72*(3), 543-572.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to meta-*

analysis. John Wiley & Sons.

Brainerd, C. J., Reyna, V. F., Gomes, C. F. A., Kenney, A. E., Gross, C. J., Taub, E. S., Spreng, R. N., & Alzheimer's Disease Neuroimaging Initiative. (2014). Dual-retrieval models and neurocognitive impairment. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 40*(1), 41–65. https://doi.org/10.1037/a0034057

Brayley, N. (2021, Nov 19). *Why Change Management is the Most Critical Leadership Skill.* Forbes. https://www.forbes.com/sites/forbescommunicationscouncil/2021/11/19/why-change-management-is-the-most-critical-leadership-skill/?sh=79cfac773f22

Brezina, I. (2010). Folk conceptions of wise person's personality in Asian cultures. *Studia Psychologica*, *52*(4), 347.

Brienza, J. P., & Grossmann, I. (2017). Social class and wise reasoning about interpersonal conflicts across regions, persons and situations. *Proceedings of the Royal Society B: Biological Sciences*, *284*(1869), 20171870.

Brienza, J. P., Kung, F. Y. H., Santos, H. C., Bobocel, R., & Grossman, I. (2018). *Situated WIse Reasoning Scale (SWIS)* [Database record]. APA PsycTests. https://doi.org/10.1037/t70486-000

Broadbent, D. E., Cooper, P. F., FitzGerald, P., & Parkes, K. R. (1982). The cognitive failures questionnaire (CFQ) and its correlates. *British journal of clinical psychology*, *21*(1), 1-16.

Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network: anatomy, function, and relevance to disease. *Ann N Y Acad Sci, 1124*, 1- 38.

Buschert, V., Bokde, A. L., & Hampel, H. (2010). Cognitive intervention in Alzheimer disease. *Nature Reviews Neurology*, *6*(9), 508-517.

Bushlack, T. J., & Bock, T. (2018). Validating the "Centering for Wisdom Assessment":

Assessing the role of contemplative practices in the cultivation of practical wisdom. *Journal of psychology and theology*, *46*(3), 143-167.

Canadian Institute for Health Information (CIHI). (2022, Nov 3). *National health expenditure trends, 2022—Snapshot*. Canadian Institute for Health Information. https://www.cihi.ca/en/national-health-expenditure-trends-2022-snapshot

Catanzaro, S. J., & Mearns, J. (1990). Measuring generalized expectancies for negative mood regulation: Initial scale development and implications. *Journal of personality assessment*, *54*(3-4), 546-563.

Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. *Journal of thoracic disease*, *7*(11), E537.

Carpenter, P. A., Just, M. A., & Shell, P. (1990). What one intelligence test measures: a theoretical account of the processing in the Raven Progressive Matrices Test. *Psychological review*, *97*(3), 404.

Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology*, *54*(1), 1–22. https://doi.org/10.1037/h0046743

Cattell, R. B. (1967). The theory of fluid and crystallized general intelligence checked at the 5-6 year-old level. *British Journal of Educational Psychology, 37*(2), 209–224. https://doi.org/10.1111/j.2044-8279.1967.tb01930.x

Cattell, R. B. (1971). *Abilities: Their structure, growth, and action.* New York: Houghton Mifflin.

Chan, M. Y., Park, D. C., Savalia, N. K., Petersen, S. E., & Wig, G. S. (2014). Decreased segregation of brain systems across the healthy adult lifespan. *Proceedings of the National Academy of Sciences*, *111*(46), E4997-E5006.

Chaouali, W., Souiden, N., & Ringle, C. M. (2021). Elderly customers' reactions to service failures: The role of future time perspective, wisdom and emotional intelligence. *Journal of Services Marketing*, *35*(1), 65-77.

Cheraghi, F., Kadivar, P., Ardelt, M., Asgari, A., & Farzad, V. (2015). Gender as a moderator of the relation between age cohort and three-dimensional wisdom in Iranian culture. *The International Journal of Aging and Human Development*, *81*(1-2), 3-26.

Cheraghi, F., Webster, J., Kadivar, P., Asgari, A., & Mazlum, F. (2021). Validating the Self-assessed Wisdom Scale (SAWS) in an Iranian Sample: Psychometric and Developmental Findings. *Journal of Cross-Cultural Gerontology*, *36*, 407-429.

Cheung, C. K., & Chow, E. O. W. (2020). Contribution of wisdom to well-being in Chinese older adults. *Applied Research in Quality of Life*, *15*, 913-930.

Chong, M., Bhushan, C., Joshi, A.A., Choi S1, Haldar J.P., Shattuck D.W., Spreng R.N., Leahy R.M.. (2017). Individual Parcellation of resting fMRI with a group functional connectivity prior. *NeuroImage*, *156*, 87–100. doi:10.1016/j.neuroimage.2017.04.054

Clare, L., & Woods, R. T. (2004). Cognitive training and cognitive rehabilitation for people with early-stage Alzheimer's disease: A review. *Neuropsychological Rehabilitation, 14*(4), 385–401. https://doi.org/10.1080/09602010443000074

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences, 2nd ed*. Hillsdale, NJ: Erlbaum.

Cooper, H., Hedges, L. V., & Valentine, J. C. (Eds.). (2019). *The handbook of research synthesis and meta-analysis*. Russell Sage Foundation.

Craik, F. I., & Bialystock, E. (2006). Cognition through the lifespan: Mechanisms of change. *Trends in Cognitive Sciences*, *10*(3), 131–138. https://doi.org/10.1016/j.tics.2006.01.007

Dalla Barba, G., Attali, E., & La Corte, V. (2010). Confabulation in healthy aging is related to interference of overlearned, semantically similar information on episodic memory recall. *J Clin Exp Neuropsychol, 32*(6), 655-660.

Damoiseaux, J. S. (2017). Effects of aging on functional and structural brain connectivity. *Neuroimage*, *160*, 32-40.

Darboh, B. S. (2018). *Cognitive Mechanisms of Wise Reasoning Across the Adult Lifespan* [Master's thesis, York University]. YorkSpace.

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology, 10*, 85.

Davis, D. M., & Hayes, J. A. (2011). What are the benefits of mindfulness? A practice review of psychotherapy-related research. *Psychotherapy*, *48*(2), 198.

Deloitte. (2021). *Deloitte Insights: 2021 global health care outlook—Accelerating industry change.* Deloitte. https://www2.deloitte.com/content/dam/Deloitte/pt/Documents/life-sciences-health-care/2021-Global-health-care-outlook.pdf

Denney, N. W., Dew, J. R., & Kroupa, S. L. (1995). Perceptions of wisdom: What is it and who has it? *Journal of Adult Development*, *2*(1), 37–47. https://doi.org/10.1007/BF02261740

Dennis, J. P., & Vander Wal, J. S. (2010). The cognitive flexibility inventory: Instrument development and estimates of reliability and validity. *Cognitive Therapy and Research*, 3, 241-253. https://doi.org/10.1007/s10608-009-9276-4

Dumbravă, I. L. (2017). An empirical approach to wisdom processes. *Romanian Journal of Applied Psychology*, *19*(2).

Edmondson, R. (2005). Wisdom in later life: Ethnographic approaches. *Ageing & Society, 25*(3), 339-356.

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *British Medical Journal, 315*(7109), 629-634. https://doi.org/10.1136/bmj.315.7109.629

Ericsson, K. A., & Simon, H. A. (1984). *Protocol analysis: Verbal reports as data*. Cambridge, MA: The M. I. T. Press.

Ericsson, K. A., & Smith, J. (Eds.). (1991). *Towards a general theory of expertise: Prospects and limits.* New York: Cambridge University Press.

Erikson, E. H. (1959). Identity and the life cycle. New York: International University Press.

Evans, J. S. B. (2012). Spot the difference: distinguishing between two kinds of processing. *Mind & Society*, *11*, 121-131. https://doi.org/10.1007/s11299-012-0104-2

Farrington, D. P. (1991). Longitudinal research strategies: Advantages, problems, and prospects. *Journal of the American Academy of Child & Adolescent Psychiatry*, *30*(3), 369-374.

Feng, X. J., Krägeloh, C. U., Billington, D. R., & Siegert, R. J. (2018). To what extent is mindfulness as presented in commonly used mindfulness questionnaires different from how it is conceptualized by senior ordained Buddhists?. *Mindfulness*, *9*, 441-460.

Fischl, B. (2012). FreeSurfer. *NeuroImage, 62*(2), 774–781. https://doi.org/10.1016/j.neuroimage.2012.01.021

Fisher, Z., & Tipton, E. (2015). robumeta: An R-package for robust variance estimation in meta-analysis. *arXiv preprint arXiv:1503.02220.*

Freeman, A. T., Santini, Z. I., Tyrovolas, S., Rummel-Kluge, C., Haro, J. M., & Koyanagi, A. (2016). Negative perceptions of ageing predict the onset and persistence of depression and anxiety: Findings from a prospective analysis of the Irish Longitudinal Study on Ageing (TILDA). *Journal of Affective Disorders*, *199*, 132-138.

García-Campayo, J., Del Hoyo, Y. L., Barcelo-Soler, A., Navarro-Gil, M., Borao, L., Giarin, V., ... & Montero-Marin, J. (2018). Exploring the wisdom structure: Validation of the Spanish new short Three-Dimensional Wisdom Scale (3D-WS) and its explanatory power on psychological health-related variables. *Frontiers in Psychology*, *9*, 692.

Gates, N., & Valenzuela, M. (2010). Cognitive exercise and its role in cognitive function in older adults. *Current psychiatry reports*, *12*, 20-27. doi: 10.1007/s11920-009-0085-y

Geerligs, L., Renken, R. J., Saliasi, E., Maurits, N. M., & Lorist, M. M. (2015). A brain-wide study of age-related changes in functional connectivity. *Cerebral cortex*, *25*(7), 1987-1999.

Geerligs, L., Tsvetanov, K. A., & Henson, R. N. (2017). Challenges in measuring individual differences in functional connectivity using fMRI: The case of healthy aging. *Human Brain Mapping, 38*(8), 4125-4156.

Gerhardt, M.W., Nachemson-Ekwall, J., & Fogel, B. (2022, Mar 8). *Harnessing the Power of Age Diversity.* Harvard Business Review. https://hbr.org/2022/03/harnessing-the-power-of-age-diversity#:~:text=Age%2Ddiverse%20teams%20are%20valuable,skills%2C%20information%2C%20and%20net

Gerlach, K. D., Spreng, R. N., Madore, K. P., & Schacter, D. L. (2014). Future planning: default network activity couples with frontoparietal control network and reward-processing regions during process and outcome simulations. *Social cognitive and affective neuroscience*, *9*(12), 1942-1951. https://doi.org/10.1093/scan/nsu001

Ghisletta, P., & Aichele, S. (2017). Quantitative methods in psychological aging research: a mini-review. *Gerontology*, *63*(6), 529-537.

Glaser, R. (1986). On the nature of expertise. In F. Klix & H. Hagendorf (Eds.), *Human memory and cognitive capabilities* (Part B, pp. 915-928). Amsterdam: North-Holland.

Globerman, S. (2021, Mar). *Aging and Expenditures on Health Care.* Fraser Research Bulletin. https://www.fraserinstitute.org/sites/default/files/aging-and-expenditures-on-health-care.pdf

Glück, J. (2011). "She looks back without bitterness": Wisdom as a developmental opposite of embitterment?. In *Embitterment: Societal, psychological, and clinical perspectives* (pp. 70-82). Vienna: Springer Vienna.

Glück, J. (2018). Measuring wisdom: Existing approaches, continuing challenges, and new developments [Special issue]. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *73*(8), 1393–1403. https://doi.org/10.1093/geronb/gbx140

Glück, J., & Bluck, S. (2011). Laypeople's conceptions of wisdom and its development: Cognitive and integrative views. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *66*(3), 321–324. https://doi.org/10.1093/geronb/gbr011

Glück, J., Bluck, S., Baron, J., & McAdams, D. (2005). The wisdom of experience: Autobiographical narratives across adulthood. *International journal of behavioral development*, *29*(3), 197-208.

Glück, J., König, S., Naschenweng, K., Redzanowski, U., Dorner, L., Straßer, I., & Wiedermann, W. (2013). How to measure wisdom: Content, reliability, and validity of five measures. *Frontiers in Psychology*, *4*, Article 405. https://doi.org/10.3389/fpsyg.2013.00405

Glück, J., Strasser, I., & Bluck, S. (2009). Gender differences in implicit theories of wisdom. *Research in Human Development*, *6*(1), 27–44. https://doi.org/10.1080/15427600902779370

Grady, C. (2012). The cognitive neuroscience of ageing. *Nature Reviews Neuroscience*, *13*(7), 491-505.

Greaves, C., Zacher, H., McKenna, B., & Rooney, D. (2014). Wisdom and narcissism as predictors of transformational leadership. *Leadership & Organization Development Journal*, *35*(4), 335-358.

Grennan, G., Balasubramani, P. P., Alim, F., Zafar-Khan, M., Lee, E. E., Jeste, D. V., & Mishra, J. (2021). Cognitive and neural correlates of loneliness and wisdom during emotional bias. *Cerebral Cortex*, *31*(7), 3311-3322.

Greve, D. N., & Fischl, B. (2009). Accurate and robust brain image alignment using boundary-based registration. *NeuroImage, 48*(1), 63–72. https://doi.org/10.1016/j.neuroimage.2009.06.060

Grossmann, I. (2012). *Getting wisdom: Aging, culture and perspective*. (Publication No. 3519596) [Doctoral dissertation, University of Michigan]. ProQuest Dissertations Publishing.

Grossmann, I. (2017a). Wisdom in context. *Perspectives on Psychological Science, 12*(2), 233–257. https://doi.org/10.1177/1745691616672066

Grossmann, I. (2017b). Wisdom and how to cultivate it: Review of emerging evidence for a constructivist model of wise thinking. *European Psychologist*, *22*(4), 233–246. https://doi.org/10.1027/1016-9040/a000302

Grossmann, I., Gerlach, T. M., & Denissen, J. J. (2016). Wise reasoning in the face of everyday life challenges. *Social Psychological and Personality Science*, *7*(7), 611-622.

Grossmann, I., Karasawa, M., Izumi, S., Na, J., Varnum, M. E., Kitayama, S., & Nisbett, R. E. (2012). Aging and wisdom: Culture matters. *Psychological science*, *23*(10), 1059-1066.

Grossmann, I., & Kross, E. (2014). Exploring Solomon's paradox: Self-distancing eliminates the self-other asymmetry in wise reasoning about close relationships in younger and older adults. *Psychological science*, *25*(8), 1571-1580.

Grossmann, I., Weststrate, N. M., Ardelt, M., Brienza, J. P., Dong, M., Ferrari, M., ... & Vervaeke, J. (2020). The science of wisdom in a polarized world: Knowns and unknowns. *Psychological inquiry*, *31*(2), 103-133. doi:10.1080/1047840X.2020.1750917.

Grossmann, I., Na, J., Varnum, M. E., Kitayama, S., & Nisbett, R. E. (2013). A route to well-being: intelligence versus wise reasoning. *Journal of Experimental Psychology: General*, *142*(3), 944.

Grossmann, I., Na, J., Varnum, M. E., Park, D. C., Kitayama, S., & Nisbett, R. E. (2010). Reasoning about social conflicts improves into old age. *Proceedings of the National Academy of Sciences*, *107*(16), 7246-7250.

Hasher, L., & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Brower (Ed.), *The psychology of learning and motivation* (pp. 193-225). San Diego, CA: Academic Press

Heckhausen, J., Dixon, R. A., & Baltes, P. B. (1989). Gains and losses in development throughout adulthood as perceived by different adult age groups. *Developmental Psychology*, *25*(1), 109–121.

Hedden, T., Lautenschlager, G., & Park, D. C. (2005). Contributions of processing ability and knowledge to verbal memory tasks across the adult life-span. *Q J Exp Psychol A, 58*(1), 169-190.

Hedden, T., Park, D. C., Nisbett, R., Ji, L. J., Jing, Q., & Jiao, S. (2002). Cultural variation in

verbal versus spatial neuropsychological function across the life span. *Neuropsychology*, *16*(1), 65. https://doi.org/10.1037/0894-4105.16.1.65

Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *British Medical Journal, 327*(7414), 557-560. https://doi.org/10.1136/bmj.327.7414.557

Igarashi, H., Levenson, M. R., & Aldwin, C. M. (2018). The development of wisdom: A social ecological approach. *The Journals of Gerontology: Series B*, *73*(8), 1350-1358.

Intezari, A., & Pauleen, D. J. (2018). Conceptualizing wise management decision-making: A grounded theory approach. *Decision Sciences*, *49*(2), 335-400. https://doi.org/10.1111/deci.12267

Isaacowitz, D. M., Vaillant, G. E., & Seligman, M. E. (2003). Strengths and satisfaction across the adult lifespan. *International Journal of Aging & Human Development*, 57, 181–201.https://doi.org/10.2190/61EJ-LDYR-Q55N-UT6E

Jaleha, A. A., & Machuki, V. N. (2018). Strategic leadership and organizational performance: A critical review of literature. *European Scientific Journal*, *14*(35), 124-149.

Jennings, P. A. (2004). *The role of personality, stress, and coping in the development of wisdom*. University of California, Davis.

Jennings, P. A., Aldwin, C. M., Levenson, M. R., Spiro III, A., & Mroczek, D. K. (2006). Combat exposure, perceived benefits of military service, and wisdom in later life: Findings from the Normative Aging Study. *Research on Aging*, *28*(1), 115-134.

Jeste, D. V., Ardelt, M., Blazer, D., Kraemer, H. C., Vaillant, G., & Meeks, T. W. (2010). Expert consensus on characteristics of wisdom: A Delphi method study. *The Gerontologist*, *50*(5), 668–680. https://doi.org/10.1093/geront/gnq022

Jeste, D. V., Di Somma, S., Lee, E. E., Nguyen, T. T., Scalcione, M., Biaggi, A., ... & Brenner, D. (2020). Study of loneliness and wisdom in 482 middle-aged and oldest-old adults: a comparison between people in Cilento, Italy and San Diego, USA. *Aging & mental health*, *25*(11), 2149-2159.

Kantarovich, K., Mwilambwe-Tshilobo, L., Fernández-Cabello, S., Setton, R., Baracchini, G., Lockrow, A. W., ... & Turner, G. R. (2022). White matter lesion load is associated with lower within-and greater between-network connectivity across older age. *Neurobiology of aging*, *112*, 170-180.

Kekes, J. (1983). Wisdom. *American Philosophical Review, 20*, 277-286.

Kelly, J. (2023, Mar 1). *Can 5 Generations Coexist in the Workplace?*. Forbes. https://www.forbes.com/sites/jackkelly/2023/03/01/can-five-generations-coexist-in-the-workplace/?sh=5b58a31431f2

Kilburg, R. R. (2006). Barriers to leading wisely. In *Executive wisdom: Coaching and the emergence of virtuous leaders* (pp. 115–144). American Psychological Association.

Kim, S., & Knight, B. G. (2015). Adaptation of the three-dimensional wisdom scale (3D-WS) for the Korean cultural context. *International psychogeriatrics*, *27*(2), 267-278.

Knight, R. (2014, Sept 25). *Managing People from 5 Generations.* Harvard Business Review. https://hbr.org/2014/09/managing-people-from-5-generations

Knight, A. J., & Parr, W. V. (1999). Age as a factor in judgments of wisdom and creativity. *New Zealand Journal of Psychology, 28*(1), 37-47.

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of chiropractic medicine*, *15*(2), 155-163. https://doi.org/10.1016/j.jcm.2016.02.012

Kong, R., Yang, Q., Gordon, E., Xue, A., Yan, X., Orban, C., Zuo, X. N., Spreng, N., Ge, T., Holmes, A., Eickhoff, S., & Yeo, B. T. T. (2021). Individual-specific areal-level parcellations improve functional connectivity prediction of behavior. *Cerebral Cortex, 31*(10), 4477–4500. https://doi.org/10.1093/cercor/bhab101

Kounidas, G., & Kastora, S. (2022). Mindfulness training for borderline personality disorder: A systematic review of contemporary literature. *Personality and Mental Health*, *16*(3), 180-189.

Krafcik, D. (2011). *Words from the wise: A qualitative and quantitative study of nominated exemplars of wisdom* (Publication No. 3457971) [Doctoral dissertation, Institute of Transpersonal Psychology]. ProQuest Dissertations Publishing.

Krause, N. (2016). Assessing the relationships among wisdom, humility, and life satisfaction. *Journal of Adult Development*, *23*, 140-149.

Kundu, P., Brenowitz, N. D., Voon, V., Worbe, Y., Vértes, P. E., Inati, S. J., Saadd, S., Bandettini P. A., & Bullmore, E. T. (2013). Integrated strategy for improving functional connectivity mapping using multiecho fMRI. *Proc Natl Acad Sci U S A*, *110*(40), 16187-16192. doi:10.1073/pnas.1301725110

Kundu, P., Inati, S. J., Evans, J. W., Luh, W. M., & Bandettini, P. A. (2012). Differentiating BOLD and non-BOLD signals in fMRI time series using multi-echo EPI. *Neuroimage*, *60*(3), 1759-1770. doi:10.1016/j.neuroimage.2011.12.028

Kunzmann, U., Nowak, J., Thomas, S., & Nestler, S. (2018). Value relativism and perspective taking are two distinct facets of wisdom-related knowledge. *The Journals of Gerontology: Series B*, *73*(8), 1384-1392.

Kross, E., & Grossmann, I. (2012). Boosting wisdom: Distance from the self enhances wise

reasoning, attitudes, and behavior. *Journal of Experimental Psychology: General, 141*(1), 43–48. http://doi.org/10.1037/a0024158

Kunzmann, U., & Baltes, B. (2003). Wisdom-related knowledge: Affective, motivational, and interpersonal correlates. *Personality and Social Psychology Bulletin*, *29*(9), 1104-1119.

Kunzmann, U., & Baltes, P. B. (2005). The psychology of wisdom: Theoretical and empirical challenges. In R. J. Sternberg & J. Jordan (Eds.), *A handbook of wisdom: Psychological perspectives* (pp. 110–136). Cambridge University Press. https://doi.org/10.1017/CBO9780511610486.006

Kunzmann, U., Nowak, J., Thomas, S., & Nestler, S. (2018). Value relativism and perspective taking are two distinct facets of wisdom-related knowledge. *The Journals of Gerontology: Series B*, *73*(8), 1384-1392.

Kwon, Y. (1995). *Wisdom in Korean families: Its development, correlates, and consequences for life adaptation* (Publication No. 9511929) [Doctoral dissertation, Cornell University]. ProQuest Dissertations Publishing.

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: A practical primer for t-tests and ANOVAs. *Frontiers in Psychology, 4,* 863. https://doi.org/10.3389/fpsyg.2013.00863

Landis, P. H. (1947). *Social policies in the making: A dynamic view of social problems.* Lippincott. https://doi.org/10.1037/11584-000

Law, A., & Staudinger, U. M. (2016). Eudaimonia and wisdom. *Handbook of eudaimonic well-being*, 135-146.

Lee, S., Choun, S., Aldwin, C. M., & Levenson, M. R. (2015). Cross-cultural comparison of

self-transcendent wisdom between the United States and Korea. *Journal of Cross-Cultural Gerontology*, *30*, 143-161.

Leeman, T. M., Knight, B. G., Fein, E. C., Winterbotham, S., & Webster, J. D. (2022). An evaluation of the factor structure of the Self-Assessed Wisdom Scale (SAWS) and the creation of the SAWS-15 as a short measure for personal wisdom. *International Psychogeriatrics*, *34*(3), 241-251.

Lehrl, S. (1999). *Mehrfachwahl-Wortschatz-Intelligenztest: MWT-B*. Spitta.

Lerner, R. M. (1986). *Concepts and theories of human development.* New York: Random House.

Levenson, M. R., Jennings, P. A., Aldwin, C. M., & Shiraishi, R. W. (2005). Self-transcendence: Conceptualization and measurement. *The International Journal of Aging & Human Development, 60*(2), 127-143.

Levy, S. R., & Macdonald, J. L. (2016). Progress on Understanding Ageism. *Journal of Social Issues, 72*(1), 5–25.

Li, Y., Gao, J., Enkavi, A. Z., Zaval, L., Weber, E. U., & Johnson, E. J. (2015). Sound credit scores and financial decisions despite cognitive aging. *Proc Natl Acad Sci U S A, 112*(1), 65-69.

Lindbergh, C. A., Romero-Kornblum, H., Weiner-Light, S., Young, J. C., Fonseca, C., You, M., ... & Chiong, W. (2022). Wisdom and fluid intelligence are dissociable in healthy older adults. *International psychogeriatrics*, *34*(3), 229-239.

Lindenberger, U., Mayr, U., & Kliegl, R. (1993). Speed and intelligence in old age. *Psychology and aging*, *8*(2), 207.

Linley, P. A., Maltby, J., Wood, A. M., Joseph, S., Harrington, S., Peterson, C., . . . Seligman, M. E. P. (2007). Character strengths in the United Kingdom: The VIA inventory of

strengths. *Personality and Individual Differences, 43*(2), 341-351.

Lyster, T. L. (1996). *A nomination approach to the study of wisdom in old age* (Publication No. AINQ54368) [Doctoral dissertation, Concordia University]. ProQuest Information & Learning.

Malagurski, B., Liem, F., Oschwald, J., Mérillat, S., & Jäncke, L. (2020). Functional dedifferentiation of associative resting state networks in older adults–A longitudinal study. *NeuroImage, 214*, 116680.

Mann, C. J. (2003). Observational research methods. Research design II: cohort, cross sectional, and case-control studies. *Emergency medicine journal*, *20*(1), 54-60.

Mansfield, C. D., McLean, K. C., & Lilgendahl, J. P. (2010). Narrating traumas and transgressions: Links between narrative processing, wisdom, and well-being. *Narrative Inquiry*, *20*(2), 246-273.

Mansour, K., & Al-Hidabi, D. A. (2021). A Systematic Review of Research on Wisdom: Its Components and Measurement. *IIUM Journal of Educational Studies*, *9*(1), 46-70.

Marcoen, A., Coleman, P., & O'Hanlon, A. (2007). Psychological ageing. *Ageing in society*, 38-67.

Mather, M., & Carstensen, L. L. (2005). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in cognitive sciences*, *9*(10), 496-502.

McIntosh, A.R., & Lobaugh, N.J. (2004). Partial least squares analysis of neuroimaging data: applications and advances. *NeuroImage*, *23*, S250–63. doi:10.1016/j.neuroimage.2004.07.020

McIntosh, A.R., & Mišić , B. (2013). Multivariate statistical analyses for neuroimaging data. *Annu Rev Psychol*, *64*(1), 499–525. doi:10.1146/annurev- psych-113011-143804.

Meeks, T. W., & Jeste, D. V. (2009). Neurobiology of wisdom: A literature overview. *Archives of General Psychiatry*, *66*(4), 355–365. https://doi.org/10.1001/archgenpsychiatry.2009.8

Mickler, C., & Staudinger, U. M. (2008). Personal wisdom: Validation and age-related differences of a performance measure. *Psychology and aging*, *23*(4), 787.

Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual review of neuroscience*, *24*(1), 167-202.

Moraitou, D., & Efklides, A. (2012). The Wise Thinking and Acting Questionnaire: The Cognitive Facet of Wisdom and Its Relation with Memory, Affect, and Hope. Journal of Happiness Studies, 13, 849-873. http://dx.doi.org/10.1007/s10902-011-9295-1

Mwilambwe-Tshilobo, L., Ge, T., Chong, M., Ferguson, M. A., Misic, B., Burrow, A. L., Leahy, R. M., & Spreng, R. N. (2019). Loneliness and meaning in life are reflected in the intrinsic network architecture of the brain. *Soc Cogn Affect Neurosci*, *14*(4), 423-433. doi:10.1093/scan/nsz021

Mwilambwe-Tshilobo, L., Setton, R., Bzdok, D., Turner, G. R., & Spreng, R. N. (2023). Age differences in functional brain networks associated with loneliness and empathy. *Network Neuroscience*, *7*(2), 496-521.

Nasreddine, Z. S., Phillips, N. A., Bédirian, V., Charbonneau, S., Whitehead, V., Collin, I., ... & Chertkow, H. (2005). The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society*, *53*(4), 695-699.

Nesselroade, J. R., & Molenaar, P. C. (2016). Some behavioral science measurement concerns and proposals. *Multivariate behavioral research*, *51*(2-3), 396-412.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological review*, *84*(3), 231.

Ng, R., & Lim-Soh, J. W. (2021). Ageism linked to culture, not demographics: Evidence from an 8-billion-word corpus across 20 countries. *The Journals of Gerontology: Series B*, *76*(9), 1791-1798.

Nguyen, T. T., Zhang, X., Wu, T. C., Liu, J., Le, C., Tu, X. M., ... & Jeste, D. V. (2021). Association of loneliness and wisdom with gut microbial diversity and composition: an exploratory study. *Frontiers in psychiatry*, *12*, 395.

Nussbaum, J. (2013). The communication of wisdom: The nature and impact of communication and language change across the life span. *Journal of Language and Social Psychology*, *32*(3), 243-260. doi:10.1177/0261927X12463009

Oelmüller, W. (Ed.). (1989). *Philosophie und Weisheit.* Paderborn: Schöningh.

Oh, H. (2013). *Wisdom and the life course: An analysis of life course factors related to laypeople's conceptions of wisdom* (Publication No. 3729247) [Doctoral dissertation, University of Florida]. ProQuest Dissertations Publishing.

Orwoll, L., & Achenbaum, A. (1993). Gender and the development of wisdom. *Human Development*, *36*(5), 274-296. https://doi.org/10.1159/000278214

Orwoll, L., & Perlmutter, M. (1990). *The study of wise persons: Integrating a personality perspective*. In R. Sternberg (Ed.). *Wisdom: Its Nature, Origins, and Development* (pp. 160-178). Cambridge: Cambridge University Press. doi:10.1017/CBO9781139173704.009

Osbeck, L. M., & Robinson, D. N. (2005). *Philosophical theories of wisdom*. In R. J. Sternberg

& J. Jordan (Eds.), A handbook of wisdom: Psychological perspectives (pp. 61–83). Cambridge University Press.

Oxford English Dictionary. (1926). *Wisdom.* Oxford English Dictionary. https://www.oed.com/dictionary/wisdom_n?tab=meaning_and_use&tl=true#14117686

Oxman, T. E. (2018). Reflections on aging and wisdom. *The American Journal of Geriatric Psychiatry*, *26*(11), 1108–1118. https://doi.org/10.1016/j.jagp.2018.07.009

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021a). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. British Medical Journal, 372. https://doi.org/10.1016/j.ijsu.2021.105906

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & McKenzie, J. E. (2021b). PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews. British Medical Journal, 372. https://doi.org/10.1136/bmj.n160

Palmore, E. (2005). Three decades of research on ageism. *Generations*, *29*(3), 87-90.

Park, D. C., Polk, T. A., Mikels, J. A., Taylor, S. F., & Marshuetz, C. (2001). Cerebral aging: integration of brain and behavioral models of cognitive function. *Dialogues in Clinical Neuroscience,* 3(3), 151-165.

Park, H. L., O'Connell, J. E., & Thomson, R. G. (2003). A systematic review of cognitive decline in the general elderly population. *International journal of geriatric psychiatry*, *18*(12), 1121-1134.

Parker, G., Smith, T., Shea, C., Perreira, T. A., & Sriharan, A. (2022). Key Healthcare

Leadership Competencies: Perspectives from Current Healthcare Leaders. *Healthcare Quarterly (Toronto, Ont.)*, *25*(1), 49-56. doi: 10.12927/hcq.2022.26806

Pascual-Leone, J. (2000). Mental attention, consciousness, and the progressive emergence of wisdom. *Journal of Adult Development*, *7*(4), 241-254.

Pasupathi, M., & Staudinger, U. M. (2001). Do advanced moral reasoners also show wisdom? Linking moral reasoning and wisdom-related knowledge and judgement. *International Journal of Behavioral Development*, *25*(5), 401-415.

Petrides, M. (2005). Lateral prefrontal cortex: architectonic and functional organization. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *360*(1456), 781-795.

Pillemer, K., Nolte, J., Schultz, L., Yau, H., Henderson Jr, C. R., Cope, M. T., & Baschiera, B. (2022). The benefits of intergenerational wisdom-sharing: A randomized controlled study. *International Journal of Environmental Research and Public Health*, *19*(7), 4010.

Rakoczy, H., Wandt, R., Thomas, S., Nowak, J., & Kunzmann, U. (2018). Theory of mind and wisdom: The development of different forms of perspective-taking in late adulthood. *British Journal of Psychology*, *109*(1), 6-24.

Raven J. C. (1941). Standardisation of progressive matrices. *British Journal of Medical Psychology*, 19, 137-150.

Reitan, R. M. (1958). Validity of the Trail Making Test as an indicator of organic brain damage. *Perceptual and Motor Skills, 8,* 271–276. https://doi.org/10.2466/PMS.8.7.271-276

Renkewitz, F., & Keiner, M. (2019). How to detect publication bias in psychological research. *Zeitschrift für Psychologie, 227*(4).

Reuter-Lorenz, & Cappell, K. A. (2008). Neurocognitive aging and the compensation hypothesis.

Curr Dir Psychol Sci, 17(3), 177-182. doi:10.1111/j.1467-8721.2008.00570.x

Rice, E. F. (1958). *The renaissance idea of wisdom.* Cambridge, MA: Harvard University Press.

Rodgers, M. A., & Pustejovsky, J. E. (2021). Evaluating meta-analytic methods to detect selective reporting in the presence of dependent effect sizes. *Psychological Methods, 26*(2), 141. https://psycnet.apa.org/doi/10.1037/met0000300

Ryff, C. D., & Heincke, S. G. (1983). Subjective organization of personality in adulthood and aging. *Journal of Personality and Social Psychology, 44*(4), 807–816. https://doi.org/10.1037/0022-3514.44.4.807

Sahrani, R., Matindas, R. W., Takwin, B., & Mansoer, W. W. (2014). The role of reflection of difficult life experiences on wisdom. *Journal of the Indian Academy of Applied Psychology, 40*(2), 315-323.

Salthouse, T. A. (1992). *Theoretical perspectives on cognitive aging.* Hillsdale, NJ: Erlbaum.

Salthouse, T. A. (1996). The processing-speed theory of adult age differences in cognition. *Psychol Rev, 103*(3), 403-428.

Samanez-Larkin, G. R. (2013). Financial Decision Making and the Aging Brain. *APS Obs, 26*(5), 30-33.

Sawchuk, D. (2015). Aging and older adults in three roman catholic magazines: Successful aging and the third and fourth ages reframed. *Journal of Aging Studies, 35,* 221-228. doi:10.1016/j.jaging.2015.08.012

Schaefer, A., Kong, R., Gordon, E., Laumann T.O., Zuo X.N., Holmes A.J., Eickhoff S.B., & Yeo B.T.T., (2018). Local-Global Parcellation of the Human Cerebral Cortex from Intrinsic Functional Connectivity MRI. *Cereb Cortex*, *28*(9), 3095-114. doi:10.1093/cercor/bhx179

Schneider, T. R., Nusbaum, H. C., Kim, Y., Borders, M. R., & Ryan, T. J. (2023). Emotional intelligence predicts wise reasoning. *The Journal of Positive Psychology*, *18*(1), 106-120.

Schneider, T. R., Nusbaum, H. C., Kim, Y., Borders, M. R., & Ryan, T. J. (2023). Emotional intelligence predicts wise reasoning. *The Journal of Positive Psychology*, *18*(1), 106-120.

Setton, R., Mwilambwe-Tshilobo, L., Girn, M., Lockrow, A.W., Baracchini, G., Lowe, A.J., Cassidy, B.N., Li, J., Luh, W.-M., Bzdok, D., Leahy, R.M., Ge, T., Marguilies, D.S., Mišić, B., Bernhardt., B.C., Stevens, W.D., De Brigard, F., Kundu, P., Turner, G.R. & Spreng, R.N. (2021). *Functional architecture of the aging brain.* bioRxiv, https://doi.org/10.1101/2021.03.31.437922

Setton, R., Mwilambwe-Tshilobo, L., Girn, M., Lockrow, A. W., Baracchini, G., Hughes, C., Lowe, A. J., Cassidy, B. N., Li, J., Misic, B., Bernhardt, B. C., Stevens, W. D., De Brigard, F., Kundu, P., Turner, G. R., & Spreng, R. N. (2023). Age differences in the functional architecture of the human brain. *Cerebral Cortex*, *33*(1), 114-134. https://doi.org/10.1093/cercor/bhac056

Shields, C. (2022). Aristotle. In *The Stanford Encyclopedia of Philosophy* (Spring 2022 Edition). Stanford, CA: Stanford University.

Shipley, W. C. (1940). *Shipley Institute of Living Scale (SILS)* [Database record]. APA PsycTests. https://doi.org/10.1037/t07774-000

Shipley, W. C., Gruber, C. P, Martin, T. A., & Klein, A. M. (2009). *Shipley-2 manual*. Los Angeles, CA: Western Psychological Services.

Simonton, D. K. (1990). Creativity and wisdom in aging. *Handbook of the psychology of aging*, *3*, 320-329.

Smith, L. (2012). *Conceptualizations of wisdom in the native American community.* [Doctoral

dissertation, Antioch University Santa Barbara].

Smith, J., Staudinger, U. M., & Baltes, P. B. (1994). Occupational settings facilitating wisdom-related knowledge: The sample case of clinical psychologists. *Journal of Consulting and Clinical Psychology*, *62*(5), 989.

Smith, J., & Baltes, P. B. (1990). Wisdom-related knowledge: Age/cohort differences in response to life-planning problems. *Developmental psychology*, *26*(3), 494.

Sorokowski, P., Sorokowska, A., Frackowiak, T., & Löckenhoff, C. E. (2017). Aging perceptions in tsimane' amazonian Forager–Farmers compared with two industrialized societies. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 72*(4), 561-570. https://doi.org/10.1093/geronb/gbv080

Speck, O., Ernst, T., & Chang, L. (2001). Biexponential modeling of multigradient-echo MRI data of the brain. *Magnetic Resonance in Medicine: An Official Journal of the International Society for Magnetic Resonance in Medicine, 45*(6), 1116-1121.

Spreng, R. N. (2012). The fallacy of a "task-negative" network. *Front Psychol, 3,* 145.

Spreng, R. N. (2022). Goal-directed cognition in older and younger adults. *OSF https://doi. org/10.17605/OSF. IO/YHZXE*.

Spreng, R. N., Cassidy, B. N., Darboh, B. S., DuPre, E., Lockrow, A. W., Setton, R., & Turner, G. R. (2017). Financial exploitation is associated with structural and functional brain differences in healthy older adults. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, *72*(10), 1365-1368.

Spreng, R.N., Lockrow, A.W., †DuPre, E., Setton, R., Spreng, K.A.P. & Turner, G.R. (2018). Semanticized autobiographical memory and the default – executive coupling hypothesis of aging. *Neuropsychologia, 110*, 37–43. doi: 10.1016/j.neuropsychologia.2017.06.009

Spreng, R. N., Setton, R., Alter, U., Cassidy, B. N., Darboh, B., DuPre, E., ... & Turner, G. R. (2022). Neurocognitive aging data release with behavioral, structural and multi-echo functional MRI measures. *Scientific Data*, *9*(1), 119.

Spreng, R.N., Stevens, W.D., Chamberlain, J., Gilmore, A.W. & Schacter, D.L. (2010). Default network activity, coupled with the frontoparietal control network, supports goal-directed cognition. *NeuroImage, 53*, 303–317.

Spreng, R. N., & Turner, G. R. (2019). The shifting architecture of cognition and brain function in older adulthood. *Perspectives on Psychological Science*, *14*(4), 523-542. https://doi.org/10.1177/1745691619827511

Spreng, R. N., & Turner, G. R. (2021). From exploration to exploitation: A shifting mental mode in late life development. *Trends in Cognitive Sciences*, *25*(12), 1058-1071. https://doi.org/10.1016/j.tics.2021.09.001

Stamenova, V., & Levine, B. (2019). Effectiveness of goal management training® in improving executive functions: A meta-analysis. *Neuropsychological rehabilitation*, *29*(10), 1569-1599.

Stange, A., & Kunzmann, U. (2009). Fostering wisdom: A psychological perspective. In M. Ferrari & G. Potworowski (Eds.), *Teaching for wisdom* (pp. 23–36). Springer Netherlands. https://doi.org/10.1007/978-1-4020-6532-3_2

Staudinger, U. M. (1989). *The study of life review: An approach to the investigation of intellectual development across the life span*. Berlin, Federal Republic of Germany: Edition Sigma.

Staudinger, U. M. (1999). Older and wiser? Integrating results on the relationship between age

and wisdom-related performance. *International Journal of Behavioral Development*, *23*(3), 641–664. https://doi.org/10.1080/016502599383739

Staudinger, U. M. (2008). A psychology of wisdom: History and recent developments. *Research in Human Development*, *5*(2), 107-120.

Staudinger, U. M. (2013). The need to distinguish personal from general wisdom: A short history and empirical evidence. In *The scientific study of personal wisdom: From contemplative traditions to neuroscience* (pp. 3-19). Dordrecht: Springer Netherlands.

Staudinger, U. M., & Baltes, P. B. (1996). Interactive minds: A facilitative setting for wisdom-related performance?. *Journal of Personality and social psychology*, *71*(4), 746.

Staudinger, U. M., Lopez, D. F., & Baltes, P. B. (1997). The psychometric location of wisdom-related performance: Intelligence, personality, and more?. *Personality and Social Psychology Bulletin*, *23*(11), 1200-1214.

Staudinger, U. M., & Glück, J. (2011a). Intelligence and wisdom. In R. J. Sternberg, & S. B. Kaufman (Eds.), *The Cambridge handbook of intelligence* (pp. 827-846) Cambridge University Press, New York, NY.

Staudinger, U. M., & Glück, J. (2011b). Psychological wisdom research: Commonalities and differences in a growing field. *Annual Review of Psychology*, *62*, 215–241. https://doi.org/10.1146/annurev.psych.121208.131659

Staudinger, U. M., Maciel, A. G., Smith, J., & Baltes, P. B. (1998). What predicts wisdom related performance? A first look at personality, intelligence, and facilitative experiential contexts. *European Journal of Personality, 12*, 1–17.

Staudinger, U. M., & Pasupathi, M. (2003). Correlates of wisdom-related performance in

adolescence and adulthood: Age-graded differences in “paths” toward desirable development. *Journal of Research on Adolescence*, *13*(3), 239-268.

Staudinger, U. M., Smith, J., & Baltes, P. B. (1992). Wisdom-related knowledge in a life review task: Age differences and the role of professional specialization. *Psychology and Aging*, *7*(2), 271.

Staudinger, U. M., Smith, J., & Baltes, P. B. (1994). *Manual for the assessment of wisdom-related knowledge*. Berlin: Max-Planck-Institut für Bildungsforschung.

Sternberg, R. J. (1980). Sketch of a componential subtheory of human intelligence. *Behavioral and Brain Sciences*, *3*(4), 573–614. https://doi.org/10.1017/S0140525X00006932

Sternberg, R. J. (1985). Implicit theories of intelligence, creativity, and wisdom. *Journal of Personality and Social Psychology*, *49*(3), 607–627.

Sternberg, R. J. (1998). A balance theory of wisdom. *Review of General Psychology*, *2*(4), 347–365.

Sternberg, R. J. (2000). Wisdom as a form of giftedness. *Gifted Child Quarterly*, *44*(4), 252–260.

Sternberg, R. J. (2005a). WICS: A model of giftedness in leadership. *Roeper Review*, *28*(1), 37–44. https://doi.org/10.1080/02783190509554335

Sternberg, R. J. (2005b). WICS: A model of leadership. *The Psychologist-Manager Journal*, *8*(1), 29–43. https://doi.org/10.1207/s15503461tpmj0801_4

Sternberg, R. J. (2005c). WICS: A model of positive educational leadership comprising wisdom, intelligence, and creativity synthesized. *Educational Psychology Review*, *17*(3), 191–262. https://doi.org/10.1007/s10648-005-5617-2

Sternberg, R. J. (2018). Wisdom, foolishness, and toxicity in human development. *Research in*

Human Development, *15*(3–4), 200–210. https://doi.org/10.1080/15427609.2018.1491216

Sterne, J. A., & Egger, M. (2005). Regression methods to detect publication and other bias in meta-analysis. In H. R. Rothstein, A.J. Sutton, and M. Borenstein (Eds.) *Publication bias in meta-analysis: Prevention, assessment and adjustments*, 99-110.

Stone, A. A., Broderick, J. E., Wang, D., & Schneider, S. (2020). Age patterns in subjective well-being are partially accounted for by psychological and social factors associated with aging. *Plos one*, *15*(12), e0242664.

Stumme, J., Jockwitz, C., Hoffstaedter, F., Amunts, K., & Caspers, S. (2020). Functional network reorganization in older adults: Graph-theoretical analyses of age, cognition and sex. *NeuroImage*, *214*, 116756.

Takahashi, M. (2000). Toward a culturally inclusive understanding of wisdom: Historical roots in the east and west. *The International Journal of Aging and Human Development, 51*(3), 217–230. https://doi.org/10.2190/H45U-M17W-3AG5-TA49

Takahashi, M., & Overton, W. F. (2002). Wisdom: A culturally inclusive developmental perspective. *International Journal of Behavioral Development*, *26*(3), 269-277.

Tanner-Smith, E. E., Tipton, E., & Polanin, J. R. (2016). Handling complex meta-analytic data structures using robust variance estimates: A tutorial in R. *Journal of Developmental and Life-Course Criminology, 2*(1), 85-112. https://doi.org/10.1007/s40865-016-0026-5

Taylor, M., Bates, G., & Webster, J. D. (2011). Comparing the psychometric properties of two measures of wisdom: Predicting forgiveness and psychological well-being with the Self-Assessed Wisdom Scale (SAWS) and the Three-Dimensional Wisdom Scale (3D-WS). *Experimental aging research*, *37*(2), 129-141.

Thomas, M. L., Bangen, K. J., Ardelt, M., & Jeste, D. V. (2021). Development of a 12-Item Abbreviated Three-Dimensional Wisdom Scale (3D-WS-12). Assessment, 24(1), 71-82. https://doi.org/10.1177/1073191115595714

Thomas, M. L., Bangen, K. J., Palmer, B. W., Martin, A. S., Avanzino, J. A., Depp, C. A., ... & Jeste, D. V. (2019). A new scale for assessing wisdom based on common domains and a neurobiological model: The San Diego Wisdom Scale (SD-WISE). *Journal of psychiatric research*, *108*, 40-47.

Tipton, E. (2015). Small sample adjustments for robust variance estimation with meta-regression. *Psychological Methods, 20*(3), 375. https://psycnet.apa.org/doi/10.1037/met0000011

Turner, G. R., & Spreng, R. N. (2015). Prefrontal engagement and reduced default network suppression co-occur and are dynamically coupled in older adults: the default–executive coupling hypothesis of aging. *Journal of cognitive neuroscience*, *27*(12), 2462-2476.

Urrutia, I. (2022, May 31). *The Wise Leader.* Humane Future of Work. https://humanefutureofwork.com/the-wise-leader/?utm_source=rss&utm_medium=rss&utm_campaign=the-wise-leader

Vandermorris, S., Au, A., Gardner, S., & Troyer, A. K. (2020). Initiation and maintenance of behaviour change to support memory and brain health in older adults: A randomized controlled trial. *Neuropsychological Rehabilitation.* https://doi.org/10.1080/09602011.2020.1841656

Vandermorris, S., Davidson, S., Au, A., Sue, J., Fallah, S., & Troyer, A. (2017). “Accepting where I’m at” – A qualitative study of the mechanisms, benefits, and impact of a

behavioral memory intervention for community-dwelling older adults. *Aging & Mental Health, 21*(9), 895–901. https://doi.org/10.1080/13607863.2016.1181709

Varangis, E., Habeck, C. G., Razlighi, Q. R., & Stern, Y. (2019). The effect of aging on resting state connectivity of predefined networks in the brain. *Frontiers in aging neuroscience*, *11*, 234.

Vásquez, E., Lee, E. E., Zhang, W., Tu, X., Moore, D. J., Marquine, M. J., & Jeste, D. V. (2020). HIV and three dimensions of Wisdom: Association with cognitive function and physical and mental well-being: For: Psychiatry Research. *Psychiatry research*, *294*, 113510.

Verhaeghen, P. (2003). Aging and vocabulary scores: a meta-analysis. *Psychol Aging, 18*(2), 332-339.

Verhaeghen, P. (2020). The examined life is wise living: The relationship between mindfulness, wisdom, and the moral foundations. *Journal of Adult Development*, *27*(4), 305-322.

Verhaeghen, P., & Cerella, J. (2002). Aging, executive control, and attention: a review of meta-analyses. *Neuroscience & Biobehavioral Reviews*, 26(7), 849-857.

Wang, X., & Cheng, Z. (2020). Cross-sectional studies: strengths, weaknesses, and recommendations. *Chest*, *158*(1), S65-S71.

Webster, J. D. (2003). An exploratory analysis of a self-assessed wisdom scale. *Journal of Adult Development*, *10*(1), 13–22.

Webster, J. D., Bohlmeijer, E. T., & Westerhof, G. J. (2014a). Time to flourish: The relationship of temporal perspective to well-being and wisdom across adulthood. *Aging & mental health*, *18*(8), 1046-1056.

Webster, J. D., Westerhof, G. J., & Bohlmeijer, E. T. (2014b). Wisdom and mental health across

the lifespan. *Journals of gerontology series b: Psychological sciences and social sciences*, *69*(2), 209-218.

Webster, J. D., Weststrate, N. M., Ferrari, M., Munroe, M., & Pierce, T. W. (2018). Wisdom and meaning in emerging adulthood. *Emerging Adulthood*, *6*(2), 118-136.

Wechsler, D. (1982). *Handanweisung zum Hamburg-Wechsler-Intelligenztest fu¨r Erwachsene (HAWIE)*. Bern, Switzerland: Huber.

Wechsler, D. (2008). Wechsler Adult Intelligence Scale--Fourth Edition (WAIS-IV) [Database record]. PsycTESTS.

Wechsler, D. (2009). *Wechsler Memory Scale (Fourth Edition).* San Antonio, TX: Pearson.

Wei, X., & Wang, F. (2020). Effect of Zhongyong thinking in the relationship of crystallized intelligence and wisdom. *Social Behavior and Personality: an international journal*, *48*(7), 1-8.

Weintraub, S., Dikmen, S. S., Heaton, R. K., Tulsky, D. S., Zelazo, P. D., Slotkin, J., Carlozzi, N. E., Bauer, P. J, Wallner-Allen, K., Fox, N., Havlik, R., Beaumont, J. L., Mungas, D., Manly, J. J, Moy, C., Conway, K., Edwards, E., Nowinski, C. J., & Gershon, R. (2014). The cognition battery of the NIH toolbox for assessment of neurological and behavioral function: validation in an adult sample. *Journal of International Neuropsychological Society, 20*(6), 567 – 78. https://doi.org/10.1017/S1355617714000320

Weiss, T. (2014). Personal transformation: Posttraumatic growth and gerotranscendence. *Journal of Humanistic Psychology, 54*(2), 203-226.

Weststrate, N. M., Ferrari, M., & Ardelt, M. (2016). The many faces of wisdom: An

investigation of cultural-historical wisdom exemplars reveals practical, philosophical, and benevolent prototypes. *Personality and Social Psychology Bulletin, 42*(5), 662-676.

Weststrate, N. M., & Glück, J. (2017). Hard-earned wisdom: Exploratory processing of difficult life experience is positively associated with wisdom. *Developmental psychology*, *53*(4), 800.

Williams, P. B., Mangelsdorf, H. H., Kontra, C., Nusbaum, H. C., & Hoeckner, B. (2016). The relationship between mental and somatic practices and wisdom. *PloS one*, *11*(2), e0149369.

Wilson, B. A., Cockburn, J., & Baddeley, A. D. (1991). *The Rivermead Behavioural Memory Test: Manual* (2nd ed.). Suffolk, England: Thames Valley Test Company.

Wonderlic, I. (2002). Wonderlic Personnel Test and Scholastic Level Exam User's Manual. *Wonderlic and Associates*: Vernon Hills, IL.

World Health Organization (WHO). (2021, Mar 18). *Ageism is a global challenge: UN.* World Health Organization. https://www.who.int/news/item/18-03-2021-ageism-is-a-global-challenge-un

World Health Organization (WHO). (2022, Oct 1). *Ageing and Health.* World Health Organization. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health#:~:text=At%20this%20time%20the%20share,2050%20to%20reach%20426%20million

Yang, S. (2008). A process view of wisdom. *Journal of Adult Development, 15*(2), 62-75. doi:http://dx.doi.org.ezproxy.library.yorku.ca/10.1007/s10804-008-9037-8

Yang, S. (2013). Wisdom and good lives: A process perspective. *New Ideas in Psychology, 31*(3), 194-201. doi:http://dx.doi.org.ezproxy.library.yorku.ca/

10.1016/j.newideapsych.2013.03.000

Yang, S. Y. (2020). Wisdom and memory: Autobiographical memories as the foundation for the recall of wisdom incidents. *New Ideas in Psychology*, *57*, 100761. https://doi.org/10.1016/j.newideapsych.2019.100761

Yeo, B.T., Krienen, F.M., Sepulcre, J., Sabuncu M.R., Lashkari D., Hollinshead M., Roffman J.L., Smoller J.W., Zöllei L., Polimeni J.R., Fischl B., Liu H., & Buckner R.L. (2011). The organization of the human cerebral cortex estimated by intrinsic functional connectivity. *J Neurophysiol*, *106*(3), 1125–65. doi:10.1152/jn.00338.2011

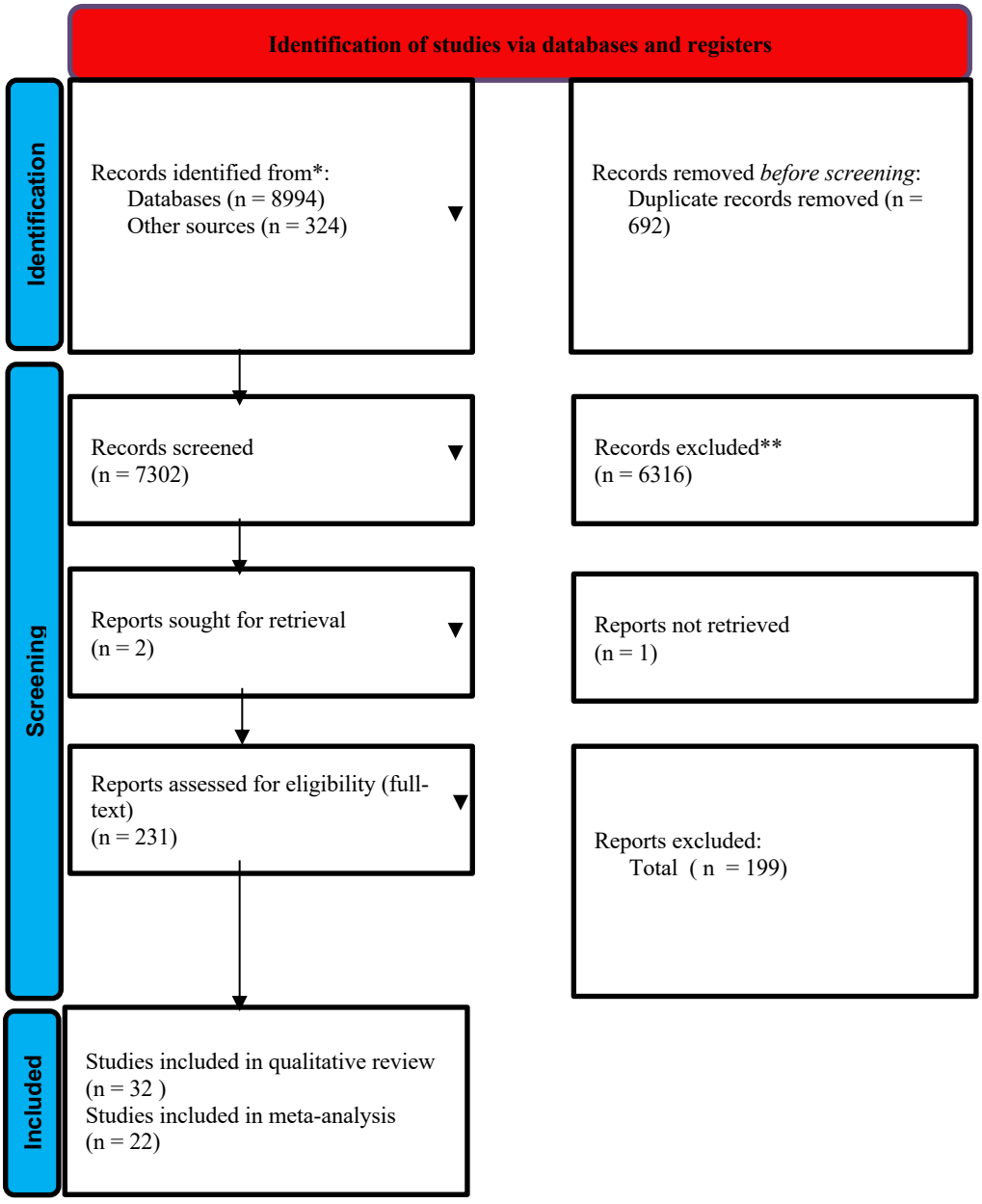
Wig, G. S. (2017). Segregated systems of human brain networks. *Trends in cognitive sciences*, *21*(12), 981-996. https://doi.org/10.1016/j.tics.2017.09.006

Zacher, H., McKenna, B., & Rooney, D. (2013). Effects of self-reported wisdom on happiness: Not much more than emotional intelligence?. *Journal of Happiness Studies*, *14*, 1697-1716.

Zeldin, S., Larson, R., Camino, L., & O'Connor, C. (2005). Intergenerational relationships and partnerships in community programs: Purpose, practice, and directions for research. *Journal of Community Psychology*, *33*(1), 1-10.

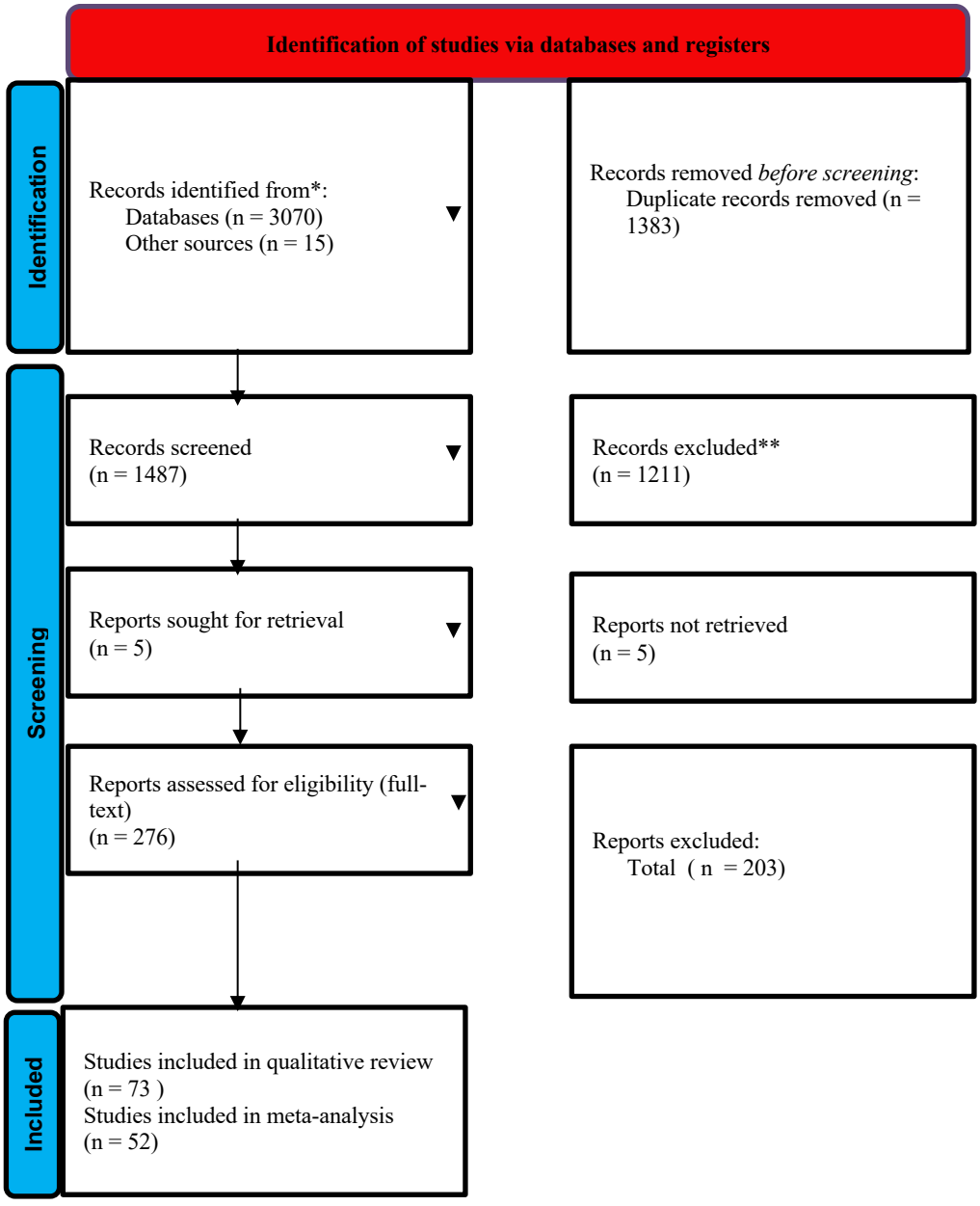
Appendix A

PRISMA Flow Chart for the Systematic Review of the Literature on Wisdom and Cognition



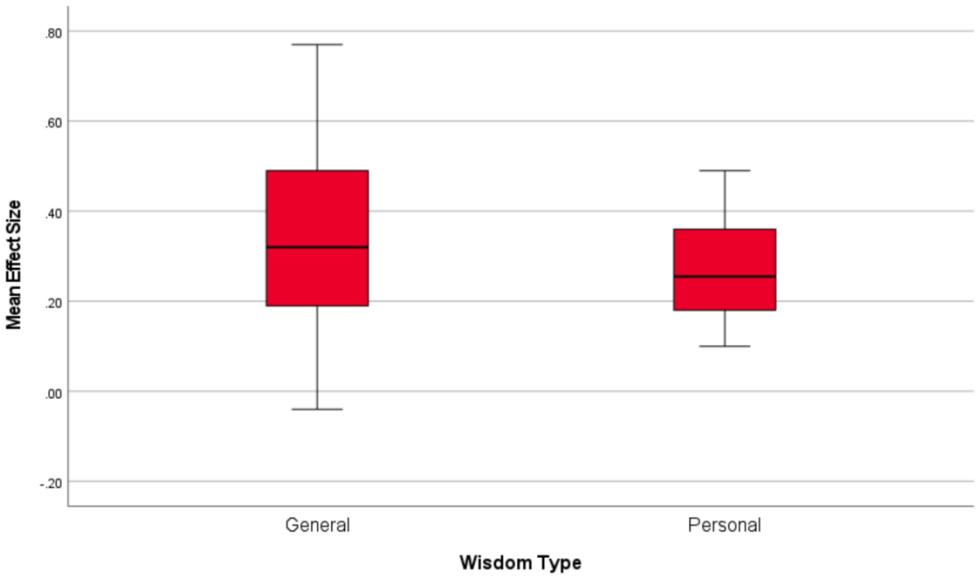
Appendix B

PRISMA Flow Chart for the Systematic Review of the Literature on Wisdom and Aging



Appendix C

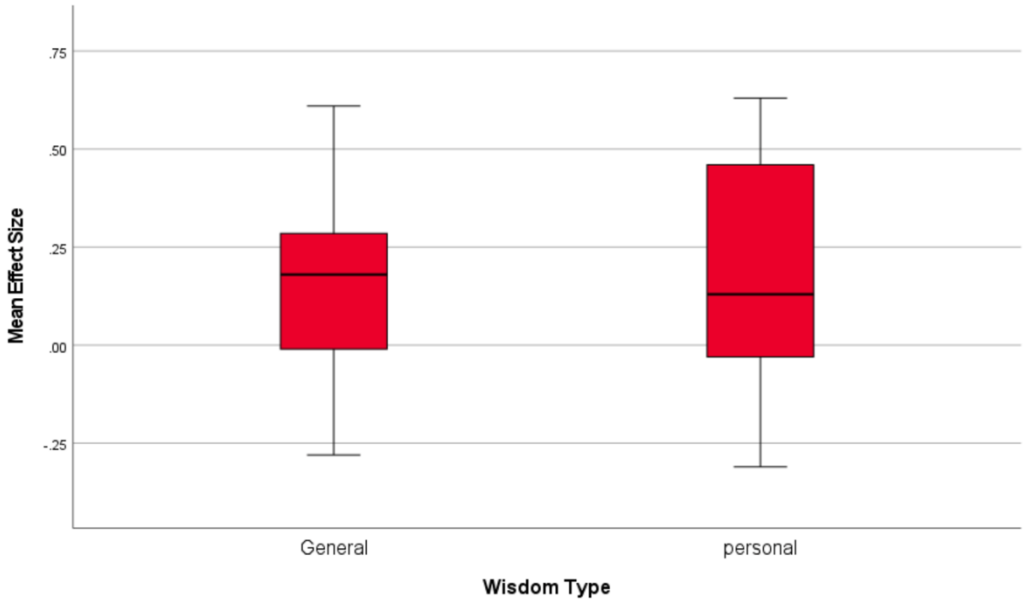
Boxplot of Mean Effect Size of Crystallized Intelligence on General Versus Personal Wisdom



Note: Figure details as described in Figure 2.7. No significant difference between mean effect sizes of studies investigating general versus personal wisdom. General wisdom outcomes: n = 31, $M(SD)$ = .37(.20); personal wisdom outcomes: n = 10, $M(SD)$ = .27(.12)

Appendix D

Boxplot of the Mean Effect Size of Fluid Intelligence on General Versus Personal Wisdom t



Note: Figure details as described in Figure 2.7. No significant difference between mean effect sizes of studies investigating general versus personal wisdom. General wisdom outcomes: n = 19, M(SD) = .14(.2); personal wisdom outcomes: n = 6, M(SD) = .27(.12)

Appendix E

Berlin Wisdom Paradigm: Life Planning and Life Review Tasks

Life Planning Tasks

Life Planning Task 1: Work-Family (Age-Based)

JOYCE, A 60-YEAR-OLD WIDOW, RECENTLY COMPLETED A DEGREE IN BUSINESS MANAGEMENT AND OPENED HER OWN BUSINESS. SHE HAS BEEN LOOKING FORWARD TO THIS NEW CHALLENGE. SHE HAS JUST HEARD THAT HER SON HAS BEEN LEFT WITH TWO SMALL CHILDREN TO CARE FOR.

JOYCE IS CONSIDERING THE FOLLOWING OPTIONS: SHE CAN PLAN TO GIVE UP HER BUSINESS AND LIVE WITH HER SON, OR SHE CAN PLAN TO ARRANGE FOR FINANCIAL ASSISTANCE FOR HER SON TO COVER CHILD-CARE COSTS.

WHAT SHOULD JOYCE DO AND CONSIDER IN MAKING HER PLANS? WHAT ADDITIONAL INFORMATION IS NEEDED?

----------OR----------

MICHAEL, A 28-YEAR-OLD MECHANIC WITH TWO PRESCHOOL-AGED CHILDREN, HAS JUST LEARNED THAT THE FACTORY IN WHICH HE IS WORKING WILL CLOSE IN THREE MONTHS. AT PRESENT, THERE IS NO POSSIBILITY FOR FURTHER EMPLOYMENT IN THIS AREA. HIS WIFE RECENTLY RETURNED TO HER WELL-PAYING NURSING CAREER.

MICHAEL IS CONSIDERING THE FOLLOWING OPTIONS: HE CAN PLAN TO MOVE TO ANOTHER CITY TO SEEK EMPLOYMENT, OR HE CAN PLAN TO TAKE ON FULL RESPONSIBILITY FOR THE CHILD-CARE AND HOUSEHOLD TASKS.

WHAT SHOULD MICHAEL DO AND CONSIDER IN MAKING HIS PLANS? WHAT ADDITIONAL INFORMATION IS NEEDED?

Life Planning Task 2: Sickness (Sex-Based)

MARY WAS DIAGNOSED WITH CANCER. THE DOCTORS TOLD HER THAT SHE HAS BUT ONE YEAR TO LIVE. MARY IS NOW THINKING ABOUT WHAT SHE SHOULD DO. AMONG OTHER OPTIONS, SHE CAN TRY, AS MUCH AS POSSIBLE, TO CONTINUE LIVING THE WAY SHE HAS BEEN, OR SHE CAN MAKE A DRASTIC CHANGE IN HER LIFE.

WHAT SHOULD MARY DO AND CONSIDER IN MAKING HER PLANS? WHAT ADDITIONAL INFORMATION IS NEEDED?

----------OR----------

MARK WAS DIAGNOSED WITH CANCER. THE DOCTORS HAVE TOLD HIM THAT HE HAS BUT ONE YEAR TO LIVE. MARK IS NOW THINKING ABOUT WHAT HE SHOULD DO. AMONG OTHER OPTIONS, HE CAN TRY, AS MUCH AS POSSIBLE, TO CONTINUE LIVING THE WAY HE HAS BEEN, OR HE CAN MAKE A DRASTIC CHANGE IN HIS LIFE.

WHAT SHOULD MARK DO AND CONSIDER IN MAKING HIS PLANS? WHAT ADDITIONAL INFORMATION IS NEEDED?

Life Planning Task 3: Inheritance (Sex-Based)
RUTH RECENTLY FOUND OUT THAT SHE WAS TO BE GIVEN A CONSIDERABLE INHERITANCE. AFTER CELEBRATING, SHE IS THINKING ABOUT WHAT TO DO. AMONG OTHER POSSIBILITIES, SHE CAN INVEST THE MONEY AND CONTINUE LIVING THE WAY SHE HAS BEEN, OR SHE CAN MAKE A DRASTIC CHANGE IN HER LIFE.
WHAT SHOULD RUTH DO AND CONSIDER IN MAKING HER PLANS? WHAT ADDITIONAL INFORMATION IS NEEDED?
----------OR----------
STEVE RECENTLY FOUND OUT THAT HE WAS TO BE GIVEN A CONSIDERABLE INHERITANCE. AFTER CELEBRATING, HE IS THINKING ABOUT WHAT TO DO. AMONG OTHER POSSIBILITIES, HE CAN INVEST THE MONEY AND CONTINUE LIVING THE WAY HE HAS BEEN, OR HE CAN MAKE A DRASTIC CHANGE IN HIS LIFE.
WHAT SHOULD STEVE DO AND CONSIDER IN MAKING HIS PLANS? WHAT ADDITIONAL INFORMATION IS NEEDED?

Life Review Task (Age-Based)
A YOUNG WOMAN DECIDED TO CONCENTRATE ON HER FAMILY AND NOT TO TAKE UP A PROFESSION; SHE MARRIED AND HAD CHILDREN. ONE DAY SHE MEETS AN OLD FRIEND WHOM SHE HAD NOT SEEN FOR A LONG TIME. THIS FRIEND ONCE HAD DECIDED TO CONCENTRATE ON HER CAREER, RATHER THAN STARTING A FAMILY. PRESENTLY, SHE IS ON HER WAY TO BECOMING A SUCCESSFUL PROFESSIONAL. THE MEETING PROMPTS THE YOUNG WOMAN TO REVIEW THE LIFE SHE HAS LED SO FAR.
WHAT MIGHT SUCH A LIFE REVIEW LOOK LIKE? WHICH ASPECTS OF HER LIFE MIGHT SHE RECALL (DECISIONS, PROBLEMS, SOLUTIONS, IMPORTANT PEOPLE, FEELINGS, HELPFUL EVENTS, OBSTACLES)? HOW MIGHT SHE REFLECT ON THE MOTIVES FOR HER ACTIONS?

HOW MIGHT SHE EVALUATE HER LIFE IN RETROSPECT? DID SHE ATTAIN WHAT SHE HAD AIMED FOR?
----------OR----------
AN ELDERLY WOMAN HAD DECIDED IN HER YOUTH TO CONCENTRATE ON HER FAMILY AND NOT TO TAKE UP A PROFESSION. HER CHILDREN LEFT HOME SEVERAL YEARS AGO. ONE DAY SHE MEETS AN OLD FRIEND, WHOM SHE HAD NOT SEEN FOR A LONG TIME. THIS FRIEND ONCE HAD DECIDED TO CONCENTRATE ON HER CAREER, RATHER THAN STARTING A FAMILY. SHE RETIRED SEVERAL YEARS AGO. THE MEETING PROMPTS THE WOMAN TO REVIEW THE LIFE SHE HAS LED SO FAR.
WHAT MIGHT SUCH A LIFE REVIEW LOOK LIKE? WHICH ASPECTS OF HER LIFE

MIGHT SHE RECALL (DECISIONS, PROBLEMS, SOLUTIONS, IMPORTANT PEOPLE, FEELINGS, HELPFUL EVENTS, OBSTACLES)? HOW MIGHT SHE REFLECT ON THE MOTIVES FOR HER ACTIONS?
HOW MIGHT SHE EVALUATE HER LIFE IN RETROSPECT? DID SHE ATTAIN WHAT SHE HAD AIMED FOR?

Appendix F

The Three-Dimensional Wisdom Scale (Ardelt, 2003)

How strongly do you agree with the following statements? Rate each response from 1 (strongly agree) to 5 (strongly disagree).

1. Ignorance is bliss
2. It is better not to know too much about things that cannot be changed
3. In this complicated world of ours, the only way we can know what's going on is to rely on leaders or experts who can be trusted
4. There is only one right way to do anything
5. A person either knows the answer to a question or he/she doesn't
6. You can classify almost all people as either honest or crooked
7. People are either good or bad
8. Life is basically the same most of the time
9. A problem has little attraction for me if I don't think it has a solution
10. I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something
11. I prefer just to let things happen rather than try to understand why they turned out that way
12. Simply knowing the answer rather than understanding the reasons for the answer to a problem is fine with me
13. I am hesitant about making decisions after thinking about them
14. I often do not understand people's behavior
15. Things often go wrong for me by no fault of my own
16. I would feel much better if my present circumstances changed
17. I try to look at everybody's side of a disagreement before I make a decision

18. When I'm upset at someone, I usually try to "put myself in his or her shoes" for a while
19. I always try to look at all sides of a problem
20. Before criticizing somebody, I try to imagine how I would feel if I were in their place
21. I sometimes find it difficult to see things from another person's point of view
22. When I am confused by a problem, one of the first things I do is survey the situation and consider all the relevant pieces of information
23. Sometimes I get so charged up emotionally that I am unable to consider many ways of dealing with my problem
24. When I look back on what has happened to me, I can't help feeling resentful
25. When I look back on what's happened to me, I feel cheated
26. I either get very angry or very depressed if things go wrong
27. I am annoyed with unhappy people who just feel sorry for themselves
28. People make too much of the feelings and sensitivity of animals
29. There are some people I know I would never like
30. I can be comfortable with all kinds of people
31. It's not really my problem if others are in trouble and need help
32. Sometime I don't feel very sorry for other people when they are having problems
33. Sometimes I feel a real compassion for everyone
34. I often have not comforted another when he or she needed it
35. I don't like to get involved in listening to another person's troubles
36. There are certain people whom I dislike so much that I am inwardly pleased when they are caught and punished for something they have done
37. Sometimes when people are talking to me, I find myself wishing they would leave
38. I'm easily irritated by people who argue with me
39. If I see people in need, I try to help them one way or another

Appendix G

The Self-Assessed Wisdom Scale (Webster, 2003)

Please rate all of the following statements using the scale below:

Strongly Disagree

Moderately Disagree

Slightly Disagree

Slightly Agree

Moderately Agree

Strongly Agree

1. I have overcome many painful events in my life
2. It is easy for me to adjust my emotions to the situation at hand
3. I often think about connections between my past and present
4. I can chuckle at personal embarrassments
5. I like to read books which challenge me to think differently about issues
6. I have had to make many important life decisions
7. Emotions do not overwhelm me when I make personal decisions
8. I often think about my personal past
9. There can be amusing elements even in very difficult life situations
10. I enjoy listening to a variety of musical styles besides my favorite kind
11. I have dealt with a great many different kinds of people during my lifetime
12. I am "tuned" into my own emotions
13. I reminisce quite frequently
14. I try and find a humorous side when coping with a major life transition
15. I enjoy sampling a wide variety of different ethnic foods
16. I have experienced many moral dilemmas
17. I am very good at reading my emotional states

18. Reviewing my past helps me gain perspective on current concerns
19. I am easily aroused to laughter
20. I often look for new things to try
21. I have seen much of the negative side of life (e.g., dishonesty, hypocrisy)
22. I can freely express my emotions without feeling like I might lose control
23. I often recall earlier times in my life to see how I've changed since then
24. At this point in my life, I find it easy to laugh at my mistakes
25. Controversial works of art play an important and valuable role in society
26. I have lived through many difficult life transitions
27. I am good at identifying subtle emotions within myself
28. Recalling my earlier days helps me gain insight into important life matters
29. I often use humor to put others at ease
30. I like being around persons whose views are strongly different than mine
31. I've personally discovered that "you can't always tell a book from its cover"
32. I can regulate my emotions when the situation calls for it
33. I often find memories of my past can be important coping resources
34. Now I find that I can really appreciate life's little ironies
35. I'm very curious about other religious and/or philosophical belief systems
36. I've learned valuable life lessons from others
37. It seems I have a talent for reading other people's emotions
38. Reliving past accomplishments in my memory increases my confidence for today
39. I can make fun of myself to comfort others
40. I've often wondered about life and what lies beyond

Supplementary Appendix A

Comprehensive Table of Results for Cognition and Wisdom Systematic Review & Meta-Analysis

Author	Sample	Domain	Measure	Wis.	Measure	Rel.	N	*M*age(SD), Range, % F	*M*wis(SD)	Statistics
Staudinger et al., 1997	Adult	Crystallized	HAWIE Vocabulary	G	BWP	+	125	45.4, 19 to 87, 59% female	N/A	Bivariate correlation: $r = .34$, $p < .05$
	Adult	Crystallized	Practical Knowledge Questionnaire (Adapted from HAWIE Knowledge Subtest)	G	BWP	+	" "	" "	" "	Bivariate correlation: $r = .24$, $p < .05$ Backward Regression Model: $\beta = .29$, $p = .00$
	Adult	Fluid	Advanced Progressive Matrices Test—Short Version	G	BWP	+	" "	" "	" "	Bivariate correlation: $r = .29$, $p < .05$ Backward Regression Model: $\beta = .19$, $p = .03$
Pasupathi & Staudinger, 2001	Adult	Crystallized	WAIS Vocabulary	G	BWP	+	220	45(16), 20 to 87, 41% female	3.9(1)	Bivariate correlation: $r = .36$, $p < .05$
	Adult	Crystallized	HAWIE Vocabulary	G	BWP	+	" "	" "	" "	Bivariate correlation: $r = .24$, $p < .05$
	Adult	Fluid	Raven's Progressive Matrices	G	BWP	+	" "	" "	" "	Bivariate correlation: $r = .23$, $p < .05$

Staudinger & Pasupathi , 2003	Older	Crystallized	HAWIE Vocabulary	G	BWP	+	145	54.2 (9.9), 35 to 75, 60% female	N/A	Bivariate correlation: r =.25, p < .01
	Older	Fluid	HAWIE Digit Symbol	G	BWP	+	" "	" "	" "	Bivariate correlation: r =.09, *ns*
Mickler & Staudinger, 2008	Adult	Crystallized	Hamburg Wechsler Intelligenztest German Version—Vocabulary	P	PWT	+	161	Overall: 59.01% female YA: 29.8(6.09), 20 to 40 OA: 67.22(4.18), 60 to 80	N/A	Bivariate Correlation: r = .24, p < .01 Partial Correlation (Controlling for Age): r = .32, p < .01
	Adult	Crystallized	Hamburg Wechsler Intelligenztest German Version—Vocabulary	G	BWP	+	" "	" "	" "	Bivariate Correlation: r = .33, p < .01 Partial Correlation (Controlling for Age): r = .42, p < .01
	Adult	Fluid	Advanced Progressive Matrices Test—Short Version	P	PWT	+	" "	" "	" "	Bivariate Correlation: r = .30, p < .01 Partial Correlation (Controlling for Age): r = .21, p < .01
	Adult	Fluid	Advanced Progressive Matrices Test—Short Version	G	BWP	+	" "	" "	" "	Bivariate Correlation: r = .17, p < .01 Partial Correlation (Controlling for Age): r = .21, p < .01

Grossmann et al.9, 2010	Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	WR	+	429	Top 20% Wisdom Scorers: 64.9 Bottom 80% Wisdom Scorers: 45.5	N/A	Bivariate Correlation: $r = .23$, $p \leq .10$ Hierarchical Regression: $\beta = .20$, $p \leq .01$
	Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	WR-SC	null	" "	" "	" "	Bivariate Correlation: $r = .09$, *ns* Hierarchical Regression: $\beta = .11$, *ns*
	Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	WR-URLK	+	" "	" "	" "	Bivariate Correlation: $r = .14$, $p \leq .01$ Hierarchical Regression: $\beta = .10$, *ns*
	Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	WR-AF	+	" "	" "	" "	Bivariate Correlation: $r = .23$, $p \leq .10$ Hierarchical Regression: $\beta = .18$, $p \leq .05$
	Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	WR-PS	null	" "	" "	" "	Bivariate Correlation: $r = -.02$, *ns* Hierarchical Regression: $\beta = -.08$, *ns*
	Adult	Crystallized	Index Score (WAIS Vocabulary and	G	WR-PC	+l	" "	" "	" "	Bivariate Correlation: $r = .19$, $p \leq .10$ Hierarchical Regression: $\beta = .20$, $p \leq .01$

		Comprehension)							
Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	WR-SCR	+	" "	" "	" "	Bivariate Correlation: r = .20, $p \leq .10$ Hierarchical Regression: β = .19, $p \leq .05$
Adult	Fluid	Index Score (WAIS Digit Span and Processing Speed)	G	WR	null	" "	" "	" "	Bivariate Correlation: r = -.08, *ns* Hierarchical Regression: β = .12, *ns*
Adult	Fluid	Index Score (WAIS Digit Span and Processing Speed)	G	WR-SC	-	" "	" "	" "	Bivariate Correlation: r = -.14, $p \leq .01$ Hierarchical Regression: β = .01, *ns*
Adult	Fluid	Index Score (WAIS Digit Span and Processing Speed)	G	WR-URLK	null	" "	" "	" "	Bivariate Correlation: r = .09, *ns* Hierarchical Regression: β = .17, $p \leq .10$
Adult	Fluid	Index Score (WAIS Digit Span and Processing Speed)	G	WR-AF	null	" "	" "	" "	Bivariate Correlation: r = -.02, *ns* Hierarchical Regression: β = .08, *ns*
Adult	Fluid	Index Score (WAIS Digit Span and Processing Speed)	G	WR-PS	-	" "	" "	" "	Bivariate Correlation: r = -.13, $p \leq .01$ Hierarchical Regression: β = .07, *ns*

	Adult	Fluid	Index Score (WAIS Digit Span and Processing Speed)	G	WR-PC	null	" "	" "	" "	Bivariate Correlation: r = -.10, *ns* Hierarchical Regression: β = .01, *ns*
	Adult	Fluid	Index Score (WAIS Digit Span and Processing Speed)	G	WR-SCR	null	" "	" "	" "	Bivariate Correlation: r = .01, *ns* Hierarchical Regression: β = .08, *ns*
Grossmann et al., 2012	Older	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	SSI (Intergroup Conflict)	+	225	American Sample: 47.34(14.70), 52% female	N/A	Bivariate Correlation: r = .16, $p \leq .05$
	Older	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	SSI (Interpersonal Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .13, $p \leq .1$
	Older	Fluid	WAIS-III Digit Span	G	SSI (Intergroup Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .02, *ns*
	Older	Fluid	WAIS-III Digit Span	G	SSI (Interpersonal Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .11, *ns*
	Older	Attention	Dot Matching & Pattern Matching	G	SSI (Intergroup Conflict)	-	" "	" "	" "	Bivariate Correlation: r = -.21, $p \leq .01$

Older	Attention	Dot Matching & Pattern Matching	G	SSI (Interpersonal Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .00, *ns*
Older	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	SSI (Intergroup Conflict)	null	186	Japanese Sample: 46.98(14.01), 53% female	N/A	Bivariate Correlation: r = .13, $p \leq .1$
Older	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	SSI (Interpersonal Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .13, $p \leq .1$
Older	Fluid	WAIS-III Digit Span	G	SSI (Intergroup Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .06, *ns*
Older	Fluid	WAIS-III Digit Span	G	SSI (Interpersonal Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .09, *ns*
Older	Attention	Dot Matching & Pattern Matching	G	SSI (Intergroup Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .04, *ns*
Older	Attention	Dot Matching & Pattern Matching	G	SSI (Interpersonal Conflict)	+	" "	" "	" "	Bivariate Correlation: r = .16, $p \leq .05$

Moraitou & Efklides, 2012	Adult	Memory	Rivermead Behavioral Memory Test—Greek Translation	P	WITHA Q-PW	-	447	Overall: 20 to 80, 51% female YA: 26.8(6.1) MA: 49.9(6.7) OA: 72.3(4.8)	N/A	Bivariate correlation: r =-.23, p < .01
	Adult	Memory	Rivermead Behavioral Memory Test—Greek Translation	P	WITHA Q-IDT	+				Bivariate correlation: r = .16, p < .01
	Adult	Memory	Rivermead Behavioral Memory Test—Greek Translation	P	WITHA Q-ALU	null				Bivariate correlation: *ns*
Glück et al., 2013	Adult	Crystallized	Mehrfachwahl-Wortschatz-Intelligenztest Vocabulary Test	P	TD-WS	null	170	Wisdom Nominees: 60.9(16.3), 26 to 92, 48.94% female Controls: 54.1(15.8), 19 to 95, 54.47% female	N/A	Bivariate Correlation: r = .135, *ns*
	Adult	Crystallized	Mehrfachwahl-Wortschatz-Intelligenztest Vocabulary Test	P	SAWS	+	" "	" "	" "	Bivariate Correlation: r = .176, p < .05
	Adult	Crystallized	Mehrfachwahl-Wortschatz-Intelligenztest	P	ASTI	null	" "	" "	" "	Bivariate Correlation: r = .116, *ns*

		Vocabulary Test							
Adult	Crystallized	Mehrfachwahl-Wortschatz-Intelligenztest Vocabulary Test	P	BWSS	+	" "	" "	" "	Bivariate Correlation: $r = .20$, $p = .011$
Adult	Fluid	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	P	TD-WS	+	" "	" "	" "	Bivariate Correlation: $r = .223$, $p < .01$
Adult	Fluid	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	P	SAWS	-	" "	" "	" "	Bivariate Correlation: $r = -.154$, $p < .05$
Adult	Fluid	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	P	ASTI	null	" "	" "	" "	Bivariate Correlation: $r = -.017$, *ns*
Adult	Fluid	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	P	BWSS	null	" "	" "	" "	Bivariate Correlation: $r = .04$, $p = .58$
Adult	Crystallized	Mehrfachwahl-Wortschatz-Intelligenztest Vocabulary Test	G	BWP	null	94	Wisdom Nominees: 60.9(16.3), 26 to 92, 48.94% female Controls: 60.0(15.1), 26 to 84, 48.94% female	N/A	Bivariate Correlation: $r = .104$, *ns*

	Adult	Fluid	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	G	BWP	null	" "	" "	" "	Bivariate Correlation: *r* = .104, *ns*
Grossmann et al., 2013	Adult	Crystallized	WAIS Vocabulary	G	SSI (Intergroup Conflict)	+	241	Overall: 49.48 (16.65), 25 to 90, 50.9% female YA: 25 to 40 MA: 41 to 59 OA: 60 to 90	N/A	Bivariate Correlation: *r* = .15, $p \leq .05$
	Adult	Crystallized	WAIS Comprehension	G	SSI (Intergroup Conflict)	null	" "	" "	" "	Bivariate Correlation: *r* = .03, *ns*
	Adult	Crystallized	WAIS Vocabulary	G	SSI (Interpersonal Conflict)	+	" "	" "	" "	Bivariate Correlation: *r* = .31, $p \leq .001$
	Adult	Crystallized	WAIS Comprehension	G	SSI (Interpersonal Conflict)	+	" "	" "	" "	Bivariate Correlation: *r* = .22, $p \leq .01$
	Adult	Crystallized	WAIS Vocabulary	G	SSI Composite	+	" "	" "	" "	Bivariate Correlation: *r* = .25, $p \leq .001$
	Adult	Crystallized	WAIS Comprehension	G	SSI Composite	null	" "	" "	" "	Bivariate Correlation: *r* = .08, *ns*

	Adult	Attention	Processing Speed Index Score	G	SSI (Intergroup Conflict)	-	" "	" "	" "	Bivariate Correlation: r = -.25, $p \leq .001$
	Adult	Attention	Processing Speed Index Score	G	SSI (Interpersonal Conflict)	null	" "	" "	" "	Bivariate Correlation: r = -.05, *ns*
	Adult	Attention	Processing Speed Index Score	G	SSI Composite	-	" "	" "	" "	Bivariate Correlation: r = -.25, $p \leq .001$
	Adult	Executive	WAIS Digit Span	G	SSI (Intergroup Conflict)	null	" "	" "	" "	Bivariate Correlation: r = -.01, *ns*
	Adult	Executive	WAIS Digit Span	G	SSI (Interpersonal Conflict)	null	" "	" "	" "	Bivariate Correlation: r = .02, *ns*
	Adult	Executive	WAIS Digit Span	G	SSI Composite	null	" "	" "	" "	Bivariate Correlation: r = .01, *ns*
Greaves et al., 2014	Adult	General	Wonderlic Personnel Test		BWP-RFK	null	77	46(11.28), 22 to 73, 74% female	N/A	Bivariate Correlation: r = -.10, *ns*
	Adult	General	Wonderlic Personnel Test		BWP-RPK	null	" "	" "	" "	Bivariate Correlation: r = .03, *ns*
	Adult	General	Wonderlic Personnel Test		BWP-LC	null	" "	" "	" "	Bivariate Correlation: r = .05, *ns*
	Adult	General	Wonderlic Personnel Test		BWP-VR	null	" "	" "	" "	Bivariate Correlation: r = .09, *ns*

	Adult	General	Wonderlic Personnel Test		BWP-U	null	" "	" "	" "	Bivariate Correlation: r = -.01, *ns*
Kim & Knight, 2015	Adult	Crystallized	Shipley-Hartford Test of Vocabulary	P	TD-WS-K	null	189	YA: 27.54(5.13), 19 to 39, 62% female OA: 77.26(9.49), 58 to 96, 60% female	N/A	Bivariate Correlation: r = .06, *ns*
	Adult	Crystallized	Shipley-Hartford Test of Vocabulary	P	TD-WS-K-CF	null	" "	" "	" "	Bivariate Correlation: r = .05, *ns*
	Adult	Crystallized	Shipley-Hartford Test of Vocabulary	P	TD-WS-K-VR	null	" "	" "	" "	Bivariate Correlation: r = .09, *ns*
	Adult	Crystallized	Shipley-Hartford Test of Vocabulary	P	TD-WS-K-EM	null	" "	" "	" "	Bivariate Correlation: r = .12, *ns*
Brienza & Grossmann, 2017	Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	SWRS-IC	+	2145	N/A	N/A	b = .356, SE = .090, $t(197)$ = 3.940, p < .001, np^2 = .075
	Adult	Crystallized	Index Score (WAIS Vocabulary and Comprehension)	G	SWRS-SC	+	" "	" "	" "	b = .191, SE = .089, $t(196)$ = 2.15, p = *.033*, np^2 = .024
Dumbravă, 2017	Young	Executive	Cognitive Flexibility Composite (Cognitive	P	TD-WS	-	100	24(6.44), 18 to 48, 87% female	124.83(9.59)	Bivariate correlation: r = -.226, p < .05 Hierarchical Regression: β = -.158, *ns*

			Flexibility Inventory; Adapted Computer Task)							
Weststrate & Glück, 2017	Adult	Crystallized	Mehrfachwahl-Wortschatz-Intelligenztest Vocabulary Test	P	SRC	null	94	Wisdom nominees: 60.9(16.3), 26 to 92, 49% female Controls: 60(15.1), 26 to 84, 49% female	N/A	Bivariate Correlation: *r* = .16, *ns*
	Adult	Crystallized	Mehrfachwahl-Wortschatz-Intelligenztest Vocabulary Test	G	BWP	null	" "	" "	" "	Bivariate Correlation: *r* = .16, *ns*
	Adult	Fluid	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	P	SRC	null	" "	" "	" "	Bivariate Correlation: *r* = .09, *ns*
	Adult	Fluid	Cattell's Fluid Intelligence Test—Scale 2; German Short Version	G	BWP	null	" "	" "	" "	Bivariate Correlation: *r* = .08, *ns*
Ardelt et al., 2018a	Older	General	IQ Composite (Mean SAT & MAT scores, Army Alpha Verbal Intelligence Test)	P	GWPLS-WC	null	98	Overall Mean Birth Year: 1921, 0% female	N/A	Bivariate Correlation: *r* = -.00, *ns*

	Older	General	IQ Composite (Mean SAT & MAT scores, Army Alpha Verbal Intelligence Test)	P	GWPLS-CW	null	" "	" "	" "	Bivariate Correlation: *r* = -.01, *ns*
	Older	General	IQ Composite (Mean SAT & MAT scores, Army Alpha Verbal Intelligence Test)	P	GWPLS-RW	null	" "	" "	" "	Bivariate Correlation: *r* = .05, *ns*
	Older	General	IQ Composite (Mean SAT & MAT scores, Army Alpha Verbal Intelligence Test)	P	GWPLS-AW	null	" "	" "	" "	Bivariate Correlation: *r* = -.06, *ns*
Kunzmann et al., 2018	Adult	Crystallized	Multiple-Choice Word Test	G	BWP-VR	null	80	YA: 24.35(3.76), 18 to 31, 53% female OA: 68.43(4.58), 61 to 78, 48% female	N/A	Hierarchical Regression: *b* = 1.53, *SE* = .838, *p* = .073
	Adult	Fluid	Trail Making Test	G	BWP-VR	+	" "	" "	" "	Hierarchical Regression: *b* = 1.82, *SE* = .911, *p* = .049
Rakoczy et al., 2018	Adult	Crystallized	Multiple-Choice Word Test	G	WR-PT	null	80	YA: 24.35(3.76), 18 to 31, 63% female OA: N/A	N/A	Bivariate Correlation: *r* = .10, *ns*

	Adult	Crystallized	Multiple-Choice Word Test	G	M-WR-PT	null	" "	" "	" "	Bivariate Correlation: *r* = .07, *ns*
	Adult	Attention	Trail Making Test A	G	WR-PT	null	" "	" "	" "	Bivariate Correlation: *r* = -.16, *ns*
	Adult	Attention	Trail Making Test A	G	M-WR-PT	null	" "	" "	" "	Bivariate Correlation: *r* = .03, *ns*
	Adult	Executive	Trail Making Test B - A	G	WR-PT	null	" "	" "	" "	Bivariate Correlation: *r* = .00, *ns*
	Adult	Executive	Trail Making Test B - A	G	M-WR-PT	null	" "	" "	" "	Bivariate Correlation: *r* = .01, *ns*
Vásquez et al., 2020	Older	General	Montreal Cognitive Assessment	P	TD-WS	null	136	Persons with HIV Infection (HIV+; *n* = 61): 50.77(8.84), 26.23% female HIV Negative (HIV-; *n* = 78): 50.60(7.80), 23.38% female	HIV+: 3.42(0.58) HIV-: 3.76(0.44)	Multivariate Regression: *b* = .86, *SE* = .51, *p* = .09
	Older	General	Montreal Cognitive Assessment	P	TD-WS-C	null	" "	" "	HIV+: 3.28(0.64) HIV-: 3.75(0.49)	Multivariate Regression: *b* = .91, *SE* = .47, *p* = .06
	Older	General	Montreal Cognitive Assessment	P	TD-WS-R	null	" "	" "	HIV+: 3.57(0.70) HIV-: 3.97(0.61)	Multivariate Regression: *b* = .51, *SE* = .38, *p* = .19
	Older	General	Montreal Cognitive Assessment	P	TD-WS-A	null	" "	" "	HIV+: 3.54(0.61)	Multivariate Regression: *b* = .40, *SE* = .39, *p* = .31

									HIV-: 3.76(0.44)	
	Older	General	Montreal Cognitive Assessment	P	TD-WS-C	+	" "	" "	Lower Wisdom Group (*n* = 31): 48.77(9.02) Higher Wisdom Group (*n* = 30): 52.83(8.29)	Independent Samples T-Test: t = -2.32, *p* = .02, *d* = -.60
Wei & Wang, 2020	Young	Crystallized	Index Score (WAIS Vocabulary and Comprehension--Chinese Version)	G	SWRS	+	103	21.35(3.08), 66% female	3.22(0.7)	Bivariate correlation: *r* = .25, *p* < .05
	Young	Fluid	Advanced Progressive Matrices Test	G	SWRS	null	" "	" "	" "	Bivariate correlation: *r* = .19, *ns*
Arif et al., 2021	Young	General	First-Year College Annual Results	P	TD-WS	+	495	45.86% female	N/A	Simple Linear Regression: $F = 45.0$, $R^2 = 4.8\%$, $t = 5.41$, $\beta = .221$, $p = .00$
	Young	General	First-Year College Annual Results	P	TD-WS-C	+	"	"	3.50	Simple Linear Regression: $F = 51.54$, $R^2 = 5.4\%$, $t = 7.17$, $\beta = .233$, $p = .00$
	Young	General	First-Year College Annual Results	P	TD-WS-R	+	"	"	3.96	Simple Linear Regression: $F = 40.18$, $R^2 = 4.3\%$, $t = 6.33$, $\beta = .207$, $p = .001$

	Young	General	First-Year College Annual Results	P	TD-WS-A	+	"	"	3.05	Simple Linear Regression: $F = 27.37$, $R^2 = 3.0\%$ $t = 5.23$, $\beta = .172$, $p = .00$
Thomas, 2021	Adult	General	Cognitive Failures Questionnaire	P	TD-WS	-	1546	66(21), 21 to 100, 49% female	N/A	Bivariate Correlation: $r = -.31$, 95% CI [-.36, -.26]
	Adult	General	Cognitive Failures Questionnaire	P	A-TD-WS	-	" "	" "	" "	Bivariate Correlation: $r = -.38$, 95% CI [-.43, -.33]
Lindbergh et al., 2022	Older	Memory	Episodic Memory Composite (Benson Figure Delayed Recall; CVLT-II Immediate Recall, Delayed Recall, Recognition)	P	SD-WISE	null	141	76(7.57), 51.84 to 92.27, 56% female	4.08(0.36)	Bivariate correlation: $r = .109$, 95% CI [-.057, .269], $p = .200$ Multiple Regression: $\beta = .086$, $p = .321$
	Older	Attention	Processing Speed Composite (Length Judgment, Visual Search, Distance Judgment, Abstract Matching 1, Abstract Matching 2, Shape Judgment)	P	SD-WISE	null	" "	" "	" "	Bivariate correlation: $r = .019$, 95% CI [-.179, .216], $p = .854$ Multiple Regression: $\beta = .094$, $p = .375$

Older	Executive	Executive Functioning Composite (Stroop Interference, Modified Trail Making Test, Digits Backward, Phonemic fluency, Design Fluency)	P	SD-WISE	+	“ “	“ “	“ “	Bivariate correlation: r = .181, 95% CI [.016, .336], p = .031 Multiple Regression: β = .114, p = .214

Supplementary Appendix B

Meta-Analysis of the Relationship Between General Intellectual Functioning and Wisdom

The meta-analysis to examine the relationship between general intellectual functioning and wisdom included 5 studies with 20 outcomes (M = 2 outcomes per study; *Range* = 2 to 5). The majority of studies explored personal wisdom (75%). The age cohort of focus across reported outcomes was relatively well-distributed, with most focusing on an older adult sample (40%), followed by adult lifespan (35%) and younger adult (25%). Table S1 provides an overview of outcome measures of general intellectual functioning, wisdom, and their respective frequencies across included studies. The Three-Dimensional Wisdom Scale was used to examine wisdom in 3 out of 5 studies (60%), accounting for 55% of outcomes included in the meta-analysis. Of note, the instruments employed to examine general intellectual functioning varied considerably, with all 5 studies employing disparate assessment tools.

Table S1

Frequencies of Outcome Measures of Included Observations in General Intellectual Functioning Meta-Analysis

		n (%)		
Code	Outcome Measure	Outcomes	Studies	Reference
	Wisdom			
BWP	Berlin Wisdom Paradigm	5 (25)	1 (20)	Baltes & Staudinger, 2000
BWP-LC	*Lifespan Contextualism Subscale*			
BWP-RFK	*Rich Factual Knowledge Subscale*			
BWP-RPK	*Rich Procedural Knowledge Subscale*			
BWP-U	*Uncertainty Subscale*			
BWP-VR	*Value-Relativism Subscale*			
GWPLS-WC	Gallup Wellsprings of a Positive Life Survey Wisdom Composite	4 (20)	1 (20)	Isaacowitz et al., 2003
GWPLS-AW	*Affective Wisdom Subscale*			
GWPLS-CW	*Cognitive Wisdom Subscale*			
GWPLS-RW	*Reflective Wisdom Subscale*			
TD-WS	Three-Dimensional Wisdom Scale	11 (55)	3 (60)	Ardelt, 2003
TD-WS-A	*Affective Subscale*			

TD-WS-C	*Cognitive Subscale*			
TD-WS-R	*Reflective Subscale*			
	General Intellectual Functioning			
	Cognitive Failures Questionnaire	2 (10)	1 (20)	Broadbent et al., 1982
	IQ Composite (Mean SAT & MAT scores, Army Alpha Verbal Intelligence Test)	4 (20)	1 (20)	
	First-Year College Annual Results	4 (20)	1 (20)	
	Montreal Cognitive Assessment	5 (25)	1 (20)	Nasreddine et al., 2005
	Wonderlic Personnel Test	5 (25)	1 (20)	Wonderlic, 2002

The analysis revealed a negligible summary effect size for the relationship between general intellectual functioning and wisdom, d = -.0463, 95% CI [-.601, .508], SE = .2, t(3.99) = -.232, p = .83. The forest plot in Figure S1 visually summarizes the effect sizes and null aggregate point-estimate. Effect sizes demonstrated a high degree of heterogeneity among studies (I^2 = 96.72%, τ^2= .465), indicating the presence of substantial variability across the extracted effect sizes. Moderator regression analyses to investigate the potential influence of wisdom type on the observed relationship did not yield significant findings for neither personal (B = -.086, SE = .253, p = .76) nor general (B = .086, SE = .253, p = .76) wisdom. Consistent with these findings, follow-up post-hoc analyses did not provide support for a significant difference in mean effect sizes of general (M = .02, SD = .14) and personal (M = .04, SD = .42) wisdom, t(18) = -.10, p = .93.

Regression analyses to examine the potential moderating effect of age cohort on the observed relationship were also not significant, whether the sample of interest employed an adult lifespan (B = -.583, SE = .401, p = .27), younger (B = .417, SE = .468, p = .48), or older (B = .243, SE = .361, p = .57) adult sample. While mean effect sizes were higher for studies examining a younger adult sample (M = .22, SD = .46) than older (M = .23, SD = .16) or adult lifespan (M = -.19, SD = .39) sample, these differences were not significant, F(2, 17) = 2.61, n^2 = .24, p = .10. Collectively, the results suggest that the relationship between general intellectual

functioning and wisdom does not significantly vary based on the type of wisdom examined or age cohort characteristics of the study sample. Figure S2 and Figure S3 illustrate the mean effect sizes for the levels of each moderator variable.

Figure S1

Forest Plot of Effect Sizes and Point-Estimate of Aggregate Effect Size for the Relationship Between General Intellectual Functioning and Wisdom

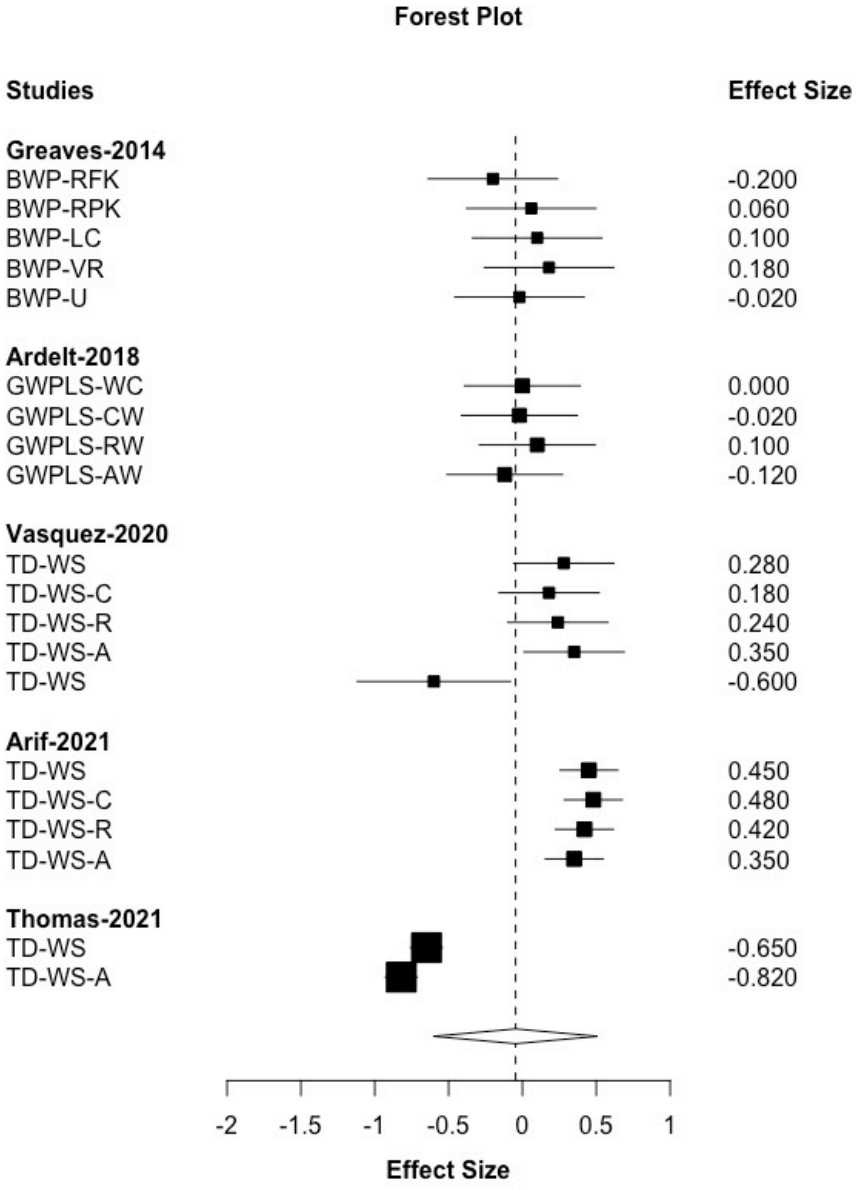


Figure S1. All figure details as described in Figure 2.1.

Figure S2

Boxplot of the Mean Effect Size of General Intellectual Functioning on General Versus Personal Wisdom

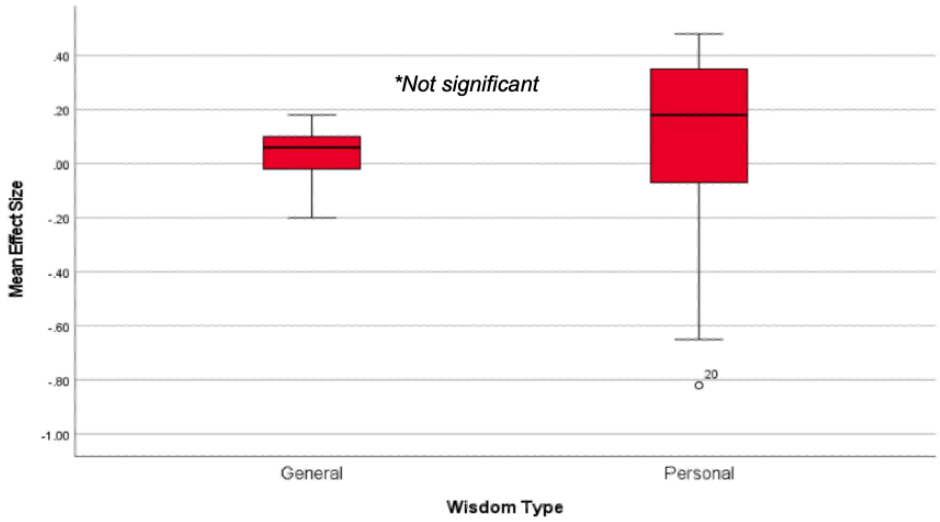


Figure S2. Figure details as described in Figure 2.7. No significant difference in mean effect sizes of studies investigating general (n = 5, M = .02, SD = .14) versus personal wisdom (n = 15, M = .04, SD = .42).

Figure S3

Boxplot of the Mean Effect Size for the Relationship Between General Intellectual Functioning and Wisdom by Age Cohort

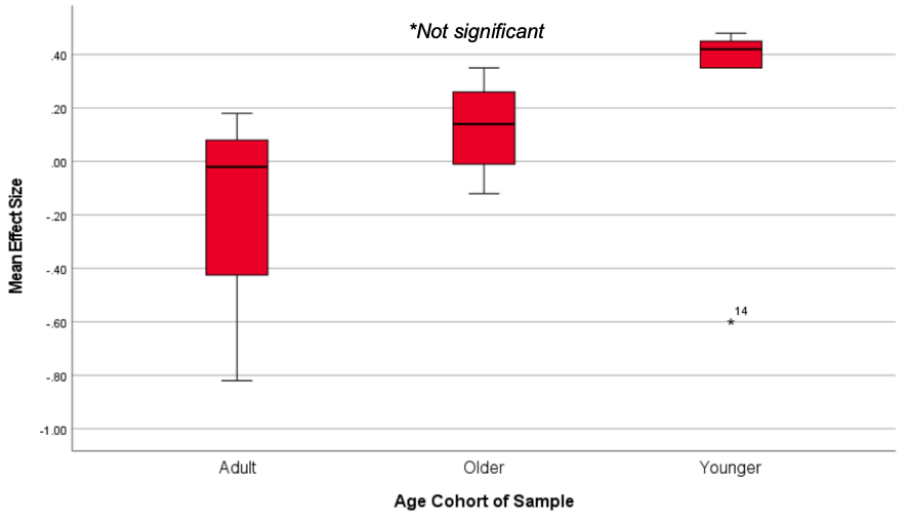


Figure S3. Figure details as described in Figure 2.7. Main effect of group type not significant. Adult lifespan sample (n = 7): M = -.19, SD = .39. Older adult sample (n = 8): M = .23, SD = .16. Younger adult sample (n = 5): M = .22, SD = .46.

Egger's regression analysis for publication bias was not significant (B = 6.233, SE = 22.588, p = .80). This is consistent with the relative symmetry of the observed effects around the point-estimate of the aggregate effect size in the funnel plot (see Figure S4), suggesting limited potential of publication bias.

Figure S4

Funnel Plot of the Effect of Publication Bias on the Observed Relationship Between General Intellectual Functioning and Wisdom

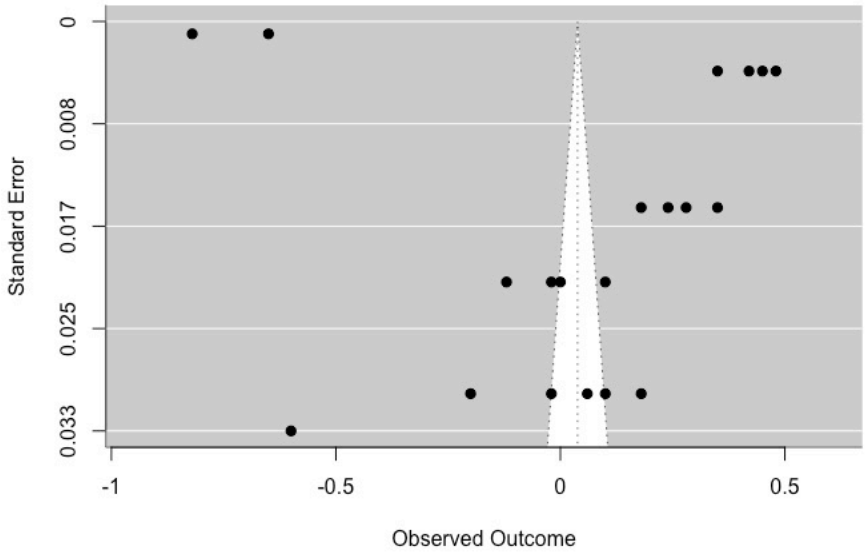


Figure S4. All figure details as described in Figure 2.2.

Supplementary Appendix C

Meta-Analysis of the Relationship Between Memory and Wisdom

The meta-analysis to investigate the relationship between memory and wisdom included 2 studies with 3 outcomes (M = 1.5 outcomes; *Range* = 1 to 2), with all studies examining personal wisdom predominantly in an adult sample (2 of 3 observations) using disparate measurement tools. Memory was examined using distinct tools in each study, though both investigations focused on episodic (memory for personal experiences and events) rather than semantic (memory for general knowledge and facts) abilities. See Table S2 for the specific outcome measures of episodic memory, personal wisdom, and associated frequencies in the current meta-analysis.

Table S2

Frequencies of Outcome Measures of Included Observations in Memory Meta-Analysis

	n (%)		
Outcome Measure	Outcomes	Studies	Reference
Wisdom			
San Diego Wisdom Scale	1 (33)	1 (50)	Thomas et al., 2019
Wise Thinking and Acting Questionnaire	2 (67)	1 (50)	Moraitou & Efklides, 2012
Memory			
Episodic Memory Composite (Benson Figure Delayed Recall; CVLT-II Immediate Recall, Delayed Recall, Recognition)	1 (33)	1 (50)	Broadbent et al., 1982
Rivermead Behavioral Memory Test—Greek Translation	2 (67)	1 (50)	Wilson et al., 1991

Results of the point-estimate for the aggregate effect of memory ability were not interpreted as Satterthwaite *df* were less than 4 (Tipton, 2015; Tanner-Smith et al., 2016). Accordingly, we employed a qualitative review to synthesize the findings (n = 3) from eligible studies (n = 2), which was indicative of conflicting findings in the literature. Specifically, one study provided support for a significant inverse relationship between self-reported practical

wisdom (a dimension of personal wisdom emphasizing moral reasoning) and episodic memory ability (Moraitou & Efklides, 2012). Here, it was proposed that older adults recruit semantic memory (crystallized knowledge) to support wise reasoning in service of declining episodic memory ability (Moraitou & Efklides, 2012). Additionally, self-reported integrated dialectical thinking (a core component of personal wisdom involving the adoption of multiple perspectives) demonstrated a positive association with episodic memory ability (Moraitou & Efklides, 2012). In contrast, the second study observed a negligible effect of episodic memory on self-reported personal wisdom, even when controlling for covariates (age, sex, education) (Lindbergh et al., 2022).

Supplementary Appendix D

Meta-Analysis of the Relationship Between Attention and Wisdom

The meta-analysis exploring the relationship between attention and wisdom included 4 studies with a total of 10 outcomes. Half of the included outcomes consisted of an adult lifespan sample and the other half examined an older adult sample. The majority of outcomes reported on general (90%) rather than personal wisdom, utilizing a semi-structured interview approach (50%). All studies implemented different measurement tools to assess attentional ability. Of note, while the search intended to capture the broader range of attentional capacities, all of the identified articles examined processing speed. Table S3 provides an overview of outcome measures of processing speed, wisdom, and their respective frequencies across included studies.

Table S3

Frequencies of Outcome Measures of Included Observations in Attention Meta-Analysis

		n (%)		
Code	Outcome Measure	Outcomes	Studies	Reference
	Wisdom			
M-WR-PT	Modified Wise Reasoning Task: Perspective-Taking Subscale	1 (10)	1 (25)	Kross & Grossmann, 2012
SD-WISE	San Diego Wisdom Scale	1 (10)	1 (25)	Thomas et al., 2019
SSI	Semi-Structured Interview	7 (70)	2 (50)	Grossmann et al., 2013
WR-PT	Wise Reasoning Composite (Semi-Structured Interview)—Perspective Taking Subscale	1 (10)	1 (25)	Grossmann et al., 2010
	Processing Speed			
	Dot Matching & Pattern Matching	4 (40)	1 (25)	Hedden et al., 2002
	Processing Speed Composite (Length Judgment, Visual Search, Distance Judgment, Abstract Matching 1, Abstract Matching 2, Shape Judgment)	1 (10)	1 (25)	Lindbergh et al., 2022
	Processing Speed Index Score	3 (3)	1 (25)	Hedden et al., 2002
	Trail Making Test A	2 (20)	1 (25)	Reitan, 1958

The overall effect size for the relationship between attention and wisdom was not significant, d = -.119, 95% CI [-.437, .199], SE = .0989, $t(2.95)$ = -1.21, p = .32, suggesting that

there is a negligible association between processing speed and wisdom. A summary of the included effect sizes is illustrated in a forest plot in Figure S5. Effect sizes were characterized by substantial heterogeneity among studies (I^2 = 79.85%, τ^2= .092). Correspondingly, moderator analyses were performed to explore the influence of age cohort on the observed point-estimate. The results of the regression analysis did not provide evidence for an impact of the age cohort of the sample examined, whether the sample consisted of an adult lifespan (*B* = -.282, *SE* = .127, *p* =.16) or older adult (*B* = .282, *SE* = .127, *p* =.16) cohort. Post-hoc analyses did not provide support for a significant difference in mean effect sizes for studies investigating an adult lifespan (*M* = -.28, *SD* = .26) versus older adult (*M* = .002, *SD* = .27) sample, *t*(8) = 1.69, *p* = .74. The relative mean effect sizes of included outcomes that examined an adult lifespan (*n* = 5) versus older adult (*n* = 5) sample are illustrated in Figure S6. Given that a considerable majority of outcomes examined personal (90%) rather than general wisdom, wisdom type was not investigated as a moderator in the current meta-analysis.

Figure S5

Forest Plot of Effect Sizes and Point-Estimate of Aggregate Effect Size for the Relationship Between Attention and Wisdom

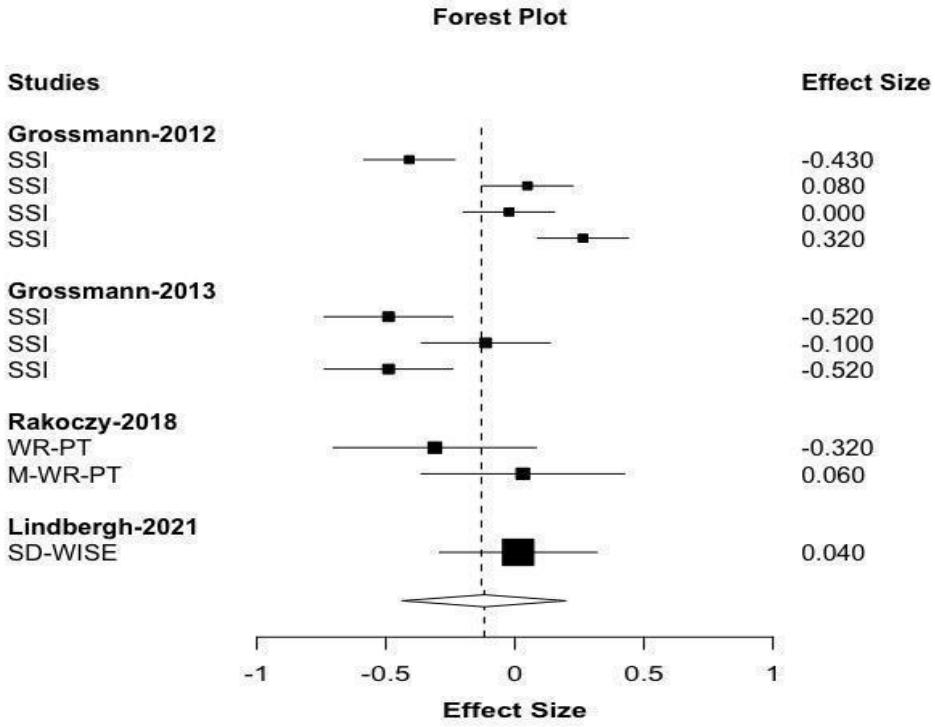


Figure S5. All figure details as described in Figure 2.1.

Figure S6

Boxplot of the Mean Effect Size for the Relationship Between Processing Speed and Wisdom by Age Cohort

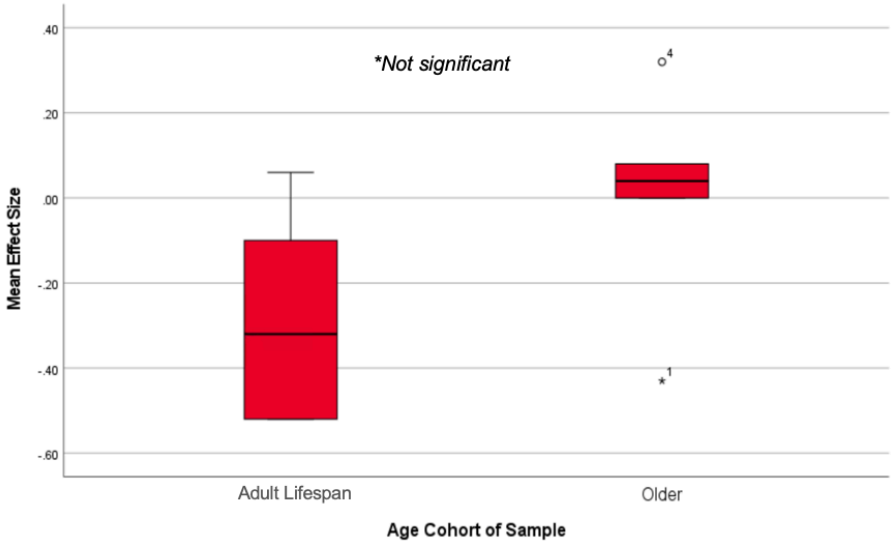


Figure S6. Figure details as described in Figure 2.7. No significant difference between mean effect sizes in adult lifespan versus older adult samples. Adult lifespan sample (n = 5): M = -.28, SD = .26. Older adult sample (n = 5): M = .002, SD = .27.

Egger's regression analysis for the presence of publication bias was not significant, B = .596, SE = 9.06, p = .96. Consistent with these findings, the funnel plot in Figure S7 demonstrates relative symmetry of the observed effects around the point-estimate, suggesting limited potential of publication bias.

Figure S7

Funnel Plot of the Effect of Publication Bias on the Observed Relationship Between Attention and Wisdom

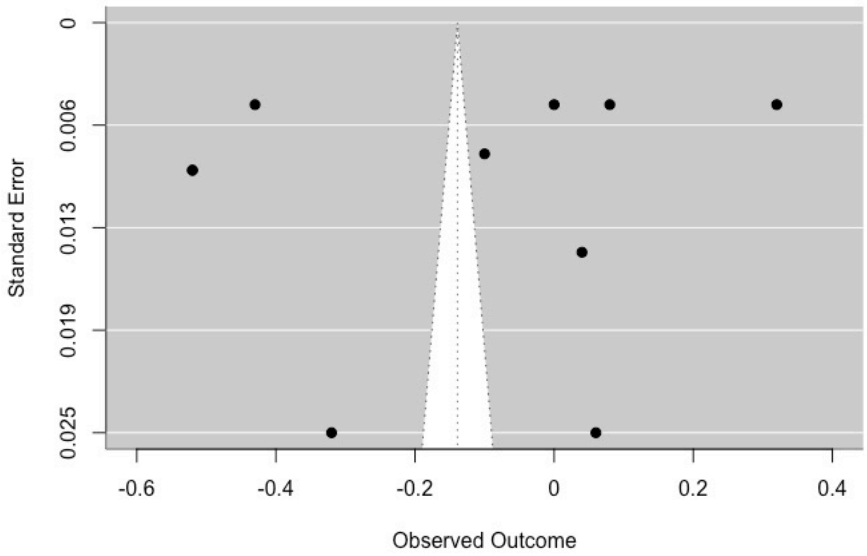


Figure S7. All figure details as described in Figure 2.2.

Supplementary Appendix E

Meta-Analysis of the Relationship Between Executive Function and Wisdom

The meta-analysis to investigate the relationship between executive function and wisdom included a total of 4 studies with 7 outcomes (M = 1.75 outcomes per study; *Range* = 1 to 3). The majority of the included studies reported outcomes related to general rather than personal wisdom in an adult lifespan sample (71% for each of these moderators). All studies employed disparate measurement tools to assess wisdom and executive function. See Table S4 for a summary of outcome measures and associated frequencies for executive function and wisdom.

Table S4

Frequencies of Outcome Measures of Included Observations in Executive Function Meta-Analysis

		n (%)		
Code	Outcome Measure	Outcomes	Studies	Reference
	Wisdom			
M-WR-PT	Modified Wise Reasoning Task: Perspective-Taking Subscale	1 (10)	1 (25)	Kross & Grossmann, 2012
SD-WISE	San Diego Wisdom Scale	1 (14)	1 (25)	Thomas et al., 2019
SSI	Semi-Structured Interview	3 (43)	1 (25)	Grossmann et al., 2013
TD-WS	Three-Dimensional Wisdom Scale	1 (14)	1 (25)	Ardelt, 2003
WR-PT	Wise Reasoning Composite (Semi-Structured Interview)—Perspective Taking Subscale	1 (14)	1 (25)	Grossmann et al., 2010
	Memory			
	Cognitive Flexibility Composite (Cognitive Flexibility Inventory; Adapted Computer Task)	4 (40)	1 (25)	Armbruster et al., 2012; Dennis & Vander Wal, 2010
	Executive Functioning Composite (Stroop Interference, Modified Trail Making Test, Digits Backward, Phonemic fluency, Design Fluency)	1 (10)	1 (25)	Lindbergh et al., 2022
	Trail Making Test B - A	3 (3)	1 (25)	Reitan, 1958
	WAIS Digit Span	2 (20)	1 (25)	Wecshler, 1982

The results of the point-estimate for the summary effect size revealed a negligible association between executive function and wisdom, d = -.007, 95% CI [-.543, .529], SE = .167, t(2.96) = -.041, p = .97. A summary of the included effect sizes is illustrated in a forest plot in

Figure S8. There was a moderate degree of heterogeneity in effect sizes among included studies (I^2 = 68.94%, τ^2= .074). Moderator analyses were subsequently performed to examine the influence of wisdom type on the observed relationship. Here, neither personal (B = -.045, SE = .415, p = .92) nor general (B = .045, SE = .415, p = .92) wisdom emerged as significant moderators of the association between executive ability and wisdom. Consistent with these findings, post-hoc analyses did not provide support for a significant difference in mean effect sizes of studies investigating personal versus general wisdom, $t(1)$ = .14, p = .91. The mean effect sizes of included outcomes that examined general (n = 5) and personal (n = 2) wisdom are illustrated in Figure S9. The limited variability in the age demographics of included outcomes (i.e., 5 out of 7 outcomes examined the adult lifespan) suggested that age cohort moderation analyses were not indicated.

Figure S8

Forest Plot of Effect Sizes and Point-Estimate of Aggregate Effect Size for the Relationship Between Executive Function and Wisdom

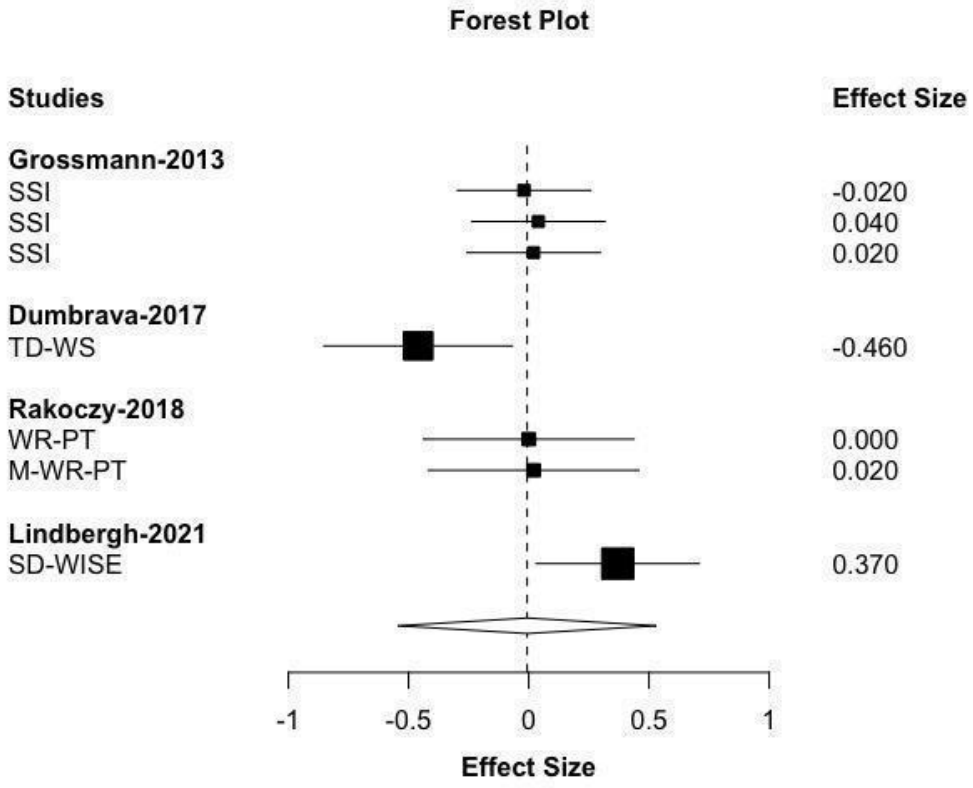


Figure S8. All figure details as described in Figure 2.1.

Figure S9

Boxplot of the Mean Effect Size of Executive Function on Personal Versus General Wisdom

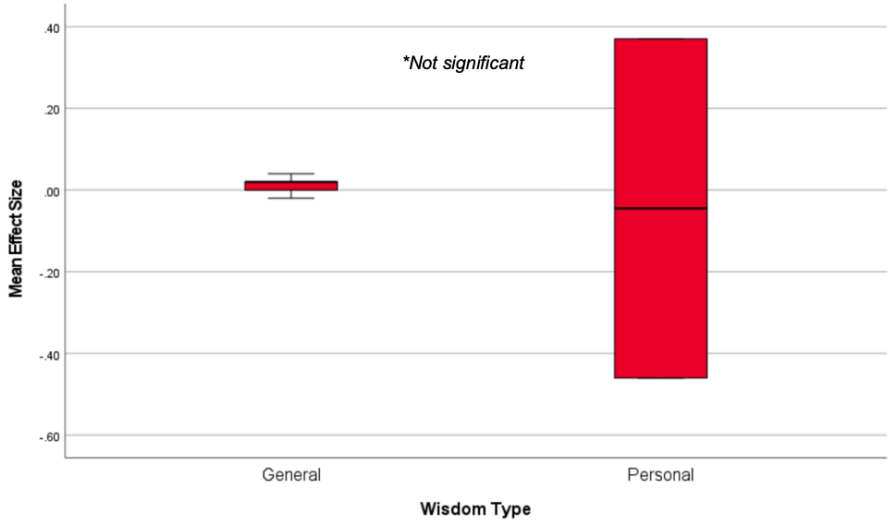


Figure S9. Figure details as described in Figure 2.7. No significant difference in mean effect sizes of studies investigating general versus personal wisdom. General wisdom (n = 5): M = .01, SD = .02. Personal wisdom (n = 2): M = -.05, SD = .59.

To examine the potential effect of publication bias on the current results, an Egger's regression analysis was conducted, which did not yield significant results, (B = -17.48, SE = 22.47, p = .53). In parallel, visual inspection of the funnel plot displayed in Figure S10 reveals a symmetrical relationship, suggesting limited potential of publication bias.

Figure S10

Funnel Plot of the Effect of Publication Bias on the Observed Relationship Between Executive Function and Wisdom

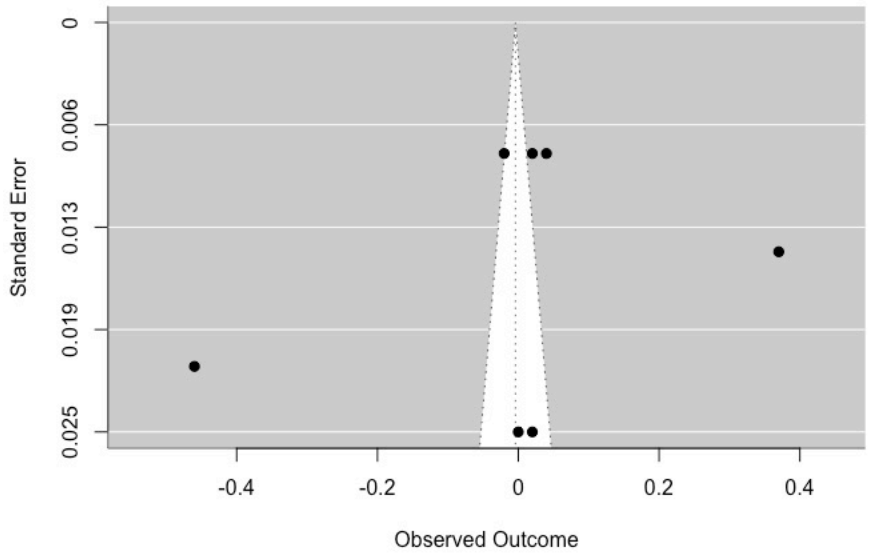


Figure S10. All figure details as described in Figure 2.2.

Supplementary Appendix F

Comprehensive Table of Results for Aging and Wisdom Systematic Review & Meta-Analysis

Author	Sample	Focus	Rel.	Wis.	Measure	N	*M*age(SD), Range, % F	*M*wis(SD)	Statistics
Smith & Baltes, 1990	Adult	Wisdom and age when reasoning about early life problems.	-	G	BWP-VR	60	YA: 29 MA: 45 OA: 68	" "	Independent samples t-test: Younger Adults + Middle-Aged > Older Adults, t(57) = 3.25, p < .002
	Adult	Wisdom and age when reasoning about early life problems.	-	G	BWP-RF-RP	" "	" "	" "	Independent samples t-test: Younger Adults + Middle-Aged > Older Adults, t(57) = 3.96, p < .001
	Adult	Wisdom and age when reasoning about early life problems.	-	G	BWP-I	" "	" "	" "	Independent samples t-test: Younger Adults + Middle-Aged > Older Adults, t(57) = 3.03, p < .004
	Adult	Wisdom and age when reasoning about early life, normative problems.	-	G	BWP	" "	" "	" "	Independent samples t-test: Younger Adults + Middle-Aged > Older Adults, t(57) = 2.44 p < .01

	Adult	Wisdom and age when reasoning about early life, non-normative problems.	-	G	BWP	" "	" "	" "	Independent samples t-test: Younger Adults + Middle-Aged > Older Adults, t(57) = 3.48, p < .001
	Adult	Wisdom and age when reasoning about late life, normative problems.	-	G	BWP	60	" "	" "	Independent samples t-test: Younger Adults + Middle-Aged > Older Adults, t(57) = 2.19, p = .03
Staudinger et al., 1992	Adult	Wisdom and age when reasoning about late life problems.	+	G	BWP-LR-RF	43	100% female YA: 32 OA: 71	YA: 3.4(1.2) OA: 4.32(1.2)	ANOVA Older Adults > Younger Adults
	Adult	Wisdom and age when reasoning about early life problems.	-	G	BWP-LR-RF	" "	" "	YA: 3.45(1.4) OA: 2.95(1.2)	ANOVA Younger Adults > Older Adults
Staudinger & Baltes, 1996	Adult	Wisdom and age when there is an interactive minds element (i.e., dyadic discussion) to working through wisdom-	+	G	BWP	244	Overall: 43.51(15.23), 61% female YA: 30.06(6.70), 62% female OA: 57.19(7.07), 60% female	N/A	Bivariate Correlation: r = .33

		related problems.							
Ardelt, 1997	Older	Wisdom and age in a sample of women.	+	P	TD-WS	81	68.46(4.75), 100% female	TD-WS: 0(.79) TD-WS-C: 4.74(1.4) TD-WS-R: 5.34(1.15) TD-WS-A: 5.34(1.15)	Bivariate Correlation: $r = .21$
	Older	Wisdom and age in a sample of men.	+	P	TD-WS	39	70.15(5.12), 0% female	TD-WS: 0(.68) TD-WS-C: 5.45(1.17) TD-WS-R: 5.45(1.10) TD-WS-A: 5.88(1.09)	Bivariate Correlation: $r = .01$
Ardelt, 2000a	Older	Wisdom and age.	=	P	TD-WS	121	67.2% female	TD-WS-C: 4.74(1.5) TD-WS-R: 5.34(1.15) TD-WS-A: 5.92(1.33)	Bivariate Correlation: $r = .21$, *ns*
Pasupathi & Staudinger, 2001	Adult	Performance-based wisdom and age.	=	G	BWP	220	45(16), 41% female	3.9(1)	Bivariate Correlation: $r = -.03$, *ns*

Takahashi & Overton, 2002	Older	Synthetic features of wisdom and age.	+	P	RU-SISA	136	American Sample: Middle-Aged Men: 46.1(7.3) Middle-Aged Women: 46.8(6.9) Older Adult Men: 69.7(5.1) Older Adult Women: 72.3(5.6) Japanese Sample: Middle-Aged Men: 46.8(7.2) Middle-Aged Women: 41.5(6.5) Older Adult Men: 71.0(7.1) Older Adult Women: 67.5(2.5)	MA: 43.40(5.25) OA: 45.25(6.42)	Multivariate Analysis of Variance for Age Effect: Univariate F = 5.48, $p < .05$, SDFC = -.44
	Older	Synthetic features of wisdom and age.	+	P	EE-EC	" "	" "	MA: 20.79(3.92) OA: 22.02(3.93)	Multivariate Analysis of Variance for Age Effect: Univariate F = 3.69, $p < .05$, SDFC = -.27
	Older	Synthetic features of wisdom and age.	=	P	ER-NMR	" "	" "	MA: 109.46 (14.09) OA: 112.13 (14.36)	Multivariate Analysis of Variance for Age Effect: Univariate F = 1.70, *ns,* SDFC = -.00

	Older	Analytical features of wisdom and age.	+	G	KD-WV	" "	" "	MA: 27.47(6.79) OA: 22.09(6.59)	Multivariate Analysis of Variance for Age Effect: Univariate F = 20.59, $p < .01$, SDFC = -.68
	Older	Analytical features of wisdom and age	+	G	AR-WS	" "	" "	MA: 19.12(3.25) OA: 20.50(3.28)	Multivariate Analysis of Variance for Age Effect: Univariate F = 6.92 $p < .01$, SDFC = -.39
Kunzmann & Baltes, 2003	Adult	Performance-based wisdom and age.	+	G	BWP	293	50% female	N/A	Bivariate Correlation: $r = .39$, $p < .01$
Staudinger & Pasupathi, 2003	Older	Performance-based wisdom and age.	=	G	BWP	145	54.2(9.9), 60%	N/A	Bivariate correlation: r = -.06, *ns*
Webster, 2003	Adult	Self-reported wisdom and age.	=	P	SAWS	85	52.54(9.67), 54.12% female	134.43 (19.58)	Bivariate Correlation: $r = .117$, *ns*
Jennings et al., 2006	Older	Self-reported wisdom and age in a sample of men with military experience.	=	P	ASTI-ST	615	74(6.8), 0% female	33.42(5.09)	Bivariate Correlation: $r = .04$, *ns*
	Older	Self-reported wisdom and age in a sample of men with military experience.	+	P	ASTI-A	" "	" "	12.09(3.31)	Bivariate Correlation: $r = .13$, $p < .01$

Mickler & Staudinger, 2008	Adult	Performance-based wisdom and age.	+/-	P	PWT	161	59.01% female	N/A	Bivariate Correlation: $r = .23$, $p < .01$ Univariate ANOVA: $F(1, 159) = 9.00$, $p < .01$ MANOVA: $F(5, 155) = 8.83$, $n^2 = .222$, $p < .01$ MANCOVA: $F(5, 149) = 2.19$, $n^2 = .069$, $p < .10$
	Adult	Performance-based wisdom and age.	=	P	PWT-SK	" "	" "	" "	Univariate ANOVA: $F(1, 159) = 1.74$, $n^2 = .011$, *ns* MANCOVA: $F(1, 153) = 3.22$, $n2 = .021$, $p < .10$
	Adult	Performance-based wisdom and age.	=	P	PWT-GSR	" "	" "	" "	Univariate ANOVA: $F(1, 159) = 2.29$, $n^2 = .014$, *ns* MANCOVA: $F(1, 153) = .43$, $n^2 = .003$, *ns*
	Adult	Performance-based wisdom and age.	-/=	P	PWT-IS	" "	" "	" "	Univariate ANOVA: $F(1, 159) = 11.50$, $n^2 = .067$, $p < .01$ MANCOVA: $F(1, 153) = .61$, $n^2 = .004$, *ns*
	Adult	Performance-based wisdom and age.	-/=	P	PWT-SR	" "	" "	" "	Univariate ANOVA: $F(1, 159) = 30.20$, $n2 = .160$, $p < .01$ MANCOVA: $F(1, 153) = 3.81$, $n2 = .024$, $p < .10$
	Adult	Performance-based wisdom and age.	-/=	P	PWT-TA	" "	" "	" "	Univariate ANOVA: $F(1, 159) = 5.57$, $n^2 = .034$, $p < .01$

									MANCOVA: $F(1, 153) = .05$, $n^2 = .000$, *ns*
	Adult	Performance-based wisdom and age.	=	G	BWP	" "	" "	" "	Bivariate Correlation: $r = .00$, *ns* MANOVA: $F(1, 149) = .00$, *ns*
Ardelt, 2009	Adult	Self-reported wisdom and age.		P	TD-WS	642	Overall: 73.05% female YA: 21, 73% female OA: 71(8.04), 52 to 87, 73% female	YA: 3.63(.37) OA: 3.62(.40)	Univariate ANOVA: No main effect for age group, $F(1, 638) = .08$, $p = .78$, $n^2 = .000$
	Adult	Self-reported wisdom and age.		P	TD-WS-C	" "	" "	YA: 3.70(.47) OA: 3.44(.56)	Independent Samples T-Test: $t = -.57$, $p = .57$
	Adult	Self-reported wisdom and age.		P	TD-WS-R	" "	" "	YA: 3.65(.49) OA: 3.82(.49)	Independent Samples T-Test: $t = -.37$, $p = .71$
	Adult	Self-reported wisdom and age.		P	TD-WS-A	" "	" "	YA: 3.53(.44) OA: 3.60(.50)	Independent Samples T-Test: $t = -1.42$, $p = .16$
Ardelt, 2010	Adult	Self-reported wisdom and age in college educated younger adults, college	=	P	TD-WS	655	YA: 18 - 22+, 73% female OA: 71(8.04), 52 to 87, 73% female	YA: 3.63(.37) OA: 3.62(.40)	independent samples t-test: $t = .19$, $p = .85$

	educated older adults, and non-college educated older adults.							
Adult	Self-reported wisdom and age in college educated older adults versus college educated younger adults.	+	P	TD-WS	557	" "	" "	ANOVA: $F(2, 649) = 7.37$, $p = .001$, $n^2 = .022$ Post Hoc Tests: College Educated Older Adults > College Educated Younger Adults, $p < .03$
Adult	Self-reported wisdom and age in college educated older adults versus college educated younger adults.	=	P	TD-WS-C	" "	" "	" "	ANOVA: $F(2, 649) = 33.35$, $p < .001$, $n^2 = .093$ Post Hoc Tests: College Educated Older Adults = College Educated Younger Adults, *ns*
Adult	Self-reported wisdom and age in college educated older adults versus college educated younger adults.	+	P	TD-WS-R	" "	" "	" "	ANOVA: $F(2, 649) = 8.96$ $p < .001$, $n^2 = .027$ Post Hoc Tests: College Educated Older Adults > College Educated Younger Adults, $p < .03$
Adult	Self-reported wisdom and age in college	+	P	TD-WS-A	" "	" "	" "	ANOVA: $F(2, 649) = 4.06$, $p = .02$, $n^2 = .012$

	educated older adults versus college educated younger adults.							Post Hoc Tests: College Educated Older Adults > College Educated Younger Adults, $p < .03$
Adult	Self-reported wisdom and age in non-college educated older adults versus college educated younger adults.	-	P	TD-WS	575	" "	" "	ANOVA: $F(2, 649) = 4.06$, $p = .02$, $n^2 = .012$ Post Hoc Tests: Non-College Educated Older Adults = College Educated Younger Adults, *ns*
Adult	Self-reported wisdom and age in non-college educated older adults versus college educated younger adults.	-	P	TD-WS-C	" "	" "	" "	ANOVA: $F(2, 649) = 33.35$, $p < .001$, $n^2 = .093$ Post Hoc Tests: Non-College Educated Older Adults < College Educated Younger Adults, $p < .001$
Adult	Self-reported wisdom and age in non-college educated older adults versus college educated younger adults.	+	P	TD-WS-R	" "	" "	" "	ANOVA: $F(2, 649) = 8.96$ $p < .001$, $n^2 = .027$ Post Hoc Tests: Non-College Educated Older Adults > College Educated Younger Adults, Bonferroni: $p < .03$ and Tukey HSD: $p = .054$

	Adult	Self-reported wisdom and age in non-college educated older adults versus college educated younger adults.	=	P	TD-WS-A	" "	" "	" "	ANOVA: $F(2, 649) = 4.06$, $p = .02$, $n^2 = .012$ Post Hoc Tests: Non-College Educated Older Adults = College Educated Younger Adults, *ns*
Grossmann et al., 2010	Adult	Performance-based wisdom and age.	+	G	WR	429	Top 20% Wisdom Scorers: 64.9 Bottom 80% Wisdom Scorers: 45.5	N/A	Bivariate Correlation: $r = .51$, $p \leq .001$ Linear Regression: Older adults significantly overrepresented among top 20% of wisdom scorers, $\beta = .52$, $t = 9.09$, $p < .001$ Hierarchical Regression: Model 1: $\beta = .51$, $t = 9.21$, $p \leq .001$ Model 2: $\beta = .58$, $p \leq .001$ Independent Samples T-Test: Older Adults > Younger Adults: $t = 10.26$, $p < .001$ Older Adults > Middle-Aged: $t = 7.97$, $p < .001$ Younger Adults = Middle-Aged: $t = 1.71$, $p = .09$
	Adult	Performance-based wisdom and age.	+	G	WR-SC	" "	" "		Bivariate Correlation: $r = .37$, $p \leq .001$

							Hierarchical Regression: Model 1: β = .37, $p \leq .001$ Model 2: β = .36, $p \leq .001$
Adult	Performance-based wisdom and age.	+	G	WR-URLK	“ “	“ “	Bivariate Correlation: r = .15, $p \leq .05$ Hierarchical Regression: Model 1: β = .15, $p \leq .05$ Model 2: β = .24, $p \leq .01$
Adult	Performance-based wisdom and age.	+	G	WR-AF	“ “	“ “	Bivariate Correlation: r = .34, $p \leq .001$ Hierarchical Regression: Model 1: β = .34, $p \leq .001$ Model 2: β = .40, $p \leq .001$
Adult	Performance-based wisdom and age.	+	G	WR-PS	“ “	“ “	Bivariate Correlation: r = .42, $p \leq .001$ Hierarchical Regression: Model 1: β = .42, $p \leq .001$ Model 2: β = .46, $p \leq .001$
Adult	Performance-based wisdom and age.	+	G	WR-PC	“ “	“ “	Bivariate Correlation: r = .36, $p \leq .001$ Hierarchical Regression: Model 1: β = .36, $p \leq .001$ Model 2: β = .37, $p \leq .001$
Adult	Performance-based wisdom and age.	+	G	WR-SCR	“ “	“ “	Bivariate Correlation: r = .23, $p \leq .01$

									Hierarchical Regression: Model 1: β = .23, $p \leq .01$ Model 2: β = .27, $p \leq .001$
Mansfield et al., 2010	Adult	Self-reported wisdom and age.	=	P	TD-WS	85	39.8, 18 to 71, 69% female	N/A	Bivariate Correlation: r = -.11, *ns*
Beaumont, 2011	Young	Self-reported wisdom and age.	+	P	TD-WS	320	20.43(2.54), 18 to 29, 68.44% female	Men: 3.40(.45) Women: 3.54(.45)	Bivariate Correlation: r = .11, p < .05
	Young	Self-reported wisdom and age.	+	P	TD-WS-C	" "	" "	Men: 3.44(.57) Women: 3.60(.48)	Bivariate Correlation: r = .18, p < .01
	Young	Self-reported wisdom and age.	=	P	TD-WS-R	" "	" "	Men: 3.54(.54) Women: 3.51(.58)	Bivariate Correlation: r = .07, *ns*
	Young	Self-reported wisdom and age.	=	P	TD-WS-A	" "	" "	Men: 3.25(.53) Women: 3.49(.51)	Bivariate Correlation: r = .04, *ns*
Taylor et al., 2011	Adult	Self-reported wisdom and age.	=	P	SAWS	176	36.60(12.07), 18 to 68, 65% female	N/A	Bivariate Correlation: r = .076, *ns*
	Adult	Self-reported wisdom and age.	=	P	TD-WS	" "	" "	" "	Bivariate Correlation: r = -.056, *ns*

Grossmann et al., 2012	Adult	Performance-based wisdom and age when reasoning about intergroup conflict in an American sample.	+	G	SSI	411	American: 47.34(14.70), 52% female Japanese: 46.98(14.01), 53% female YA: 25 to 40 MA: 41 to 59 OA: 60 to 75	N/A	Bivariate Correlation: $r = .53$, $p \leq .001$
	Adult	Performance-based wisdom and age when reasoning about intergroup conflict in a Japanese sample.	=	G	SSI	" "	" "	" "	Bivariate Correlation: $r = -.01$, *ns*
	Adult	Performance-based wisdom and age when reasoning about interpersonal conflict in an American sample.	+	G	SSI	" "	" "	" "	Bivariate Correlation: $r = .24$, $p \leq .001$
	Adult	Performance-based wisdom and age when reasoning about interpersonal conflict in a	=	G	SSI	" "	" "	" "	Bivariate Correlation: $r = -.06$, *ns*

		Japanese sample.							
Moraitou & Efklides, 2012	Adult	Self-reported wisdom and age.	-	P	WITHAQ -IDT	446	Overall: 20 to 80, 51% female YA: 26.8(6.1), 20 to 39 MA: 49.9(6.7), 40 to 64 OA: 72.3(4.8), 65 to 80	N/A	Bivariate Correlation: $r = -.23$, $p < .05$
Bang & Montgomery, 2013	Young	Self-reported wisdom and age.	=	P	TD-WS-C	639	Overall: 18 to 22 Korean Sample: 19.6(1.47), 50% female American Sample: 19.87(1.32), 56% female	Ages 18 to 19: 3.47(.56) Ages 20 to 22: 3.54(.53)	Independent Samples T-Test: $t = -1.51$, *ns*
	Young	Self-reported wisdom and age.	+	P	TD-WS-R	" "	" "	Ages 18 to 19: 3.18(.47) Ages 20 to 22: 3.34(.49)	Independent Samples T-Test: $t = -4.17$, $p < .01$
	Young	Self-reported wisdom and age.	=	P	TD-WS-A	" "	" "	Ages 18 to 19: 3.15(.49) Ages 20 to 22: 3.22(.47)	Independent Samples T-Test: $t = -1.82$, *ns*

Glück et al., 2013	Adult	Self-reported wisdom and age.	=	P	SAWS	170	Wisdom Nominees: 60.9(16.3), 26 to 92, 48.94% female Controls: 54.1(15.8), 19 to 95, 54.47% female	N/A	Bivariate Correlation: $r = .15$, $p = .052$
	Adult	Self-reported wisdom and age.	-	P	TD-WS	" "	" "	" "	Bivariate Correlation: $r = -.17$, $p = .0025$ Independent Samples T-Test: $t(167) = 2.54$, $p = .012$
	Adult	Self-reported wisdom and age.	-	P	TD-WS-C	" "	" "	" "	Bivariate Correlation: $r = -.39$, $p < .001$
	Adult	Self-reported wisdom and age.	=	P	ASTI	" "	" "	" "	Bivariate Correlation: $r = .12$, $p = .144$
	Adult	Self-reported wisdom and age.	=	P	BWSS	" "	" "	" "	Bivariate Correlation: $r = .10$, $p = .204$
	Adult	Performance-based wisdom and age.	=	G	BWP	94	Wisdom Nominees: 60.9(16.3), 26 to 92, 48.94% female Controls: 60.0(15.1), 26 to 84, 48.94% female	N/A	Bivariate Correlation: $r = -.16$, $p = .132$
Grossmann et al., 2013	Adult	Performance-based wisdom and age.	+	G	SSI	241	49.48(16.65), 25 to 90, 50.9% female	N/A	Bivariate correlation: $r = .52$, $p < .005$

Zacher et al., 2013	Young	Self-reported wisdom and age.	=	P	TD-WS	N/A	21(4.11), 17 to 41, 74.3% female	3.74(.45)	Bivariate Correlation: $r = .02$, *ns*
	Young	Self-reported wisdom and age.	=	P	TD-WS-C	" "	" "	3.82(.55)	Bivariate Correlation: $r = .02$, *ns*
	Young	Self-reported wisdom and age.	=	P	TD-WS-R	" "	" "	3.71(.58)	Bivariate Correlation: $r = .00$, *ns*
	Young	Self-reported wisdom and age.	=	P	TD-WS-A	" "	" "	3.69(.50)	Bivariate Correlation: $r = .03$, *ns*
	Adult	Self-reported wisdom and age.	+	P	TD-WS	400	31.6(12.51), 16 to 74, 59.3% female	3.52(.50)	Bivariate Correlation: $r = .21$, $p < .01$
	Adult	Self-reported wisdom and age.	+	P	TD-WS-C	" "	" "	3.56(.62)	Bivariate Correlation: $r = .17$, $p < .01$
	Adult	Self-reported wisdom and age.	+	P	TD-WS-R	" "	" "	3.55(.63)	Bivariate Correlation: $r = .18$, $p < .01$
	Adult	Self-reported wisdom and age.	+	P	TD-WS-A	" "	" "	3.44(.60)	Bivariate Correlation: $r = .16$, $p < .01$
Sahrani et al., 2014	Adult	Self-reported wisdom and age.	null	P	TD-WS	30	N/A	N/A	Multiple Regression: $b = .525$, $SE = 2.187$, $\beta = .045$, $t = .240$, $p = .812$
Webster et al., 2014a	Adult	Self-reported wisdom and age.	=	P	SAWS	512	46.46(21.37), 17 to 92, 64% female	Overall: 171.87 (21.90)	Bivariate Correlation: $r = -.009$, *ns*

								YA: 169.08 (21.62) MA: 177.69 (21.62) OA: 168.44 (21.33)	
	Adult	Self-reported wisdom and age.	+/-	P	SAWS	" "	" "	" "	Three by Four ANOVA: $F(2, 500) = 4.78$, $p = .009$, $n^2 = .019$ Middle-Aged > Younger Adults Middle-Aged > Older Adults Younger Adults = Older Adults Hierarchical Regression: Model 1: $b = .050$, $t = 1.109$, $p = .268$ Model 2: $b = .057$, $t = 1.139$, $p = .255$ Model 3: $b = .155$, $t = 3.517$, $p = .00$ Model 4: $b = .186$, $t = 4.946$, $p = .00$
Webster et al., 2014b	Adult	Self-reported wisdom and age.	=	P	SAWS	512	46.46(21.37), 17 to 92, 64% female YA: 17 to 29 MA: 30 to 59 OA: 60 to 92	N/A	Bivariate Correlation: $r = -.009$, *ns*
	Adult	Quadratic relationship between self-	+/-	P	SAWS	" "	" "	" "	Bivariate Correlation: $r = -.224$, $p = .05$

		reported wisdom and age.							
Bang, 2015	Young	Self-reported wisdom and age.	+	P	TD-WS	198	20.94(1.76), 18 to 25, 54.8% female		One-way MANOVA: $F(6, 378) = 2.268$ $p < .05$, $n^2 = .035$
	Young	Self-reported wisdom and age.	=	P	TD-WS-C	" "	" "	Ages 18 to 20: 3.32(.41) Ages 21 to 22: 3.39(.62) Ages 23 to 25: 3.51(.59) Affective: Reflective:	Follow-up ANOVA: $F(2, 191) = 1.58$, *ns*
	Young	Self-reported wisdom and age.	+	P	TD-WS-R	" "	" "	Ages 18 – 20: 3.24(.42) Ages 21 to 22: 3.42(.53) Ages 23 to 25: 3.55(.55)	Follow-up ANOVA: $F(2, 191) = 5.20$, $p < .01$, $n^2 = .052$
	Young	Self-reported wisdom and age.	+	P	TD-WS-A	" "	" "	Ages 18 – 20: 3.13(.51) Ages 21 to 22: 3.33(.54) Ages 23 to 25:	Follow-up ANOVA: $F(2, 191) = 4.45$, $p < .05$, $n^2 = .045$

								3.41(.58)	
Cheraghi et al., 2015	Adult	Self-reported wisdom and age.	=	P	TD-WS-F	439	Overall: 34.09(13.69), 18 to 80, 62% female YA: 18 to 34, 64.7% female MA: 35 to 54, 58.9% female OA: ≥ 55, 50.9% female	N/A	Bivariate Correlation *r* = .00, ns
	Adult	Self-reported wisdom and age.	-	P	TD-WS-C-F	" "	" "	" "	Bivariate Correlation: *r* = -.17, *p* < .01
	Adult	Self-reported wisdom and age.	=	P	TD-WS-R-F	" "	" "	" "	Bivariate Correlation: *r* = -.01, ns
	Adult	Self-reported wisdom and age.	+	P	TD-WS-A-F	" "	" "	" "	Bivariate Correlation: *r* = .19, *p* < .01
	Adult	Self-reported wisdom and age in a higher education sample.	+	P	TD-WS-F	269	N/A	" "	Bivariate Correlation: *r* = .15, *p* < .05
	Adult	Self-reported wisdom and age in a higher education sample.	=	P	TD-WS-C-F	" "	" "	" "	Bivariate Correlation: *r* = -.01, *ns*

Adult	Self-reported wisdom and age in a higher education sample.	+	P	TD-WS-R-F	" "	" "	" "	Bivariate Correlation: $r = .12$, $p < .05$
Adult	Self-reported wisdom and age in a higher education sample.	+	P	TD-WS-A-F	" "	" "	" "	Bivariate Correlation: $r = .24$, $p < .01$
Adult	Self-reported wisdom and age in a lower education sample.	=	P	TD-WS-F	177	" "	" "	Bivariate Correlation: $r = -.06$, *ns*
Adult	Self-reported wisdom and age in a lower education sample.	-	P	TD-WS-C-F	" "	" "	" "	Bivariate Correlation: $r = -.21$, $p < .01$
Adult	Self-reported wisdom and age in a lower education sample.	=	P	TD-WS-R-F	" "	" "	" "	Bivariate Correlation: $r = -.06$, *ns*
Adult	Self-reported wisdom and age in a lower education sample.	=	P	TD-WS-A-F	" "	" "	" "	Bivariate Correlation: $r = .14$, *ns*
Adult	Self-reported wisdom and age in a	=	P	TD-WS-F	271	" "	" "	Bivariate Correlation: $r = -.09$, *ns*

	female sample.							
Adult	Self-reported wisdom and age in a female sample.	-	P	TD-WS-C-F	" "	" "	" "	Bivariate Correlation: $r = -.22$, $p < .01$
Adult	Self-reported wisdom and age in a female sample.	=	P	TD-WS-R-F	" "	" "	" "	Bivariate Correlation: $r = -.09$, *ns*
Adult	Self-reported wisdom and age in a female sample.	+	P	TD-WS-A-F	" "	" "	" "	Bivariate Correlation: $r = .13$, $p < .01$
Adult	Self-reported wisdom and age in a male sample.	+	P	TD-WS-F	168	" "	" "	Bivariate Correlation: $r = .16$, $p < .05$
Adult	Self-reported wisdom and age in a male sample.	=	P	TD-WS-C-F	" "	" "	" "	Bivariate Correlation: $r = -.09$, *ns*
Adult	Self-reported wisdom and age in a male sample.	=	P	TD-WS-R-F	" "	" "	" "	Bivariate Correlation: $r = .13$, *ns*
Adult	Self-reported wisdom and age in a male sample.	+	P	TD-WS-A-F	" "	" "	" "	Bivariate Correlation: $r = .31$, $p < .01$

Grossmann et al., 2016	Adult	Self-reported wisdom and age.	+	P	DDWR-WR	152	26.82(6.56), 49% female	N/A	Multilevel Modelling: b = .004, SE = .002, $t(132)$ = 1.97, p = .051, 95% CI [.0003, .0007]
	Adult	Self-reported wisdom and age.	+	P	DDWR-IH	" "	" "	" "	Multilevel Modelling: b = .005, SE = .002, $t(132)$ = 2.15, p = .033, 95% CI [.0006, .0009]
	Adult	Self-reported wisdom and age.	=	P	DDWR-ST	" "	" "	" "	Multilevel Modelling: b = .037, SE = .020, $t(132)$ = 1.89, p = .062, 95% CI [-.002, .080]
	Adult	Self-reported wisdom and age.	=	P	DDWR-PC	" "	" "	" "	Multilevel Modelling: b = .012, SE = .011, $t(132)$ = 1.00, *ns*
Williams et al., 2016	Adult	Self-reported wisdom and age in a sample of individuals who practice meditation.	=	P	TD-WS	54	41.61(14.55), 18 to 68, 54% female	4.01(.36)	Bivariate Correlation: r = -.01, *ns*
	Adult	Self-reported wisdom and age in a sample of individuals who practice meditation.	=	P	TD-WS-C	" "	" "	4.30(.35)	Bivariate Correlation: r = .02, *ns*

Adult	Self-reported wisdom and age in a sample of individuals who practice meditation.	=	P	TD-WS-R	" "	" "	3.88(.46)	Bivariate Correlation: *r* = -.03, *ns*
Adult	Self-reported wisdom and age in a sample of individuals who practice meditation.	=	P	TD-WS-A	" "	" "	3.85(.53)	Bivariate Correlation: *r* = -.02, *ns*
Adult	Self-reported wisdom and age in a sample of individuals who engage in somatic practices (i.e., Alexander Technique).	=	P	TD-WS	65	50.49(13.76), 24 to 80, 86% female	3.90(.33)	Bivariate Correlation: *r* = .22, *ns*
Adult	Self-reported wisdom and age in a sample of individuals who engage in somatic practices (i.e., Alexander Technique).	=	P	TD-WS-C	" "	" "	4.25(.45)	Bivariate Correlation: *r* = .21, *ns*
Adult	Self-reported wisdom and	=	P	TD-WS-R	" "	" "	3.66(.36)	Bivariate Correlation: *r* = .08, *ns*

	age in a sample of individuals who engage in somatic practices (i.e., Alexander Technique).							
Adult	Self-reported wisdom and age in a sample of individuals who engage in somatic practices (i.e., Alexander Technique).	=	P	TD-WS-A	" "	" "	3.79(.47)	Bivariate Correlation: *r* = .19, *ns*
Adult	Self-reported wisdom and age in a sample of individuals who engage in somatic practices (i.e., Feldenkrais Method).	=	P	TD-WS	94	52.8(11.68), 27 to 76, 77% female	3.92(.39)	Bivariate Correlation: *r* = .04, *ns*
Adult	Self-reported wisdom and age in a sample of individuals who engage in somatic practices (i.e.,	=	P	TD-WS-C	" "	" "	4.20(.58)	Bivariate Correlation: *r* = .16, *ns*

	Feldenkrais Method).							
Adult	Self-reported wisdom and age in a sample of individuals who engage in somatic practices (i.e., Feldenkrais Method).	=	P	TD-WS-R	" "	" "	3.83(.47)	Bivariate Correlation: *r* = .09, *ns*
Adult	Self-reported wisdom and age in a sample of individuals who engage in somatic practices (i.e., Feldenkrais Method).	=	P	TD-WS-A	" "	" "	3.74(.44)	Bivariate Correlation: *r* = -.18, *ns*
Young	Self-reported wisdom and age in a sample of ballet dancers.	=	P	TD-WS	81	25.35(7.37), 11 to 62, 94% female	3.59(.37)	Bivariate Correlation: *r* = .11, *ns*
Young	Self-reported wisdom and age in a sample of ballet dancers.	=	P	TD-WS-C	" "	" "	4.00(.57)	Bivariate Correlation: *r* = .18, *ns*
Young	Self-reported wisdom and age in a	=	P	TD-WS-R	" "	" "	3.31(.47)	Bivariate Correlation: *r* = -.07, *ns*

		sample of ballet dancers.							
	Young	Self-reported wisdom and age in a sample of ballet dancers.	=	P	TD-WS-A	" "	" "	3.47(.45)	Bivariate Correlation: *r* = .13, *ns*
Weststrate & Glück, 2017	Adult	Self-reported wisdom and age.	=	P	SRC	94	Wisdom nominees: 60.9(16.3), 26 to 92, 49% female Controls: 60(15.1), 26 to 84, 49% female	N/A	Bivariate Correlation: *r* = -.10, *ns*
	Adult	Performance-based wisdom and age.	=	G	BWP	" "	" "		Bivariate Correlation: *r* = -.13, *ns*
Ardelt & Jeste, 2018	Older	Self-reported wisdom and age.	-	P	TD-WS	994	77.3(12.2), 51 to 99, 49% female	N/A	Bivariate Correlation: *r* = -.13, *p* < .01
	Older	Self-reported wisdom and age.	-	P	TD-WS-C	" "	" "	" "	Bivariate Correlation: *r* = -.21, *p* < .01
	Older	Self-reported wisdom and age.	=	P	TD-WS-R	" "	" "	" "	Bivariate Correlation: *r* = -.05, *ns*
	Older	Self-reported wisdom and age.	=	P	TD-WS-A	" "	" "	" "	Bivariate Correlation: *r* = -.05, *ns*
Ardelt et al., 2018b	Adult	Self-reported wisdom and age.	-	P	TD-WS-C	14,248	36.46(12.68), 18 to 98, 48.5% female	N/A	Bivariate Correlation: *r* = -.05, *p* < .001

									Multiple Regression: b = .00109, β = .03, *ns*
	Adult	Self-reported wisdom and age.	+	P	TD-WS-R	" "	" "	" "	Bivariate Correlation: r = .07, p < .001 Multiple Regression: b = .00337, β = .09, $p \leq .001$
	Adult	Self-reported wisdom and age.	=	P	TD-WS-A	" "	" "	" "	Bivariate Correlation: r = -.04, p < .001 Multiple Regression: b = -.00179, β = -.05, $p \leq .001$
Bushlack & Bock, 2018	Young	Self-reported wisdom and age.	=	P	BWSS	153	Overall: 38% female Ages 18 to 24: 11% female Ages 25 to 34: 56% female Aged ≥ 35: 33% female	3.52(.53)	Bivariate Correlation: r = .09, *ns*
García-Campayo et al., 2018	Adult	Self-reported wisdom and age.	=	P	TD-WS-C	624	75.64% female	N/A	Independent Samples T-Test: ΔMn = .02, p = .845, d = .03
	Adult	Self-reported wisdom and age.	+	P	TD-WS-R	" "	" "	" "	Independent Samples T-Test: ΔMn = .27, p = .010, d = .35
	Adult	Self-reported wisdom and age.	+	P	TD-WS-A	" "	" "	" "	Independent Samples T-Test: ΔMn = .13, p = .010, d = .38

Rakoczy et al., 2018	Adult	Performance-based wisdom and age.	=	G	WR-PT	80	YA: 24.35(3.76), 18 to 31, 63% female OA: N/A	N/A	Bivariate Correlation: r = -.06, *ns* Independent Samples T-Test: $t(72.82)$ = .49, *ns*
	Adult	Performance-based wisdom and age.	=	G	M-WR-PT	" "	" "	" "	Bivariate Correlation: r = .06, *ns* Independent Samples T-Test: $t(79)$ = .89, *ns*
Webster et al., 2018	Young	Self-reported wisdom and age.	+/=	P	SAWS	271	20.37(2.50), 17 to 29, 62.13% female	177.77 (19.16)	Bivariate Correlation: r = .13, p < .05 Hierarchical Regression: b = .64, SE = .477, β = .08, *ns*
	Young	Self-reported wisdom and age.	=	P	SAWS-H	" "	" "	36.68(5.89)	Bivariate Correlation: r = -.06, *ns*
	Young	Self-reported wisdom and age.	=	P	SAWS-ER	" "	" "	33.48(5.66)	Bivariate Correlation: r = .05, *ns*
	Young	Self-reported wisdom and age.	=	P	SAWS-R	" "	" "	36.49(5.78)	Bivariate Correlation: r = .10, *ns*
	Young	Self-reported wisdom and age.	+	P	SAWS-O	" "	" "	34.87(5.38)	Bivariate Correlation: r = .19, p < .01
	Young	Self-reported wisdom and age.	+	P	SAWS-E	" "	" "	36.25(5.50)	Bivariate Correlation: r = .18, p < .01
Alhosseini & Ferrari, 2019	Adult	Self-reported wisdom and age.	=	P	TD-WS	80	YA: 25(2.73), 21 to 30, 53% female	N/A	Bivariate Correlation: r_s = -.05, *ns*

							OA: 78.85(9.4), 62 to 99, 47.5% female		
	Adult	Self-reported wisdom and age.	=	P	TD-WS-C	" "	" "	" "	Bivariate Correlation: r_s = -.07, *ns*
	Adult	Self-reported wisdom and age.	=	P	TD-WS-R	" "	" "	" "	Bivariate Correlation: r_s = -.10, *ns*
	Adult	Self-reported wisdom and age.	=	P	TD-WS-A	" "	" "	" "	Bivariate Correlation: r_s = -.01, *ns*
Ardelt & Bruya, 2020	Young	Self-reported wisdom and age at the beginning of the semester in a sample of undergraduate students.	=	P	TD-WS	263	Overall (N = 480): 19.5, 18 to 22, 59.5% female	N/A	Bivariate Correlation: r = .13, *ns*
	Young	Self-reported wisdom and age at the beginning of the semester in a sample of undergraduate students.	+	P	TD-WS-C	" "	" "	" "	Bivariate Correlation: r = .17, p < .05
	Young	Self-reported wisdom and age at the beginning of the semester in a sample of	=	P	TD-WS-R	" "	" "	" "	Bivariate Correlation: r = .10, *ns*

	undergraduate students.							
Young	Self-reported wisdom and age at the beginning of the semester in a sample of undergraduate students.	=	P	TD-WS-A	“ “	“ “	“ “	Bivariate Correlation: $r = .06$, *ns*
Young	Self-reported wisdom and age at the end of the semester in a sample of undergraduate students.	+	P	TD-WS	217	“ “	“ “	Bivariate Correlation: $r = .19$, $p < .01$
Young	Self-reported wisdom and age at the end of the semester in a sample of undergraduate students.	+	P	TD-WS-C	“ “	“ “	“ “	Bivariate Correlation: $r = .21$, $p < .01$
Young	Self-reported wisdom and age at the end of the semester in a sample of undergraduate students.	+	P	TD-WS-R	“ “	“ “	“ “	Bivariate Correlation: $r = .16$, $p < .01$

	Young	Self-reported wisdom and age at the end of the semester in a sample of undergraduate students.	=	P	TD-WS-A	" "	" "	" "	Bivariate Correlation: r = .12, *ns*
Chaouali et al., 2020	Older	Self-reported wisdom and age.	=	P	A-TD-WS	240	63.99(3.278), > 60, 53.3% female	N/A	Bivariate Correlation: r = -.003, ns
Jeste et al., 2020	Older	Self-reported wisdom and age in an Italian sample.	-	P	SD-WISE	259	Ages 50 to 65 (n = 212): 57.8(4.5), 53% female Aged ≥ 90 years (n = 47): 92.7(3.0), 68% female	Ages 50 to 65: 3.7(.4) Aged ≥90: 3.3(.4)	Post-Hoc Holm Adjustment Test: ≥ 90 years < 50 to 65 years, p = .0000 Controlling for Education: ≥ 90 years < 50 to 65 years, p < .0001
	Older	Self-reported wisdom and age in an Italian sample.	-	P	SD-WISE-PB	" "	" "	Ages 50 to 65: 4.1(.6) Aged ≥90: 3.5(.7)	Post-Hoc Holm Adjustment Test: ≥90 years < 50 to 65 years, p = .0000 Controlling for Education: ≥ 90 years < 50 to 65 years, p < .0001
	Older	Self-reported wisdom and age in an Italian sample.	=	P	SD-WISE-ER	" "	" "	Ages 50 to 65: 3.2(.7) Aged ≥90: 3.1(.7)	Post-Hoc Holm Adjustment Test: ≥ 90 years = 50 to 65 years, p = .2719
	Older	Self-reported wisdom and age in an Italian sample.	-	P	SD-WISE-SR	" "	" "	Ages 50 to 65: 3.7(.6) Aged ≥90: 3.2(.5)	Post-Hoc Holm Adjustment Test: ≥90 years < 50 to 65 years, p = .0000 Controlling for Education: ≥ 90 years < 50 to 65 years, p = .0001

Older	Self-reported wisdom and age in an Italian sample.	-	P	SD-WISE-ADV	" "	" "	Ages 50 to 65: 3.9(.6) Aged ≥90: 3.4(.7)	Post-Hoc Holm Adjustment Test: ≥90 years < 50 to 65 years, p = .0000 Controlling for Education: ≥90 years < 50 to 65 years, p = .0023
Older	Self-reported wisdom and age in an Italian sample.	=	P	SD-WISE-D	" "	" "	Ages 50 to 65: 3.4(.8) Aged ≥90: 3.2(.7)	Post-Hoc Holm Adjustment Test: ≥90 years = 50 to 65 years, p = .1156
Older	Self-reported wisdom and age in an Italian sample.	-	P	SD-WISE-SA	" "	" "	Ages 50 to 65: 3.6(.6) Aged ≥90: 3.3(.5)	Post-Hoc Holm Adjustment Test: ≥90 years < 50 to 65 years, p = .0028 Controlling for Education: ≥90 years < 50 to 65 years, p = .0220
Older	Self-reported wisdom and age in an American sample.	-	P	SD-WISE	223	Ages 50 to 65 (n = 138): 58.1(4.9), 49% female Aged ≥ 90 years (n = 85): 93.2(3.2), 48% female	Ages 50 to 65: 3.9(.4) Aged ≥90: 3.3(.4)	Post-Hoc Holm Adjustment Test: ≥ 90 years < 50 to 65 years, p = .0049 Controlling for Education: ≥90 years < 50 to 65 years, p = .0020
Older	Self-reported wisdom and age in an American sample.	=	P	SD-WISE-PB	" "	" "	Ages 50 to 65: 4.2(.5) Aged ≥90: 4.2(.5)	Post-Hoc Holm Adjustment Test: ≥ 90 years = 50 to 65 years, p = .4815 Controlling for Education: ≥90 years = 50 to 65 years, p = .4490
Older	Self-reported wisdom and age in an American sample.	=	P	SD-WISE-ER	" "	" "	Ages 50 to 65: 3.8(.7) Aged ≥90: 3.6(.6)	Post-Hoc Holm Adjustment Test: ≥90 years = 50 to 65 years, p = .1767
Older	Self-reported wisdom and	-	P	SD-WISE-SR	" "	" "	Ages 50 to 65: 3.8(.7)	Post-Hoc Holm Adjustment Test: ≥90 years < 50 to 65 years, p = .0049

		age in an American sample.						Aged ≥90: 3.5(.5)	Controlling for Education: ≥ 90 years < 50 to 65 years, p = .0024
	Older	Self-reported wisdom and age in an American sample.	=	P	SD-WISE-ADV	" "	" "	Ages 50 to 65: 4.0(.6) Aged ≥90: 3.8(.5)	Post-Hoc Holm Adjustment Test: ≥90 years = 50 to 65 years, p = .1747 Controlling for Education: ≥90 years = 50 to 65 years, p = .1772
	Older	Self-reported wisdom and age in an American sample.	=	P	SD-WISE-D	" "	" "	Ages 50 to 65: 3.8(.8) Aged ≥90: 3.7(.7)	Post-Hoc Holm Adjustment Test: ≥90 years = 50 to 65 years, p = .2131
	Older	Self-reported wisdom and age in an American sample.	-/=	P	SD-WISE-SA	" "	" "	Ages 50 to 65: 3.8(.6) Aged ≥90: 3.6(.6)	Post-Hoc Holm Adjustment Test: ≥90 years < 50 to 65 years, p = .0053 Controlling for Education: ≥ 90 years = 50 to 65 years, p = .0065
Stone et al., 2020	Adult	Self-reported wisdom and age.	+	P	A-TD-WS	3294	54.84(8.56), 51.9% female	3.39(.54)	Bivariate correlation: r =.181, p < .001
Vásquez et al., 2020	Older	Self-reported wisdom and age in a sample of individuals with HIV infection and controls.	+	P	TD-WS	136	HIV+: 50.77(8.84), 26.23% female Controls: 50.60(7.80), 23.38% female	HIV+: 3.42(0.58) Controls: 3.76(0.44)	Independent Samples T-Test: t = -1.83, p = .04, d = -.48
Verhaeghen, 2020	Adult	Self-reported wisdom and age.	+/=	P	WAS	173	39.8(11.7), 21 to 74, 44% female		Bivariate Correlation: r = .11, *ns* Hierarchical Regression:

									Model 1: *b* = .08, *ns* Model 2: *b* = .13, *p* < .05 Model 3: *b* = .12, *p* < .05 Model 4: *b* = .13, *p* < *.05*
	Adult	Self-reported wisdom and age.	=	P	WASW	" "	" "		Bivariate Correlation: *r* = .10, *ns* Hierarchical Regression: Model 1: *b* = .09, *ns* Model 2: *b* = .09, *ns* Model 3: *b* = .10, *ns* Model 4: *b* = .10, *ns*
	Young	Self-reported wisdom and age.	=	P	WAS	260	19.7(1.5), 18 to 26, 54% female		Bivariate Correlation: *r* = .03, *ns* Hierarchical Regression: Model 1: *b* = -.01, *ns* Model 2: *b* = -.02, *ns* Model 3: *b* = -.01, *ns* Model 4: *b* = .01, *ns*
	Young	Self-reported wisdom and age.	=	P	WASW	" "	" "		Bivariate Correlation: *r* = .04, *ns* Hierarchical Regression: Model 1: *b* = .02, *ns* Model 2: *b* = .01, *ns* Model 3: *b* = .03, *ns* Model 4: *b* = .03, *ns*
Wei & Wang, 2020	Young	Performance-based wisdom and age when reasoning about interpersonal conflict.	=	P	SWRS	103	21.35(3.08), 66% female	3.22(0.7)	Bivariate correlation: *r* = .14, *ns*

Cheraghi et al., 2021	Adult	Self-reported wisdom and age.	+	P	SAWS-F	575	33.73(12.83), 17 to 88, 59.13% female	181.06 (22.5)	Bivariate Correlation: $r = .082$, $p = .048$
Grennan et al., 2021	Adult	Self-reported wisdom and age.	+	P	SD-WISE	147	Overall: 40.7(22.6), 18 to 84, 58% female YA: 18 to 25 MA: 26 to 64 OA: 65 to 84	N/A	Kruskal-Wallis Test: $p < .02$ Post-hoc Mann-Whitney Tests: Older adults reported significantly higher wisdom than younger adults, $p = .005$
Nguyen et al., 2021	Adult	Self-reported wisdom and age.	+	P	TD-WS	184	62.39(15.77), 28 to 97, 48% female	3.62(.43)	Bivariate Correlation: $r = .235$, $p = .004$
Leeman et al., 2022	Adult	Self-reported wisdom and age.	+/-	P	SAWS-15	709	35.67, 15 to 92, 78% female A:15 to 18 YA: 19 to 40 MA: 41 to 65 OA: 66 to 92	A: 65.42(8.98) YA: 69.12(9.19) MA: 72.04(8.53) OA: 71.09(9.21)	One-Way ANOVA: $F(3, 705) = 11.25$, $p < .001$, $n^2 = .05$ Hochberg's GT2 Post-Hoc Group Comparisons: Adolescents < all other groups Younger Adults < Middle-Aged Younger Adult = Older Adults Middle-Aged = Older Adults
Lindbergh et al., 2022	Older	Self-reported wisdom and age.	-	P	SD-WISE	141	76(7.57), 51.84 to 92.27, 56% female	4.08(.36)	Bivariate correlation: $r = -.197$, [95% CI - .351, -.033], $p = .019$ Multiple Regression: $\beta = -.171$, $p = .05$
Schneider et al., 2023	Adult	Performance-based wisdom and age.	-	P	SWRS	99	33.5(11.7), 18 to 72, 43% female	3.24(.84)	Bivariate Correlation: $r = -.22$, $p < .05$

Adult	Self-reported wisdom and age.	=	P	A-TD-WS	" "	" "	3.46(.65)	Bivariate Correlation: $r = .10$, *ns*
Young	Performance-based wisdom and age.	=	P	SWRS	150	21.22(5.3), 18 to 63, 63% female	3.63(.78)	Bivariate Correlation: $r = .05$, *ns*
Young	Self-reported wisdom and age.	+	P	A-TD-WS	" "	" "	2.90(.38)	Bivariate Correlation: $r = .17$, $p < .05$

Supplementary Appendix G

Bivariate Correlations of General Wisdom, Cognitive Indices, and Demographic Variables in the Combined Sample

	BWP	Age	Education	Sex	Semantic	Episodic
BWP	-					
Age	-.05	-				
Education	**.13***	**.42****	-			
Sex	-.05	.05	-.08	-		
Semantic	**.25****	**.41****	.05	.01	-	
Episodic	**.17****	**-.71****	**-.27****	**-.20****	.14	-

*Note: *p < .05 ** p < .01; Dummy coding to create binary age cohort and sex variables, where younger = 0, older = 1; female = 0, male*

Supplementary Appendix H

Bivariate Correlations of Personal Wisdom, Cognitive Indices, and Demographic Variables in the Combined Sample

	TD-WS	SAWS	Age	Education	Sex	Semantic	Episodic
TD-WS	-						
SAWS	**.21****	-					
Age	**.16****	**.23****	-				
Education	**.17****	.07	**.42****	-			
Sex	-.02	-.04	-.01	.40	-		
Semantic	**.17****	**.12***	**.41****	**.41****	.01	-	
Episodic	-.05	**-.21***	**-.71****	**-.27****	**-.20****	.14	-

*Note: *p < .05 ** p < .01; Dummy coding to create binary age cohort and sex variables, where younger = 0, older = 1; female = 0, male*

Supplementary Appendix I

Bivariate Correlations of General Wisdom, Cognitive Indices, and Demographic Variables in a Younger Adult Sample

	BWP	Education	Sex	Semantic	Episodic
BWP	-				
Education	**.19***	-			
Sex	-.03	-.05	-		
Semantic	**.26****	**.15***	.13	-	
Episodic	**.16***	.02	**-.23****	**.36****	-

*Note: *p < .05 ** p < .01; Dummy coding to create binary sex variable, where female = 0, male = 1.*

Supplementary Appendix J

Bivariate Correlations of Personal Wisdom, Cognitive Indices, and Demographic Variables in a Younger Adult Sample

	TD-WS	SAWS	Education	Sex	Semantic	Episodic
TD-WS	-					
SAWS	**.23****	-				
Education	.07	.01	-			
Sex	-.05	-.01	-.05	-		
Semantic	.03	.06	**.15***	.13	-	
Episodic	.07	-.05	.02	**-.23****	**.36****	-

*Note: *p < .05 ** p < .01; Dummy coding to create binary sex variable, where female = 0, male = 1.*

Supplementary Appendix K

Bivariate Correlations of General Wisdom, Cognitive Indices, and Demographic Variables in an Older Adult Sample

	BWP	Education	Sex	Semantic	Episodic
BWP	-				
Education	.15	-			
Sex	-.08	.13	-		
Semantic	**.34****	**.36****	-.09	-	
Episodic	**.24****	.08	**-.36****	**.33****	-

*Note: *p < .05 ** p < .01; Dummy coding to create binary sex variable, where female = 0, male = 1.*

Supplementary Appendix L

Bivariate Correlations of General Wisdom, Cognitive Indices, and Demographic Variables in an Older Adult Sample

	TD-WS	SAWS	Education	Sex	Semantic	Episodic
TD-WS	-					
SAWS	.15	-				
Education	.12	-.06	-			
Sex	-.03	-.08	.13	-		
Semantic	.20*	.01	**.36****	-.09	-	
Episodic	.12	-.09	.08	**-.36****	**.33****	-

*Note: *p < .05 ** p < .01; Dummy coding to create binary sex variable, where female = 0, male =1*