The Aging Mind at Work: A Framework for Age-Differentiated Cognitive Processing

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Abstract

As global populations age, workplaces are increasingly shaped by older adults whose cognitive profiles differ in systematic ways from their younger counterparts. This paper reviews age-related changes in cognition through both deficit-based and adaptation-focused lenses, examining how shifts in memory, attention, inhibitory control, and fluid versus crystallized intelligence affect workplace-relevant domains such as social cognition, creativity, and decision-making. To integrate these findings, it introduces the Age-Differentiated Processing Model, a stage-based framework outlining how older and younger adults differ in how they access, delete, integrate, retrieve, and act on information. The model emphasizes differences in how cognitive resources are allocated and applied across processing stages, shaped by contextual demands and motivational priorities. A real-world workplace scenario illustrates how these differences unfold in practice. Directions for future research, including the need for more ecologically valid and lifespan-inclusive studies, are discussed in the final section.

Keywords: aging, cognition, memory, executive function, decision making, work performance

Introduction

The global population is aging at an unprecedented rate, creating a demographic shift with profound implications. By 2030, one in six people worldwide will be over 60, and by 2050, close to one in four (World Health Organization, 2024). This transformation is being driven by two key forces: rising life expectancy and declining fertility rates (Kulik et al., 2014).

Over time, global life expectancy has increased dramatically, from 46.5 years in 1950 to 71.7 years in 2022 and is projected to reach 77.3 years by 2050 (Richter, 2023). Additionally, the age distribution is shifting as the number of centenarians (people aged 100 or older) is expected to more than double by 2030, and the population of adults aged 80 and older is projected to triple by 2050 (Schaeffer, 2024). In other words, age milestones once considered extraordinary are increasing part of the new normal. This shift is further intensified by fewer people being born. In 2020, for the first time in history, adults aged 60 and older outnumbered children under five (WHO, 2024), an inflection point that signals the shrinking size of younger generations. This reflected a steady decline in fertility that has unfolded over several decades. Specifically, the global fertility rate has dropped from 4.9 children per woman in 1950 to 2.3 in 2023, and is projected to reach 2.1 by 2050 (UN DESA, Population Division, 2024), the replacement level at which a population merely sustains itself.

As the global age structure shifts, one of the most immediate and far-reaching impacts is on the labour force. Fewer young adults are entering the workforce while more older adults are reaching retirement age, leading to a shrinking labour pool that is already contributing to slower economic growth and reduced productivity (Bloom et al., 2015; Kulik et al., 2014). Compounding the issue, many older adults leave the workforce earlier than necessary. In the United States, only 65.8% of adults aged 55 to 64 are currently employed (U.S. Bureau of Labor

Statistics, 2024), representing a significant loss of experience and expertise. This demographic shift also strains public finances, as fewer workers mean reduced tax revenues, limiting funding for essential services while pension and healthcare costs continue to rise (Bloom et al., 2015; Kulik et al., 2014).

To combat these challenges, extending working lives is a logical and necessary solution, but how organizations and society harness the potential of older workers remains an open question. As people work later into their lives, they do not remain static; their skills, perspectives, and cognitive processes evolve with age. While experience and expertise deepen, other cognitive functions may shift in ways that affect how individuals learn, adapt, and contribute in the workplace. Understanding these cognitive changes is essential to creating environments where older workers can thrive, allowing organizations to fully leverage their strengths while addressing potential challenges.

This review defines younger adults as those aged 18-30 and older adults as those over 65. It begins by examining the cognitive penalties and adaptations that accompany aging. It then explores how these changes manifest in key domains of workplace functioning, including social cognition, creativity, and decision-making. Building on these foundations, the final section introduces the Age-Differentiated Processing Model, a framework that consolidates diverse findings on age-related cognitive shifts into a coherent structure. The model provides a flexible lens for understanding how older and younger adults process information across tasks. In this review, it is applied to illustrate how age-related cognitive differences may influence workplace behaviours.

The Aging Penalty

Episodic Memory

Among the cognitive functions most affected by aging, episodic memory is often noted as an area of vulnerability. This form of memory involves recalling personal events anchored in a specific time and place, requiring the individual to mentally re-experience the surrounding context, sensory details, and their own sense of self within that past moment. Research using recall tasks has consistently shown that older adults tend to retrieve fewer specific details than younger adults, and their recollections are often more general, lacking the vividness and contextual richness of younger counterparts (Levine et al., 2002; Park et al., 2002). Neuroimaging findings further align with these behavioural patterns, showing that older adults exhibit reduced activity in brain regions involved in episodic imagery and contextual detail, such as the posterior hippocampus and precuneus (Grilli & Sheldon, 2022; Schacter et al., 2013).

One possible explanation for this decline centres on the concept of relational memory, which refers to the ability to form and retrieve associations between distinct elements of an experience, such as people, objects, spatial context, and temporal details (Ryan et al., 2020). This process is foundational to episodic memory as it allows events to be recalled as coherent, contextually rich episodes. According to the associative deficit hypothesis, aging weakens the ability to bind related information. This has been shown in memory tests requiring participants to recall which words were originally paired together. It was found that while older adults could recall the individual words, they struggled to remember which ones had been paired, especially when the pairings did not have an obvious link (Naveh-Benjamin, 2000). Neuroimaging evidence reflects similar patterns, showing that age-related declines in hippocampal volume are associated with impairments in relational memory (Ryan et al., 2020).

Attention and Processing Speed

Good memory performance relies on deep and elaborate encoding, which in turn requires sufficient attentional resources (Craik et al., 2018). In older adults, these resources are reduced, resulting in less effective encoding and poorer memory outcomes. Support for this comes from memory studies involving divided attention, where younger and older adults performed memory recall tasks under two conditions: full attention and divided attention (DA). Under DA, participants had to simultaneously complete a secondary task, drawing attentional resources away from memory encoding of the primary task. The key finding was that younger adults under DA performed similarly to older adults under full attention (Anderson et al., 1998; Lindenberger et al., 2000). This suggests that older adults function as if their attention is already divided, providing evidence that aging leads to a reduction in available attentional resources.

This reduction in attentional resources has downstream consequences, including declines in processing speed, which refers to the rate at which cognitive activities are performed (Harada et al., 2013). This decline has been consistently observed in standard neuropsychological tasks, all of which reveal slower performance in older adults. Notably, much of this slowing reflects general cognitive decline rather than deficits specific to any one task (Salthouse, 2010).

Inhibitory Control

Inhibitory control refers to the ability to focus on goal-relevant information by actively suppressing distractions or no-longer-relevant thoughts. This process involves three main functions: access, deletion, and restraint, each of which declines with age (Amer et al., 2022).

Access refers to the ability to control how much information becomes activated in response to cues. When this process is efficient, the over-activation of both relevant and irrelevant information is prevented. However, older adults often show reduced access control, allowing distracting or outdated information to surface more easily (Kim et al., 2007). For instance, in tasks requiring participants to intentionally forget certain words, older adults are more likely than younger adults to recall those to-be-forgotten items. This reduced filtering also contributes to interference in memory tasks when earlier, now-irrelevant information continues to compete with new material (Healy et al., 2013).

Deletion involves mentally discarding information that was once relevant but is no longer needed. Studies using retrieval-induced forgetting paradigms have shown that older adults are less effective at suppressing outdated content, leading to memory interference (Amer et al., 2022). Neuroimaging evidence supports this pattern, showing sustained activation in memory-related brain regions such as the medial temporal lobe and hippocampus when older adults are presented with previously relevant but now-irrelevant information (Amer et al., 2022).

Restraint refers to the ability to stay focused by blocking distractions from competing thoughts or actions. This decline is most evident in task-switching scenarios, where older adults display greater switching costs than younger adults. They are more likely to retrieve instructions or strategies from a previous task that are no longer applicable, leading to slower and more error-prone performance. Increased susceptibility to this kind of cross-task interference reflects diminished control over internal distractions (Amer et al., 2022).

Together, these findings show that age-related reductions in inhibitory control can increase mental interference, making it harder to focus, switch tasks, and retrieve information efficiently in some contexts.

Fluid Intelligence and Working Memory

Fluid intelligence refers to the capacity to solve novel problems, reason abstractly, and identify patterns without relying on prior experience. It supports adaptation to unfamiliar tasks, flexible thinking, and logical inference (de Bruin et al., 2012). Research consistently shows that fluid intelligence declines with age. This has been demonstrated in tasks requiring individuals to detect rules, complete visual patterns, and apply logic in unfamiliar situations. While slower processing speed and reduced efficiency in frontal brain regions explain much of this decline, age continues to predict performance even after accounting for these factors, indicating the involvement of additional mechanisms (Bugg et al., 2006; Kappes et al., 2020). One of those mechanisms is working memory, which is the ability to hold and mentally manipulate information over short periods. Working memory and fluid intelligence are highly correlated across diverse reasoning and memory tasks, and they appear to draw on shared executive resources, particularly cognitive flexibility, reasoning, and attentional control. Because they share similar neural and cognitive underpinnings, declines in one are often accompanied by declines in the other (Salthouse & Pink, 2008). Together, reductions in fluid intelligence and working memory reflect a broader shift in the brain's ability to process information efficiently, especially in unfamiliar, or rapidly changing environments.

The Other Side of Aging: Adaptations

Neural Plasticity

Neural plasticity refers to the brain's ability to modify its structure and function over time to support learning, memory, and other cognitive processes. Although aging is often associated with cognitive decline, research shows that the brain retains a surprising degree of plasticity well into later life. Early theories suggested widespread neuron loss as a primary cause of cognitive aging, but later studies have shown this is not the case for most brain regions. Studies have found that the hippocampus and neocortex, areas critical for memory and thinking, do not undergo significant cell death in normal aging (Burke & Barnes, 2006). This preservation of neurons provides an important foundation for continued adaptability. Structural changes also appear more selective than once believed. In some cases, older adults show more complex neural connections than younger adults in key memory-related areas such as the parahippocampal cortex and dentate gyrus (Burke & Barnes, 2006), suggesting that the brain may compensate for age-related changes by preserving or even enhancing its structural network.

Beyond structure, many of the brain's basic communication abilities remain stable with age. In the hippocampus, neuronal signaling shows little change over time, and even when the number of neural connections declines in some regions, the brain may adapt by becoming more responsive to the signals they do receive (Burke & Barnes, 2006). There's also evidence that communication between neurons becomes more synchronized with age, which might help maintain coordination across memory-related networks. Importantly, the brain's ability to strengthen connections in response to new experiences, which is central to learning and memory, can still function in older adults, a process known as long-term potentiation.

This adaptability is also evident through behavioural studies, which have shown that older adults can improve their cognitive control through targeted training, particularly in tasks that require inhibition of distractions or irrelevant information (Wilkinson & Yang, 2016, 2020). With repeated practice, older adults have demonstrated meaningful gains on tasks designed to strengthen different aspects of inhibitory control. Together, these findings suggest that while the aging brain faces subtle shifts in function, it still holds meaningful capacity for adaptation and plasticity.

Cognitive Reserve

If plasticity reflects the brain's "hardware," referring to its capacity to physically adapt based on the quantity and integrity of available neural resources, then cognitive reserve can be thought of as the “software” that determines how efficiently that hardware is used. The concept was introduced to explain why individuals with similar levels of brain pathology can exhibit vastly different clinical outcomes (Stern, 2002). In the context of aging, cognitive reserve helps account for why some people show fewer cognitive deficits than others despite experiencing comparable levels of brain change.

Cognitive reserve has traditionally been understood through two broad models. Passive models suggest that the brain can tolerate a certain amount of damage before noticeable cognitive or functional impairments appear. In contrast, active models view the brain as capable of dynamically responding to deficits by adjusting how it functions. Within this framework, cognitive reserve refers to the brain’s ability to maintain or optimize performance by flexibly recruiting different neural networks or applying alternative cognitive strategies (Stern, 2002).

Several theoretical frameworks further illustrate how cognitive reserve may be developed and maintained across the lifespan. The Environmental Complexity Hypothesis proposes that cognitively demanding environments encourage flexible thinking and problem solving, enhancing long-term efficiency (Hyun et al., 2021). The Default-Executive Coupling Hypothesis of Aging (DECHA) suggests that older adults exhibit an adaptive shift toward the use of accumulated knowledge and familiar strategies to compensate for declines in cognitive control (Adnan et al., 2019). The Scaffolding Theory of Aging and Cognition – Revised (STAC-R) emphasizes the brain’s capacity to recruit alternative neural pathways in response to cognitive challenge. This model also highlights how enriching and depleting factors interact over time to shape brain function, and reserve capacity (Reuter-Lorenz et al., 2024).

Recent research provides evidence consistent with these frameworks. One study involving individuals at risk for Alzheimer’s disease found that those with larger social networks performed better on episodic, working, and semantic memory tasks, despite having similar levels of disease-related brain changes. This suggests that social engagement may enhance cognitive reserve and buffer the cognitive effects of neuropathology (Bennett et al., 2006). A second study found that older adults who had worked in mentally demanding occupations showed higher executive function and processing speed at retirement than those in less demanding roles, likely reflecting reserve built through years of complex cognitive engagement (Hyun et al., 2021). Additional findings highlight the role of life-course factors, showing that behaviours such as physical inactivity, smoking, depression, and alcohol use are linked to faster cognitive decline, while enriching activities across different life stages are associated with greater hippocampal volume and slower deterioration (Reuter-Lorenz et al., 2024). Together, these findings support the view that cognitive reserve develops over time through the accumulation of protective experiences, playing a key role in how well individuals age cognitively.

Semantic Memory and Crystallized Intelligence

Semantic memory refers to accumulated knowledge about the world, including facts, concepts, meanings, and vocabulary (Craik & Rose, 2012). Unlike episodic memory, semantic memory is independent of when or where the information was learned. This system tends to remain stable with age and can continue to expand (Klooster et al., 2020). These gains are part of a broader trend known as crystallized intelligence, which encompasses experience-based knowledge that develops over time. It includes abilities that are domain-specific, pragmatic, and acquired through life experience (de Bruin et al., 2012; Strough et al., 2015). While fluid intelligence tends to decline with age, crystallized intelligence typically increases in a compensatory way, supporting continued effectiveness in cognitively demanding contexts (Salthouse, 2012).

As people age, they increasingly draw on well-established knowledge structures to support new learning and reasoning. When confronted with unfamiliar, unstructured, or abstract problems, older adults benefit from leveraging existing semantic knowledge to guide inferences and performance. Neuroimaging evidence supports this pattern. Older adults show greater activation in the lateral temporal cortex, anterior temporal lobe, and ventromedial prefrontal cortex. Activity in these regions, along with stronger connectivity between the default mode and cognitive control networks, has been linked to semantic processing and the integration of prior knowledge when interpreting and learning from new information (Grilli & Sheldon, 2022; Ryan et al., 2020; Schacter et al., 2013).

Shifts in Episodic Memory and Gist Representation

Recent findings suggest that episodic memory undergoes a nuanced shift in function with age instead of a simple decline. Older adults increasingly rely on gist-based representations that highlight the meaning, structure, emotional tone, and conceptual significance of events, while retaining fewer vivid perceptual or contextual details (Fenerci et al., 2024; Grilli & Sheldon, 2022). Rather than reproducing exact moments, older adults tend to preserve the essence of the experience by focusing on what happened, why it mattered, and how it fits into broader understanding. This supports generalization and meaning-making over precise replication. Behavioural studies further support this shift. For example, older adults are more likely than younger adults to remember that an item seemed expensive, rather than recalling its exact price. They also perform similarly on tasks that require grasping general patterns, such as identifying cause-and-effect relationships or recalling the main idea of a story, even when specific sensory details are missing (Grilli & Sheldon, 2022). These patterns suggest that the capacity to extract and retain the core meaning of experiences remains intact with age and may become a preferred strategy for preserving what is most meaningful. Neuroimaging evidence reinforces this trend, showing preserved or enhanced activation in the anterior hippocampus and anterior temporal lobe (Grilli & Sheldon, 2022), regions involved in semantic abstraction and the processing of generalized content.

A study by Fenerci et al. (2024) illustrates how semantic knowledge and gist memory interact in later life. Older and younger adults watched the same short movie and then freely recalled its events. Both groups recalled a similar proportion of events, suggesting that the core ability to retain event content remains stable with age. They also showed similar temporal organization, recalling events in the order they occurred and grouping together those that happened close in time. Where they differed was in content: older adults' memories were more holistic, linking perceptual, conceptual, and event-related information into integrated narratives. Younger adults, by contrast, tended to separate specific details from their inferred meanings. These findings suggest that older adults rely more heavily on meaning-based processes to interpret and organize events, leading to a memory style that favours coherence and interpretation over precise, verbatim recall. Together, these shifts may represent a form of cognitive adaptation that preserves what is most useful and meaningful in later life.

How Cognitive Aging Shapes Key Workplace Abilities

To understand how age-related cognitive changes manifest in real-world settings, it is useful to examine domains that are central to everyday functioning in the workplace. Drawing from the World Economic Forum's 2025 projections of essential workplace skills in 2030 (World Economic Forum, 2024), many of the most valued competencies cluster around three key cognitive domains: *social cognition, creativity,* and *decision-making*. These domains not only capture a broad range of job-relevant abilities, but also reflect areas where aging has been shown to bring both strengths and challenges. The following sections link cognitive aging research to how older adults may perform in these critical areas of work.

Social Cognition and Aging

Social cognition refers to the cognitive processes through which people make sense of themselves and others to engage with their social context (Kalokerinos et al., 2015). Research on how these processes change with age reveals a complex and often contradictory picture. Some studies point to declines, particularly in areas that rely heavily on inhibitory control, while others highlight preserved or even enhanced functioning, drawing on older adults' accumulated knowledge and life experience. These findings suggest a dynamic interplay between cognitive losses and compensatory strengths, where the skill that prevails in any given situation likely depends on the specific social demands of the context. The following sections review key findings across several aspects of social cognition, including (1) emotional identification, (2) theory of mind and social inference, (3) behavioural and emotional regulation, and (4) evidence from leadership as an applied workplace context.

Emotional Identification

Emotional identification refers to the ability to interpret emotional states from cues such as facial expressions, vocal tone, and body posture (Fernandes et al., 2021). At work, this moment-to-moment skill enables socially appropriate and tactful responses. Although most research has focused on facial expressions, studies across all three modalities consistently show that older adults have more difficulty recognizing negative emotions, particularly anger, sadness, and fear. In contrast, recognition of emotions like happiness and disgust is often preserved (Ruffman et al., 2008).

These age-related declines have been primarily attributed to changes in brain function. Reductions in regions such as the orbitofrontal cortex, amygdala, cingulate cortex, ventral visual cortex, and fusiform face area are thought to impair emotion recognition (Dennis et al., 2008; Park et al., 2004; Ruffman et al., 2008). However, this neuropsychological explanation has notable limitations. For instance, it does not explain why older adults struggle to recognize fear in faces but not in voices, even though both rely on the amygdala. Isolating specific brain regions also overlooks the broader neural networks involved. There is also evidence that older adults may compensate for these changes by recruiting additional brain resources (Fernandes et al., 2021).

General cognitive decline has also been considered but does not fully account for the declines. If this were the main cause, older adults should struggle the most with emotions that younger adults also find difficult. Yet, emotions like disgust, which are challenging for younger adults to identify, tend to pose less difficulty for older adults (Ruffman et al., 2008). Differences in visual scanning may also contribute where older adults tend to focus less on the eyes, which are critical for recognizing emotions like fear and anger (Fernandes et al., 2021).

Crucially, task design significantly influences performance. Older adults recognize most emotions more accurately when expressions are presented dynamically, as they unfold in real life, and when contextual information is provided (Adnan et al, 2019; Holland et al., 2019). This suggests they benefit from richer, more realistic emotional cues, likely because these cues allow them to draw on accumulated life experience. Together, these findings paint a complex and incomplete picture. While some age-related declines in emotional identification are observed, performance depends heavily on the specific emotion, form of expression, and task features.

Theory of Mind and Social Inference

In the workplace, the ability to infer another person's mental states, such as their feelings, thoughts, or intentions, as distinct from their own, play a vital role in teamwork, leadership, and client relations. This capacity, captured by Theory of Mind (ToM) tasks, enables employees to anticipate reactions and navigate interpersonal situations with sensitivity. Research on ToM performance, shows that older adults tend to perform worse compared to younger adults across a wide range of task types regardless of domain (affective, cognitive, or mixed) or modality of presentation (verbal, visual, static, dynamic, or mixed). Specific tasks included interpreting characters' mental states from written stories, understanding social interactions in videos, and identifying false beliefs or social faux pas, such as recognizing when someone says something inappropriate or unintentionally causes harm (Fernandes et al., 2021; Henry et al., 2013). One explanation for these deficits points to age-related declines in inhibitory control, which is thought to be critical for suppressing one's own perspectives, biases, and automatic thoughts to consider someone else's point of view (Fernandes et al., 2021).

Surprisingly, despite documented difficulties with ToM tasks, older adults often outperform younger counterparts in areas like social inference and interpersonal decision-making (Kalokerinos et al., 2015; Lim & Yu, 2015). They appear to draw on accumulated life experience to navigate social dynamics more effectively, forming impressions and making trait inferences with fewer cues. Enhanced sensitivity to social context also supports more accurate interpretations of others' intentions and behaviours. In interpersonal decision-making specifically, older adults tend to apply more mature and flexible strategies (Kalokerinos et al., 2015; Lim & Yu, 2015). For example, they are more likely to engage in avoidance-denial, distancing themselves from the situation or tuning out distressing aspects to stay emotionally steady. They also use the passive-dependence approach by deferring to others or intentionally refraining from acting when direct involvement may be counterproductive. At the same time, they show greater use of analytical strategies, such as reflecting deliberately to better understand the situation and taking steps or seeking advice to address the issue directly (Blanchard-Fields et al., 2007). Interestingly, using strategies like avoidance-denial and passive-dependence require inhibitory control, suggesting that older adults may deploy cognitive resources more selectively, shaped by experience and emotional goals.

Behaviour and Emotion Regulation

Loss of inhibitory control with age can lead to socially disinhibited behaviours, such as interrupting others, asking inappropriate questions about private matters in public, or oversharing personal information. Older adults may also talk excessively about unrelated topics and are more likely to express stereotypes or fail to suppress biases during social interactions (Kalokerinos et al., 2015). In workplace settings, these behaviours can damage professional credibility and hinder collaboration. Yet, older adults also show improved ability to regulate their emotions compared to younger adults, an asset in many work environments that demand emotional maturity and interpersonal stability. Drawing from Socioemotional Selectivity Theory (SST), aging brings a motivational shift toward emotional goals, prompting older adults to prioritize strategies that enhance well-being (Beier et al., 2022; Strough et al., 2015). Building on this idea, the Selection, Optimization, and Compensation with Emotion Regulation framework (SOC-ER) suggests that older adults adapt their emotion regulation strategies based on available resources, compensating for declines by relying on preserved strengths (Urry & Gross, 2010).

Emotion regulation strategies can be categorized as either antecedent- or response-focused, based on when they are deployed (Scheibe & Carstensen, 2010). Antecedent-focused strategies occur before an emotional response is fully generated and include *selecting situations* likely to generate desired emotions, *modifying situations* to change their emotional impact, *shifting attention* toward or away from certain aspects of a situation, and *reappraising* the situation to alter its meaning. Response-focused strategies, by contrast, occur after the emotion has been triggered and involve *modulating emotional expression* (Gross, 1998).

Older adults tend to favour antecedent-focused strategies. Compared to younger adults, they are more effective at selecting emotionally meaningful environments, avoiding conflict, and shifting attention toward emotionally rewarding stimuli, reflecting a broader positivity bias in later life (Urry & Gross, 2010). Cognitive reappraisal shows more mixed results. Older adults use it more often, but are less successful with detached reappraisal, which involves stepping back from a situation to view it objectively (Kalokerinos et al., 2015; Urry & Gross, 2010). This may be because it requires both cognitive control and working memory to inhibit and manipulate emotional reactions and perspectives. On the other hand, older adults are more effective at positive reappraisal, such as finding meaning or benefits in negative experiences, likely due to accumulated life experience that provides more references for reframing events constructively, and a motivational focus on maintaining positive emotion (Charles & Carstensen, 2010; Urry & Gross, 2010). Finally, while older and younger adults are equally capable of inhibiting emotional expressions, older adults appear to rely on this strategy less often, likely to avoid the cognitive costs associated with suppression (Urry & Gross, 2010). More broadly, neuroimaging studies show that emotional regulation improves with age. Older adults display reduced neural activation during loss anticipation, greater activation in response to rewards, and weaker responses to regret (Lim & Yu, 2015).

Leadership as a Lens on Workplace Social Cognition

Leadership offers a concrete lens through which to examine social cognition in the workplace, as it is fundamentally a social influence process focused on understanding and motivating others toward shared goals (Rosing & Jungmann, 2015). While few studies have directly linked cognitive aging to leadership, behavioural evidence suggests older leaders tend to adopt more relationship-oriented styles. These include consulting team members, encouraging participative decision-making, and prioritizing trust and group cohesion, patterns that may reflect accumulated interpersonal experience and a focus on long-term relational goals (Oshagbemi, 2004; Rosing & Jungmann, 2015).

Two frameworks offer insight into the social skills that underpin effective leadership. The first centres on social intelligence, which encompasses social perceptiveness and behavioural flexibility. Social perceptiveness involves accurately interpreting the needs, goals, and dynamics of individuals and groups, drawing on rich social knowledge to perceive social cues and complex interpersonal interactions (Zaccaro et al., 1991). This maps well onto findings that older adults excel in social inference and interpersonal decision-making. Behavioural flexibility, however, presents a more nuanced picture. It refers to the ability to adapt responses across different situations. While older adults may adapt well in familiar or emotionally meaningful contexts, they may be less flexible in novel or abstract situations due to declines in cognitive control, processing speed, and working memory.

The second framework identifies three skill domains: (1) expression, or the ability to convey emotional and social information through verbal and nonverbal communication; (2) recognition and decoding, or accurately interpreting emotional expressions and social cues; and (3) regulation and control, or managing one’s emotions and behaviours in socially appropriate ways (Riggio & Reichard, 2008). Based on existing evidence, older adults may fare differently across these domains. Recognition and decoding likely show a mixed profile. While older adults have more difficulty identifying certain negative emotions, they benefit from contextual information and perform better with realistic stimuli. Their strengths in social inference and sensitivity to social context may also help offset these challenges. Expression skills appear stable with age, with no clear evidence of reduced ability to convey social or emotional cues. Regulation and control skills are more complex. On one hand, reduced inhibitory control may lead to occasional social missteps, such as oversharing or off-topic comments. On the other, older adults show stronger emotion regulation overall and tend to use proactive strategies that reduce the likelihood of emotional outbursts. In structured settings like the workplace, where norms are clearer and contextual cues are readily available, these strategies likely help keep behaviours appropriate and effective.

Taken together, the leadership lens reveals a nuanced pattern: older adults excel in social perceptiveness and expression, while behavioural flexibility, recognition of negative emotions, and regulation skills show a mix of strengths and limitations shaped by context.

Creative Thinking and Aging

Creativity is broadly defined as the ability to generate and flexibly combine ideas to form novel and useful solutions (Adnan et al., 2019). In workplace settings, creative thinking is essential because it enhances problem-solving, supports flexible responses to change, and fuels innovation by enabling the development of new products, services, and processes. Interestingly, most research to date has found that older adults consistently outperform younger adults on creative tasks. One explanation points to age-related declines in inhibitory control. When older adults process new information, they are more likely to activate not just the task-relevant concepts, but also recently encountered, no-longer-relevant information, task-unrelated thoughts, prior knowledge, and environmental cues (Amer et al., 2022). This results in a broader mental pool of loosely connected ideas, which can support creative thinking by making it easier to draw unexpected connections.

These conclusions mostly come from studies using a common paradigm where participants are exposed to distracting information during a primary task, then later complete a creativity task such as an alternate uses or idea-generation exercise. In these studies, older adults tend to outperform younger adults. However, this paradigm is limited in scope, as it primarily shows that older adults benefit when earlier distractions happen to later align with the solution (Yang et al., 2022). Whether older adults demonstrate enhanced creativity in the absence of earlier distractions remains unclear. More importantly, existing research has not examined what happens when older adults are exposed to distracting information that is later irrelevant or incongruent with the solution. In such cases, reduced inhibitory control may lead to interference rather than insight. This concern is echoed in memory research. For example, studies on cue overload show that when a single cue is linked to too many associations, retrieving the correct one becomes more difficult (Amer et al., 2022). Similarly, the broader activation of loosely connected ideas in older adults could, in theory, hinder rather than enhance creative thinking. Yet this possibility remains under-explored in creative literature. Adding to this uncertainty, a meta-analysis of workplace data found no evidence that age is associated with either declines or improvements in creativity or innovation (Rietzschel & Zacher, 2015).

Despite these open questions, other evidence supports the notion that creativity can be preserved or even enhanced with age. Neuroimaging studies using alternate uses exercises have shown that older and younger adults perform similarly, though older adults exhibit greater global efficiency across the default, fronto-parietal, and salience networks than younger adults, along with more integrated connectivity between them, suggesting an age-related shift in how creativity is neurally supported (Adnan et al., 2019). Additionally, older adults tend to experience greater positive effects, which has been linked to increased workplace creativity (Amabile et al., 2005). Their creativity also appears more responsive to job context, with both high job control (ability to determine how to perform one's tasks) and job support enhancing performance (Binnewies et al., 2008).

Decision-Making and Aging

At its core, organizational success depends on making more right decisions than wrong ones. This section explores how aging shapes decision-making through four key lenses: (1) meta-knowledge, which supports self-aware judgement; (2) conservatism, which influences openness to change; (3) risk-taking, which involves evaluating choices under uncertainty; and (4) reasoning flexibility, which affects how people apply rules and resist biases. Together, these processes help reveal how aging may influence both the quality and style of workplace decisions.

Meta-knowledge and Self-awareness

Meta-knowledge is the ability to accurately assess what you know and what you do not, which is a core form of self-awareness. In professional settings, it plays a vital role in decision-making by helping individuals recognize the limits of their expertise, avoid overconfidence, and make choices that align more effectively with organizational goals. When employees can judge the reliability of their own knowledge, they are better positioned to act with intention, collaborate strategically, and avoid costly errors that compromise deliverables, timelines, or workplace relationships.

This ability is often assessed through tasks where participants answer factual questions and then rate their confidence in each response (de Bruin et al., 2012; Kovalchik et al., 2005). Research shows that although both younger and older adults demonstrate some overconfidence, older adults tend to calibrate their confidence more accurately. They are more likely to give confidence ratings that match their performance and tend to select either high or low confidence levels, reflecting a clearer sense of what they know and what they do not. This pattern has been observed across multiple studies, including those using probability-based true-or-false tasks. Results suggest that older adults show more appropriate levels of confidence after controlling for factors such as education and cognitive ability (de Bruin et al., 2012; Kovalchik et al., 2005). These findings may reflect the accumulation of life experience as older adults may have learned to temper their overconfidence through repeated feedback and reflection. This contributes to a clearer understanding of their knowledge boundaries. In this way, aging may improve self-awareness and decision quality by drawing on crystallized insight.

Conservatism

The endowment effect refers to the tendency for people to value items more once they own them, often demanding more money to give them up than they would be willing to pay to acquire them. This asymmetry reflects loss aversion, a reluctance to part with possessions due to the perceived pain of loss outweighing the satisfaction of gain. Because it reflects a bias against change or trade, the endowment effect could be considered a behavioural indicator for conservatism. In workplace settings, this tendency may lead to resistance when established tools, workflows, or responsibilities are challenged, potentially hindering timely adaptation in environments that demand agility and responsiveness.

Older adults are often presumed to be more risk-averse and loss-sensitive, which would predict a stronger endowment effect compared to younger adults. However, a study found that older and younger adults valued items similarly, with no significant differences between what sellers demanded and what buyers offered (Kovalchik et al., 2005). One possible explanation is that older adults, through life experience, may have learned that giving up possessions is often less painful than it initially seems. This experiential learning could reduce the emotional weight of loss and weaken the endowment effect.

Risk-taking

Risk-taking inherently involves making decisions under uncertainty. In the workplace, personnel rarely face choices with complete information, requiring them to weigh potential gains against possible losses. Therefore, organizations with employees that can make informed, effective decisions under these conditions are better positioned to adapt, compete, and thrive.

Unsurprisingly, decision-making under uncertainty is often studied using experimental tasks designed to test how people respond when outcomes are not guaranteed. Two main types of uncertainty are typically examined: *risk*, where the probabilities of outcomes are known, and *ambiguity*, where those probabilities are unknown. Risk is commonly tested in two ways. In decisions from description, participants are told the exact outcomes and probabilities (e.g., choosing between a sure gain of $10 or a 50% chance of winning $20). In decisions from experience, participants repeatedly make choices and infer probabilities through feedback. This better captures how people behave when relying on personal experience rather than external information. Ambiguity, by contrast, involves choosing between options with unspecified probabilities (Frank & Seaman, 2023; Lim & Yu, 2015; Sproten et al., 2010). For example, a participant might choose between a gamble with a known 50% chance of winning and one where the odds are unclear. A preference for the known option reflects ambiguity aversion.

Findings show that older and younger adults tend to make similar choices when risks are clearly described and probabilities are known. However, when decisions rely on personal experience without explicit probabilities, older adults sometimes display slightly more risk-seeking behaviour (Lim & Yu, 2015). Evidence on age and ambiguity is mixed and limited. Some studies report no significant differences, while others suggest that older adults are less ambiguity-averse. Compared to younger adults, who typically avoid options with unknown probabilities, older adults may be more willing to engage with them (Sproten et al., 2010). This greater comfort with ambiguity may stem from their broader life experience with uncertainty or from a positivity bias that leads them to focus less on potential negatives and expect more favourable outcomes.

Reasoning Flexibility - Resistance to Framing and Applying Decision Rules

Resistance to framing refers to the ability to make consistent decisions even when the same information is presented in different ways. For example, a manager might evaluate a project proposal more favourably when told it has a "70% success rate" rather than a "30% failure rate." Strong resistance to framing means being able to see through these superficial differences and base judgments on the actual content. This ability is classified as a fluid cognitive skill because it does not depend on prior knowledge or experience, but rather on abstract reasoning and the capacity to process and compare information logically. Older adults tend to show more susceptibility to framing effects than younger adults and it is likely due to age-related declines in fluid intelligence (de Bruin et al., 2012; Strough et al., 2015). Specifically, older adults struggle to process and compare options across different framings, thus becoming more prone to being swayed by how the information is presented rather than what it actually means.

A similar pattern emerged in the task of applying novel decision rules, which refers to the ability to follow specific instructions unique to the task at hand that requires no prior experience. Success in this task depends on understanding the rule, holding it in working memory, and logically applying it to the given information. Because this process draws heavily on abstract reasoning, working memory, and flexible thinking, which reflect fluid cognitive ability, older adults tend to perform worse (de Bruin et al., 2012; Strough et al., 2015). In the workplace, this could hinder older adults' performance in fast-changing environments or roles with frequent rule shifts, especially when they cannot rely on their crystallized abilities as a scaffold.

Discussion

The preceding sections reveal a nuanced picture of cognitive aging. While many age-related changes involve well-documented declines in areas such as episodic and working memory, fluid reasoning, inhibitory control, and processing speed, these losses do not tell the whole story. Across domains like decision-making, creativity, and social cognition, older adults have shown preserved or even enhanced performance under certain conditions. These strengths appear to reflect the influence of life experience, shifting motivational priorities, and the selective use of cognitive strategies. For instance, as memory becomes less tied to precise contextual details, it may grow richer in conceptual depth and support greater meaning-making. As inhibitory control weakens, broader associative activation may foster creative insight. In socially complex situations, accumulated knowledge and emotional goals help guide more coherent and context-sensitive responses.

To synthesize these patterns, this paper introduces the *Age-Differentiated Processing Model* (see figures 1 & 2), a stage-based model of cognitive processing that captures how aging reshapes the allocation and expression of cognitive resources. Rather than viewing older and younger adults as simply stronger or weaker across various abilities, this framework highlights how both groups differ in the *way* they process, filter, and apply information throughout key stages of cognition. These stages — *access, deletion, integration, retrieval and response selection,* and *resource allocation* — represent distinct moments in mental processing where age-related differences emerge. Each stage reflects a shift not only in cognitive capacity but also in strategy and emphasis, resulting in different performance profiles across tasks and contexts. The following section examines each stage in detail, and to illustrate how these differences unfold in practice, a single example surrounding workplace decision-making is revisited at each step to show how younger and older adults may process the same scenario in distinct but equally valuable ways.

<u>Example Scenario:</u>

A cost-savings measure has been proposed in the workplace. While promising, it requires changes to established workflows and routines. The decision-maker must assess whether to support or delay its implementation.

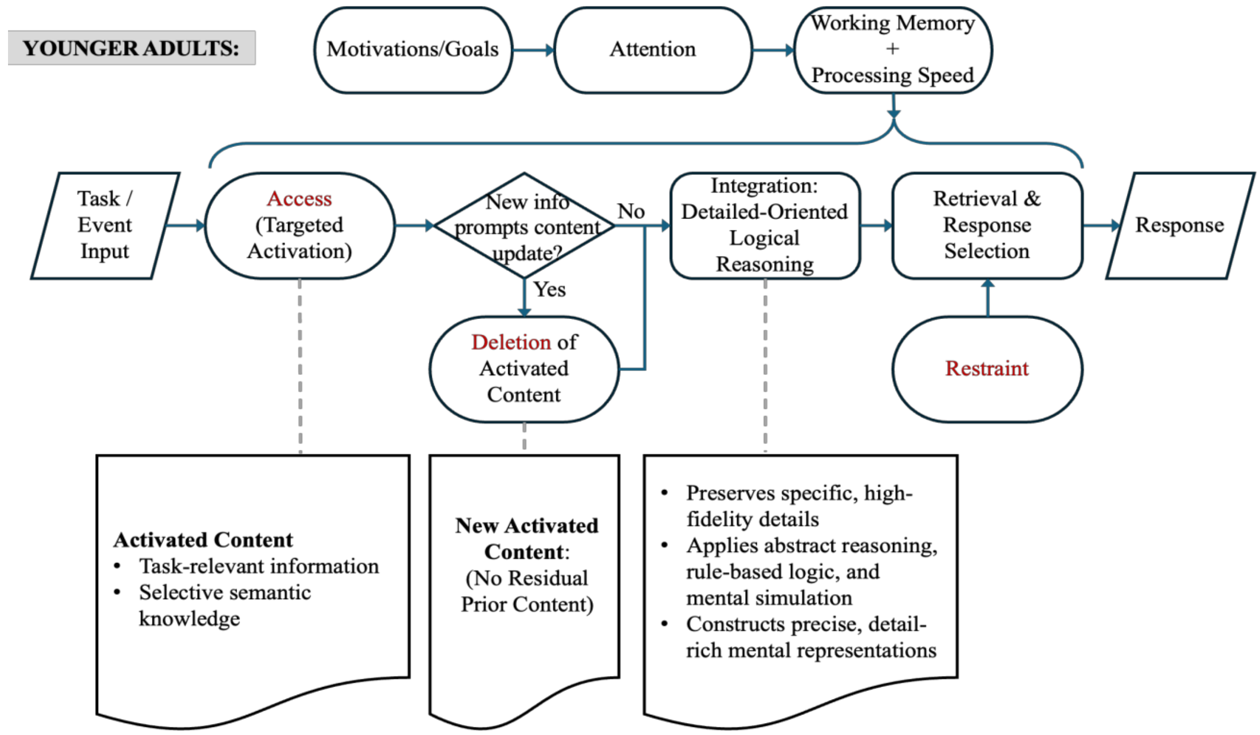

Figure 1. Age-Differentiated Processing Model - Younger Adults

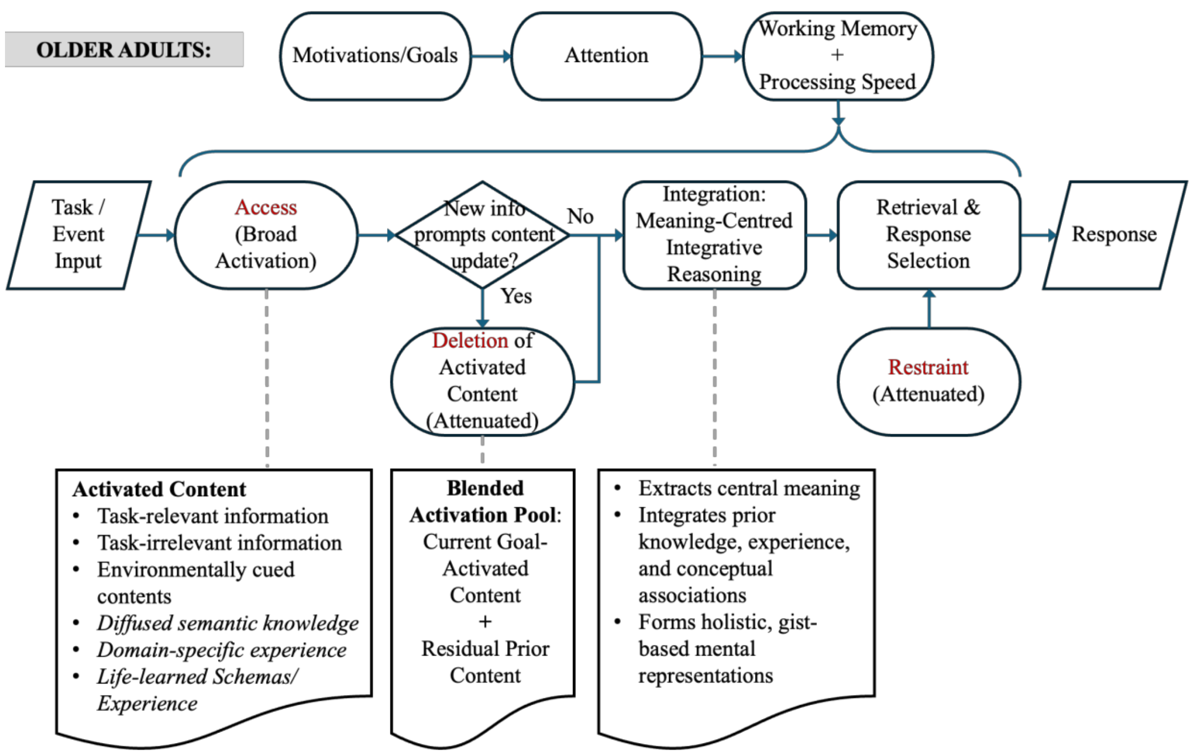

Figure 2. Age-Differentiated Processing Model - Older Adults

Access concerns the initial activation of mental content in response to a task or event. This could include any cognitively engaging activity, such as forming a social impression, making a decision under uncertainty or responding to a creative prompt. As a core function of inhibitory control, access determines which mental contents are brought to mind to support processing.

Younger adults tend to exhibit strong inhibitory control at this stage. Their activation is selective and narrowly tuned to task-relevant information, allowing for efficient focus and minimal interference. Alongside task-relevant input, they likely also draw on selectively activated semantic knowledge. In contrast, older adults show attenuated access control. Their activation tends to be broader, drawing in not only task-relevant content but also task-irrelevant information, environmentally cued content, diffused semantic associations, domain-specific experience, and life-learned schemas. The last three contents reflect crystallized intelligence and allow older adults to draw from a well of conceptual and experiential knowledge. While this expansive activation increases the diversity of information that is available for processing, it also introduces the possibility of distraction.

<u>Scenario analysis:</u> a younger adult is likely to activate information specific to the immediate task, such as projected savings, operational adjustments, and efficiency gains. Their attention is tuned to the proposal's logistics and quantifiable outcomes, supporting targeted and efficient evaluation. However, they may overlook broader organizational history or social context unless prompted. An older adult may activate a wider range of content, including proposal details, past experiences with similar initiatives, anticipated emotional reactions from staff, and contextual knowledge such as organizational values or implicit cultural attitudes toward change. This broader activation can enrich decision-making when prior knowledge is relevant and accurate, but it also increases the risk of distraction from irrelevant or outdated considerations.

Deletion refers to the cognitive control process of discarding information that was once relevant but is no longer needed as the task evolves. This step allows the mind to remain responsive to shifting demands by clearing outdated or competing material.

Younger adults typically perform well at deletion. When a task shifts, they can remove previous content from working memory and replace it with newly activated information, maintaining clarity and minimizing interference. Older adults, however, show attenuated deletion. As a result, not all previously activated content is fully removed. Some elements are only partially deleted, while others persist entirely. These residuals combine with newly accessed information to form a blended pool of activated content. While this increases the availability of associative links that can support deeper integration in later stages, it also creates the potential for interference.

<u>Scenario analysis:</u> During the discussion, new information reframes the initiative as a broader shift toward cross-functional collaboration and innovation. This reframing demands an update to how the decision is mentally represented: from a cost analysis to a strategic evaluation. A younger adult tends to discard the earlier financial frame and replace it with the new strategic one. They can quickly stop weighing budget-related metrics and shift toward content surrounding team dynamics and innovation capacity. An older adult, however, may retain aspects of the earlier financial focus (budget comparisons, or emotional reactions to past budget cuts). These elements, while now less central, continue to influence their interpretation. The result is a blended mental representation where earlier and current frames coexist. This could result in older adults appearing misaligned or overly cautious, not due to lack of understanding but because earlier evaluative criteria remain active in their reasoning.

Integration involves combining activated content into a coherent representation that can inform understanding and guide future behaviour. It reflects a key point in cognitive processing where different types of information are merged and interpreted.

Younger adults tend to emphasize detail-oriented logical reasoning at this stage. They prioritize context-specific features, apply abstract reasoning and rule-based logic, and construct high-fidelity representations that retain precise sensory or structural details.

Older adults, by contrast, tend to engage in meaning-centred, integrative reasoning. Their processing emphasizes the conceptual significance of new information, linking it with prior knowledge and accumulated experience. This often produces a more generalized, holistic representation shaped by crystallized knowledge. As new content becomes embedded within a broader web of existing knowledge and experience, it can create multiple pathways for later retrieval, allowing access through different cues, concepts, or emotional contexts. However, this process may result in less precise encoding of details, and the benefits of deeper integration depend on the situation. When prior knowledge aligns with current demands, it can enhance meaning and broaden the decision-making space; when misaligned, it may lead to biased interpretations or overlooked specifics.

<u>Scenario analysis:</u> Younger adults will likely integrate the proposal by focusing on its current features and projected outcomes. They apply abstract reasoning and logical structure to build a detailed, task-specific mental model, emphasizing measurable benefits, and procedural clarity. Their representation is sharply defined and context-bound. Older adults may sort through the blended pool of content to interpret what the proposal might imply about how people work together. They could consider patterns in team dynamics, communication breakdowns, and the

conditions that tend to foster or undermine trust. Rather than focusing on procedural steps, they may emphasize what cross-functional collaboration reveals about motivation, alignment, and cooperation. Their reasoning is guided by crystallized knowledge, leading to a generalized understanding that connects the proposal to broader insights about employee behaviour in the workplace.

Retrieval and Response Selection: At this stage, previously integrated information is retrieved and translated into a decision or behavioural response. For both age groups, this involves drawing on the mental representation formed during integration. However, older and younger adults differ in the clarity and composition of this retrieved content and in their ability to suppress competing thoughts or responses.

This stage is influenced by *restraint*, the final component of inhibitory control. It supports the suppression of interfering content and irrelevant response tendencies. Younger adults typically show stronger restraint, allowing them to retrieve a streamlined mental representation and select responses with fewer competing distractions. Older adults, by contrast, may retrieve a more diffused representation. Because their integrative stage combined prior experiences with current inputs, retrieval may include both useful background knowledge and outdated or tangential material. Weaker restraint makes it harder to suppress this interference, increasing the risk of slower or less precise responses.

Scenario analysis: Younger adults tend to retrieve a focused, task-specific mental model that clearly outlines the proposal's goals and projected outcomes. When a decision is needed, such as endorsing the proposal or recommending specific changes, they are more likely to respond quickly and with confidence. Their response is guided by the clarity of their representation and minimal interference from competing considerations. Older adults may retrieve a broader, more associative representation that includes the proposal's content alongside interpersonal implications, emotional tone, and contextual nuances. While this richness can introduce ambiguity as multiple factors compete for influence, it also reflects a more integrative and deliberative approach. As a result, slower responses may not signal indecision, but rather a thoughtful weighing of relational and long-term consequences that might be overlooked in more rapid decision-making.

Resource allocation: At every stage of information processing, cognitive resources such as working memory and processing speed are needed to manage, manipulate, and respond to information efficiently (see figures 1 & 2). These resources are shaped by attentional control, which determines how much cognitive capacity is directed toward a given task. With age, both working memory and processing speed tend to decline, limiting how much and how quickly information can be processed. However, differences in how much content is activated and retained at each stage also influence these resource demands. Younger adults typically allocate cognitive effort broadly across tasks, particularly when tasks are novel or require flexible problem-solving. Their attentional spotlight is generally guided by an exploratory tendency, driven by goals related to learning, personal growth, and information seeking. This motivational profile aligns well with a wide range of workplace and social situations, making it easier for younger adults to stay engaged across various contexts.

Older adults, by contrast, show a more selective pattern of resource allocation. Their attention and effort are more narrowly focused on tasks that align with emotionally meaningful or socially relevant goals. This reflects a motivational shift associated with aging, in which individuals prioritize relational harmony, emotional well-being, and value-consistent behaviour. As a result, when the task aligns with these goals, older adults can perform with greater focus and efficiency. But when the task lacks personal relevance or significance, they may disengage or rely on simplified heuristics to conserve effort. This selective engagement helps optimize limited resources but introduces variability in performance across contexts.

<u>Scenario analysis</u>: Throughout the proposal evaluation, younger adults likely apply steady cognitive effort across each stage. They stay engaged when the task offers opportunities to problem-solve, demonstrate competence, or acquire new information. Their broad engagement reflects a motivational orientation toward learning and advancement. Older adults allocate effort more selectively. When the proposal aligns with their values or long-term priorities, they remain fully engaged. If not, they may simplify their processing or disengage earlier, conserving effort for more personally meaningful decisions.

Looking ahead, while the Age-Differentiated Processing Model integrates existing empirical findings, future research could assess the framework more holistically by examining how these cognitive stages interact during complex, real-world tasks. Despite a growing body of research on cognitive aging, relatively few studies have applied these insights to workplace settings. This framework may offer a useful starting point for generating testable predictions about how different age groups process and respond to tasks in applied contexts. At the same time, it is important to note that the findings informing this model are primarily based on comparisons between younger adults (aged 18–30) and older adults (65+), with limited inclusion of middle-aged adults. This creates the illusion of a linear cognitive trajectory, as if one can trace the full path of cognitive aging simply by connecting the start and end points. In reality, the transition between early and late adulthood may involve nonlinear shifts or distinct trajectories that remain understudied. As such, the model may also reflect this blindspot, underscoring the need for future research that includes middle-aged populations to more accurately capture how cognitive processes evolve across the full adult lifespan. In addition, the model highlights the importance of motivational states, which shape how tasks are perceived and processed across all stages. Future research should consistently account for these differences, as they colour how individuals engage with experimental tasks. Just as crucially, motivational states may be experimentally induced to explore whether processing modes typically associated with one age group can be activated in another. This opens a promising line of inquiry with clear relevance for workplace settings, where effective leadership may require both reacting to existing motivational differences and proactively shaping them to align thinking and behaviour with shared goals. Finally, future studies could examine whether the model can help identify stage-specific bottlenecks in real-world performance. For instance, an older adult may offer a sweeping and well-integrated view of a proposal, mapping out its full landscape of implications, yet struggle to move from analysis to action. This may indicate a need for targeted support at the transition between the integration and response-selection stages.

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