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How older adults balance emotional and cognitive goals through monitoring and control using the MAMC framework

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ABSTRACT

Research suggests that aging accompanies an adaptive shift in strategic regulation of both emotion and learning. Strategic regulation plays a critical role in metacognition, or our ability to control, monitor, and modulate cognitive processes. Older adults prioritize emotional wellbeing and engage in regulating cognitive engagement based on internal motivation states as well as external environmental goals. There has been a large body of research focused on age-related shifts in regulation of cognitive and emotional processes to manage wellbeing and a large body of research examining how age-related metacognitive changes impact cognitive output. This review seeks to bridge these two domains of research and suggests that age-related cognitive changes may be better understood by considering the exchange between meta-affect (monitoring and control of emotions associated with cognitive processes) and metacognitive processes. This review also examines the socio-emotional factors that impact metacognition and specifically strategic regulation of cognitive resources associated with task engagement in older adults. In this paper, we propose that adaptive strategic regulation in older adults is the product of the integration of metacognitive and meta-affective processes. We propose that metacognition and meta-affect are intertwined, as internal emotional and cognitive goals influence the initial and ongoing understanding and evaluation of any cognitive task.

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This paper explores how older adults (individuals 60 years and older) balance emotional wellbeing and cognitive performance through strategic regulation, using a novel framework called the Meta-Affect and Metacognition (MAMC) framework (Thomas et al., 2022). In this targeted review we examine research that has identified the relationship between socio-emotional goals and cognitive engagement in older adults. We propose that how goals impact the regulation of cognitive engagement may be understood within the MAMC framework, which proposes that regulation of cognition is influenced by the

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interaction between the assessment of current goals associated with wellbeing and learning. The paper is organized into several sections, beginning with a review of literature examining the conflict between emotional and cognitive goals, followed by an in-depth explanation of the MAMC framework, which rests on a foundational metacognitive framework proposed by Nelson (1990). It then discusses how socio-emotional goals influence older adults' metacognitive processes and offers evidence from empirical studies. The paper concludes with a call for future research to examine how emotional and cognitive goals interact over time to shape older adults' behavior across different contexts.

Emotional and cognitive goals in conflict

Research examining cognitive functioning in older adults has generated complementary yet sometimes conflicting characterizations of age-related changes in cognition. There is a large body of research that suggests that older adults prioritize emotional wellbeing and therefore choose to engage in cognitive tasks that align with this motivational goal (Carstensen et al., 1999; Sedek et al., 2022). Additionally, there is a body of research that suggests that older adults demonstrate age-related deficits across a wide range of cognitive tasks (for review see, Thomas & Gutchess, 2020). Age-related deficits in performance on cognitive tasks may sometimes be accounted for by motivational shifts that prioritize wellbeing in the context of cognitive resource management. That is, when cognitive resource demand for a task is high, older adults may prioritize wellbeing over successful task engagement. In fact, research suggests a strong relationship between affect-driven motivations and motivations associated with cognitive performance (Wigfield & Eccles, 2000). In this paper, we discuss how monitoring and control of affective states and cognition may operate in a dynamic and iterative fashion to optimize cognitive output while maintaining a state of wellbeing in older adults.

Take for example an older adult engaged in a continuing education course. The continuing education course may focus on a topic relevant to supporting the individuals' daily functioning (e.g., a course on brain and memory enhancement). The individual may be highly motivated to master the material as understanding of how to support one's memory may have direct relevance to the individual. However, the motivation for mastery will require the engagement of finite cognitive resources. Research suggests that older adults will commit these resources because the cognitive task is self-relevant (Hess, 2014). However, it is important to recognize that engagement in such continuing education may temporarily decrease emotional wellbeing.

There are several reasons why emotional wellbeing may be negatively impacted. Some information may be more challenging to master, creating frustration and uncertainty. How older individuals choose, plan, and implement goals are affected by anticipated and task-concurrent emotional states, cognitive goals, and even social comparison (e.g., Bulevich & Thomas, 2012; Hess, 2014). Negative experiences may result in choice patterns that prioritize wellbeing at the cost of cognitive goals. In young adults, retrieval practice, an effortful yet effective study strategy, was shown to induce greater cognitive load and lead to higher anxiety, reducing the benefit of that strategy (Hinze & Rapp, 2014). In older adults, when some learners in a group demonstrate early mastery, other learners in that group feel threatened (Smith et al., 2017). In both groups, learning, especially learning

that is demanding, can cause negative emotions that may influence the desire to continue.

We suggest that age-related cognitive changes, as measured by performance, may be effectively understood through a metacognitive perspective that considers socio-emotional goals and emotional regulation. Research suggests that regulation of cognition depends on an evaluation of demands of the task and consideration of emotional goals. Here, we take this idea one step further and suggest that task goals that weigh the importance of cognitive performance and emotional wellbeing will impact monitoring accuracy and appropriateness of strategic regulation. Task demands and task success may alter those goals, and experience will inform assessment of difficulty and achievability. Task success guides metacognitive decisions, just as emotional goals guide meta-affective decisions. An older adult may be motivated to manage negative emotions associated with a standard cognitive exam through disengagement but may also be motivated to perform well on the task. It is unlikely that both goals can be met. An older adult may not assess the situation as one in which they can disengage to promote a positive emotional state. We suggest that it is important to understand how older adults make these tradeoffs, and whether downstream emotion regulation strategies may be employed to manage this conflict.

We adopt Feller and colleagues' (2018) definition of emotional wellbeing as a term to encompass psychological concepts such as life satisfaction, life purpose, and positive emotions. As it relates to cognitive processes associated with learning, we suggest that the evaluation of contextual factors that influence emotional wellbeing co-occur with the evaluation of learning progress. This dynamic relationship in monitoring of changing emotional and cognitive states can result in several different impacts on behavior that are used as indicators of older adult cognitive performance and functioning. Some older adults may choose to disengage from learning, resulting in poor performance. Others may weigh the value of learning as greater than the cost of wellbeing, resulting in improved performance. Still others may view the threat posed by other learners or even the instructor as one that may result in caution in how they engage with learning. Each of these outcomes on cognitive performance arises from the interplay between monitoring and control of emotional experience and cognitive performance, and prioritize optimization or cognitive resources, behavioral outcomes, and emotional experiences. When these priorities are in conflict, individuals may be required to shift strategies to achieve the optimal outcome (Filippi et al., 2020; Frank & Seaman, 2023; Thomas et al., 2022).

Meta-affect metacognition framework

We use a framework proposed by Thomas and colleagues, which suggests that monitoring and controlling learning is directly influenced by the monitoring and controlling of cognitive and emotional goals associated with learning and performance (e.g., Meta-Affect Meta-Cognition framework; Thomas et al., 2022). The MAMC rests on the foundation of long-established models of metacognition (for review see Nelson, 1990). MAMC proposes that cognitive performance and emotional experience associated with cognitive engagement is the product of meta-processes that operate to monitor and control output. The MAMC framework offers a context in which to understand why learners may opt for less effective study strategies (e.g., DeCaro & Thomas, 2020) or may choose to withhold

correct information even when they are confident in that information (e.g., Thomas et al., 2018). Like Thomas et al. (2022) we use the term meta-affect to encompass how individuals monitor emotional and more generally affective states, and exercise control to achieve optimization of those states. Importantly, in this context, meta-affect applies to monitoring and control of affective states that emerge during cognitive engagement. While the term meta-affect has sometimes been used in the Education literature (DeBellis & Goldin, 1997) where the term has traditionally been used to mean “affect about affect,” Thomas et al. (2022) and the present discussion borrows the term to refer specifically to the states of monitoring and control of affect about cognition. Like Thomas et al., we suggest that meta-affect and metacognition cooperatively operate to facilitate strategic shifts in cognitive resource deployment and task engagement to prioritize emotional experiences as they relate to cognitive outcomes (see Figure 1). The output of this process encompasses both cognitive output, like the original Nelson (1990) framework, and also emotional experience. Importantly, the MAMC framework proposes that meta-affect involves monitoring and controlling affective processes just as metacognition involves monitoring and controlling of cognitive processes. However, in the context of the MAMC framework, meta-affect centers emotional goals and assessment of emotional outcomes

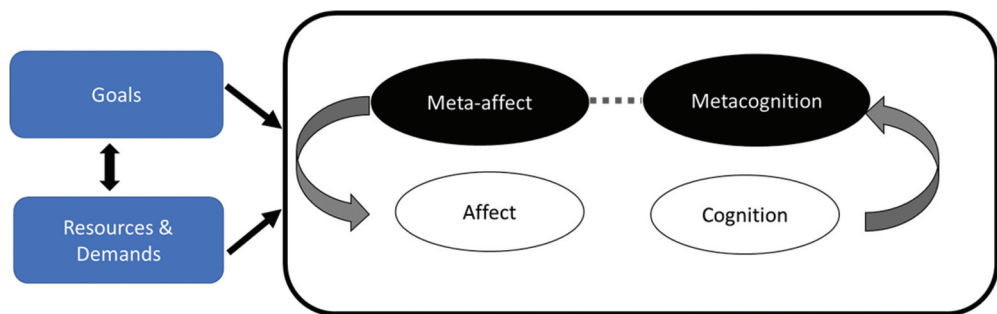


Figure 1. A revised meta-affect metacognition (MAMC) framework. Figure 1. The MAMC integration framework illustrates the dynamic interaction between meta-affect (monitoring and control of emotional states associated with cognition) and metacognition (monitoring and control of cognitive processes). The framework highlights that both meta-affect and metacognition are shaped by emotional and cognitive goals in addition to resource availability. These factors are presented in distinct boxes because they represent key external constraints or inputs that guide individuals' decisions during cognitive engagement. The output of this process encompasses both cognitive output, like the original Nelson and Narens framework, and emotional experience. Specifically, goals may encompass mastery of material and reducing anxiety, while resources and demands refer to the individual's perceived capacity (e.g., mental energy, time) and the complexity of the task. The arrows indicate the direction of influence and feedback loops within the framework. The arrows from goals and resources and demands toward meta-affect and metacognition signify that individuals' goals and their perception of available resources shape how they monitor and control both emotional and cognitive states. The bi-directional arrow between meta-affect and metacognition suggests a reciprocal relationship where emotional regulation can influence cognitive strategies and vice versa. The circular arrow between affect and cognition represents the continuous and iterative process of monitoring and adjusting emotional and cognitive states in response to task engagement and external conditions. Thus, the framework emphasizes that cognitive performance, not represented in the figure, is a result of the ongoing interplay between emotional regulation, cognitive monitoring, and contextual factors such as goals and perceived resources.

as they relate to cognitive goals and outcomes. The present discussion goes beyond Thomas et al. (2022) and considers emotion regulation, metacognition, and socio-emotional learning research involving older adults and provides a way to consider research across these areas under a unified framework of self-regulated learning.

Socio-emotional goals and emotional regulation influence cognition

Scientists have produced a large and impactful body of research that has fostered better understanding of how socioemotional goals impact older adult cognition (for review see, Sedek et al., 2022). For example, research suggests that older adults will choose to invest cognitive resources in tasks that are personally meaningful to them (e.g., Hess et al., 2021), and their performance and self-reported effort has been shown to be more strongly influenced by task relevance than that of younger adults, consistent with the prediction that motivational factors moderate cognitive engagement in later life (Hess et al., 2012). Age-related increases in the perceived costs of cognitive engagement result in older adults becoming more selective in allocated cognitive resources (e.g., Selective Engagement Theory or SET). Importantly, this SET framework implies that older adults engage in meta-processes that require monitoring of current states of wellbeing and control or selection of behaviors that will allow them to achieve a desired state of wellbeing in the context of cognitive engagement.

The Selection, Optimization, and Compensation (SOC) model of lifespan development proposes that older individuals allocate limited cognitive and emotional resources to achieve their goals (Baltes & Baltes, 1990). Indeed, older adults seem to optimize wellbeing (Charles et al., 2001), suggesting that they may be effective in regulating their emotions (Carstensen, 1993). Research examining emotion regulation suggests that older adults may engage in effective regulation through attentional deployment strategies (Wadlinger & Isaacowitz, 2011). Further, research indicates a shift in emotion regulation processes with increasing age, implying that age-related shifts in goals and motivations may impact monitoring and control of emotional states (for review, Urry & Gross, 2010).

Consistent with this proposal, the Strength and Vulnerability Integration (SAVI) theory suggests that positive emotional wellbeing in late adulthood results from the use of age-related strengths and the avoidance of age-related vulnerabilities (SAVI; Charles & Carstensen, 2010). The key age-related strengths proposed by SAVI include accrual of self-knowledge and experience, changes in goals and motivations, and selection of effective emotion regulation techniques and avoidance of vulnerabilities. This model proposes that older adults select appropriate emotion regulation strategies based on prior life experience and that older adults are driven by pro-hedonic motivations. We suggest that at the heart of the SAVI model are meta-affective strategies that involve monitoring of emotional states and control through strategic regulation and conscious evaluation and selection of situations and tasks.

The meta-process of situation selection informs both emotional experiences and metacognitive processes consequential for cognitive performance. Implicit in this and other process models that involve emotional regulation and wellbeing (e.g., Socioemotional Selectivity Theory (SST), SET), is the interaction between a meta-level and object-level (see, Nelson, 1990; Thomas et al., 2022). Take SST (Carstensen, 2006) for example, which suggests a shift in prioritization of wellbeing is a direct response to the

continuous decrease in one's time horizon. SST suggests that the perception of time results in older adults selecting to engage in more positive social engagements and focusing on more positive information generally. When time is perceived as unconstrained, individuals tend to prioritize goals related to gathering new knowledge and experiences that can serve them in the future. However, when time is perceived as limited, goals related to short-term wellbeing like regulating emotional states will be prioritized. SAVI and SST both incorporate choices to achieve emotional goals; however, SAVI highlights the role of prior experiences to foster more accurate predictions of emotional outcomes, in line with research focused on affective forecasting (Floerke et al., 2017). According to SAVI, people change the way they assess social relationships and wellbeing because of time left to live and rely on accumulated life experiences about how to regulate relationships and emotions (Charles & Piazza, 2007).

The SAVI model predicts that older adults should be more skilled at predicting outcomes based on prior experience than younger adults and, therefore, should be more adept at situation selection and modification strategies to reduce exposure to the negative consequences of some emotions. By avoiding a negative experience, older adults may also reduce the cognitive demands of regulating their emotions in the moment using cognitive reappraisal (Urry & Gross, 2010). One study found that older adults tended to select more positive and neutral material over negative material compared to younger adults and skipped more negative material in a situation modification task (Livingstone & Isaacowitz, 2015). Similarly, in a video game situation selection paradigm, older adults made more positive selections than younger adults when given a choice of games with varied emotional content (Ossenfort & Isaacowitz, 2018).

Cognitive reappraisal can also be considered a meta-process, as it involves recalling and reinterpreting the emotions related to an event to change the event's emotional impact. As with attentional deployment and situation selection, cognitive reappraisal requires an individual to assess the need for regulation at a meta-level and select appropriate control processes to impact the object level – in this case emotional experience and reinterpretation. Importantly, successful cognitive appraisal has been shown to be related to greater wellbeing and better interpersonal functioning (Gross & John, 2003).

Importantly, while emotions and socio-emotional goals have been shown to directly impact cognitive engagement, research also suggests that older adults are motivated to perform well on cognitive experimental tasks, with little consideration for socio-emotional goals (Frank et al., 2015). For example, older adults demonstrated reduced rates of mind wandering or off task thoughts when compared to younger adults in order to improve performance on a memory test (Touron, 2022). The motivation to perform well may result in engaging in cognitively effortful strategies that promote accuracy in responding. Expending cognitive effort in the context of tasks that may be devoid of personal relevance may place cognitive and socio-emotional goals in conflict with one another. We suggest that how this conflict is managed may be understood within the MAMC framework.

Considering socio-emotional goals within the MAMC framework

Thomas et al. (2022) suggested that goal-directed emotion regulation may be considered as two interactive levels and is engaged to support socio-emotional goals. Consider the meta-level as a mental simulation of the object level, where individuals evaluate goals and

manage cognitive and emotional resources. In this context we define emotional resources as the ability to recognize and manage one's current and desired emotional states. An individual may engage in some monitoring process of the simulation or model to exercise control over the object level (e.g., emotional experience, cognition processing). For example, an individual may assess their current state of learning as distant from their desired state of learning and also evaluate the emotional cost of adopting a more rigorous strategy. The individual may exercise control to affect the object level by adopting a more rigorous strategy. Control and monitoring may be defined in terms of the flow of information between the meta-level and the object level, with the meta-level understanding the object level through monitoring and influencing the object level through control. Therefore, metacognition and meta-affective control over the object level would be control over processes associated with learning and the emotional experiences associated with learning.

Within the context of the MAMC framework, older adults may engage in monitoring and control of emotional or affect states to achieve a desired state of wellbeing as they engage in cognitive tasks. This perspective suggests that emotion regulation engaged to support socio-emotional goals is a meta-process. By considering the MAMC framework as a way to understand self-regulated learning in older adults, in this paper we suggest that researchers will be better able to determine when older adults may prioritize cognitive goals and when they may prioritize emotional goals to achieve desired states of wellbeing in the context of cognitive performance.

Returning to the example of the older adult engaged in a challenging continuing education course. To maintain emotional wellbeing older adults may choose to avoid content they find highly challenging, content that they may find less personally relevant, or content that may cause them to consider their own cognitive deficits. While an older adult may be motivated to learn, the goal toward wellbeing may be more important in this scenario. Each of these factors may drive situation selections processes.

Alternatively, older adults may choose to engage with the task that may result in a negative emotional experience but may reevaluate that experience as beneficial as they may consider the benefit of the knowledge accrued to outweigh the cost of the negative emotional experience. Although there is research that examines attentional deployment and cognitive reappraisal as emotional regulation strategies, it remains unclear as to how the selection of these different control processes may vary in the context of cognitive-related goals (cf., Lee et al., 2024).

Cognitive resources and task demands influence meta-affect and metacognition

Older adults may be motivated to select less cognitively demanding activities because of declines in physical and cognitive resources (e.g., Baltes et al., 1999). Therefore, older adults may choose to disengage from lifelong learning courses because the cognitive demands become too costly. Older individuals may be aware of age-related changes in resources and prioritize goals in the context of this awareness. The cost or demands of a task may be monitored and evaluated as older adults select a level of engagement, or exercise control over the object level. SET (Hess, 2014) suggesting that costs are a primary driver of engagement, thereby

making explicit a metacognitive cue that may drive selection or control processes. Consistent with these models, research has suggested that older adults are less likely to engage in cognitively demanding activities as compared to less demanding activities (e.g., Baltes & Lang, 1997; Thomas & Millar, 2012). MAMC provides a useful framework to consider whether these are deliberate choices that consider both assessment of cognitive resources and emotional consequences associated with demanding tasks.

Importantly, models like SET propose that individuals assess or monitor the cognitive and emotional consequences associated with task engagement and choose what and how to engage based on these assessments and personal goals (Hess et al., 2022). The model directly aligns with the general conceptualization of monitoring and control between a meta and an object level of cognition (cf., Nelson, 1990). In the context of SET, the consequences of this cost-benefits analysis may be a general reduction in active participation for more cognitively demanding tasks. This normative age-related reduction in engagement may be counteracted if positive benefits are perceived to outweigh costs. For example, older adults have been shown to engage in more cognitively effortful processes when the situations are constructed to be more meaningful to them (Hess et al., 2001). Traditional metacognitive models assume that learners approach a cognitive task with the optimal level of task engagement. However, the socio-emotional aging literature presents compelling evidence that motivated task engagement is dependent on a host of subjective assessments.

At the same time, the integration of meta-affective and metacognitive processes outlined in MAMC is shaped by the cognitive resources available to older adults. As described by Thomas et al. (2022), the meta-level in MAMC continuously monitors not only task demands and anticipated affective outcomes but also the cognitive resources needed to carry out control decisions. This approach aligns with evidence that the ability to use emotional information to guide cognition varies with individual differences in cognitive capacity (Mather & Knight, 2005) and is further disrupted in Alzheimer's disease and related conditions (Kensinger et al., 2002). Because emotion regulation itself draws on executive functions and working memory, it imposes cognitive costs that may limit the precision or speed with which affective and cognitive signals are integrated (Scheffel & Gartner, 2025). Recognizing these constraints within MAMC highlights that older adults' engagement decisions reflect not only the perceived value of cognitive and emotional outcomes but also the resources available to integrate them, thereby helping to explain heterogeneity in performance across tasks and individuals. Importantly, as cognitive resources become increasingly compromised, the ability to effectively regulate emotional experiences in the context of cognitive engagement may also become comprised.

That said, models like SET and SOC have generated numerous important empirical studies highlighting the interaction between emotional and cognitive goals, and suggesting that even in the context of age-related changes in necessary cognitive resources, older adults may be able to engage in these monitoring and regulation processes. We suggest that additional progress toward understanding this important interaction may be gained by examining the direct relationship between monitoring and control processes, and by directly assessing the contribution of emotion regulation as it impacts regulation of cognition processes in older adults. We suggest that meta-affective and metacognitive

monitoring and control will be directly influenced by internal motivations as well as external pressures, cognitive resources, and demands of the task.

When both are considered as factors impacting optimization of behavior, inconsistent findings in the older adult metacognition literature are resolved. For example, Thomas et al. (2011) found that in conditions where older adults were asked to retrieve cues relevant for promoting more accurate feeling-of-knowing predictions, they were as accurate as young adults. These results suggest that external support may help older adults manage the demands of the task by directing them to relevant diagnostic cues or cues useful in accurately monitoring cognitive processes. These results also suggest that older adults may not have been motivated to expend the cognitive effort to retrieve or use diagnostic cues to make metacognitive predictions. Similarly, when older adults were directed to expend more cognitive effort during retrieval and given instructions regarding how to weigh features that may influence their confidence in retrieved memories, monitoring accuracy as measured by within person correlations were improved (Bulevich & Thomas, 2012).

Counter to the assumption that older adults perform less well than younger adults in high demanding tasks, Bulevich and Thomas (2012) found that when task demands were high, older participants were more successful in monitoring their memories than when task demands were low. Specifically, when older participants took a cued recall final test, they demonstrated a stronger positive relationship between confidence and accuracy than when they took a less demanding four-alternative forced-choice recognition test. In this study participants were first exposed to a short video and were then presented with a narrative of the video, which included information inconsistent with the video. In experiments like these, researchers often find that the presentation of inconsistent information in the narrative impairs retrieval of details from the video. Further, people tend to remember incorrect information with a high degree of confidence. The disruption in the confidence-accuracy relationship improved when older participants took a cued recall test. That is, even though participants retrieved incorrect details on the cued recall test, they were more likely to assign it an appropriate and low confidence rating.

The results from Bulevich and Thomas (2012) suggest that older adults were motivated to perform well on the task and met the challenges of a highly demanding task. The results also suggest that demanding tasks may also support older adult performance. Importantly, research also suggests that task demands may affect motivation. When the demands of the task are too high, motivation may shift from a state of wanting to perform well to a state of wanting to perform well enough.

Goals and motivations likely impact older adults' metacognitive monitoring and control to affect optimization of wellbeing and behavior. However, this relationship is not widely considered. Take for example the research by Tullis and Benjamin (2012) who reported age differences in strategic regulation using an honor/dishonor methodology. In their experiments participants either received the items they selected for restudy (choices honored) or received the items they did not select (choices dishonored). While young and older adults chose to restudy, items associated with lower predictions of future retrievability, only younger adults' memory performance improved after restudying the items they selected. In fact, older adults demonstrated numerically higher performance when they restudied the items *they did not select*. The authors posited that these findings demonstrated a failure in metacognitive control in older adults. However, there are

alternative interpretations of the data. The manipulation of dishonoring choices could yield altered motivations and task appraisals in older adults, which may have had downstream consequences for subsequent study behavior. For example, older adults *not* given those items they selected may reappraise their choices, ultimately selectively engaging in the re-learning opportunity in a manner they would not have otherwise, which may have boosted performance regardless of what was studied. In this instance, altered reappraisal of learning and motivations shifts, in addition to the relationship between monitoring and control, help us understand the cognitive outcomes for older adults.

There is a growing body of research to suggest that older adult metacognitive control decisions are influenced by their goals and value assigned to the task or components of the task. Older adults have been shown to alter their strategies to compensate from age-related declines (e.g., McDonough et al., 2015) and they have been shown to use experimentally manipulated value to guide study time allocation, devoting more time to high value as compared to low value information (Benjamin & Ross, 2008). Research has demonstrated that older adults show equivalent recall of high-value words despite overall age differences in number of words recalled (McGillivray & Castel, 2011). The research on value directed remembering suggests that older adults may use explicit cues or goals to establish parameters that impact how they engage in cognitive tasks. The agenda-based regulation model (Ariel et al., 2009) suggests that individuals may develop agendas based on study goals or task constraints and use these agendas to guide study decisions. For example, when older and younger participants were given the choice to use either item difficulty or reward when selecting items for result, they chose reward over item difficulty.

Importantly, while older adults may prioritize some information for learning in response to extrinsic motivators, they sometimes demonstrate less sensitivity to monetary reward-based influences on learning (Eppinger et al., 2013; but see; Spaniol et al., 2014). This reduced sensitivity to certain financial incentives is also consistent with theories of changes in motivation across the life span. A focus on the present due to shorter time horizons (Carstensen, 2006), a motivation to maintain a positive sense of wellbeing (Charles & Carstensen, 2010), and selectively engagement (Hess, 2014) all suggest that how older adults respond to extrinsic motivators (e.g., financial incentives), and how that response influences cognitive output, may be influenced by monitoring and control of both emotional states and cognitive performance.

Older adults may be aware of deficits or changes in cognitive processes and/or available cognitive resources and may use the parameters of the tasks to guide their approach. The research on agenda-based regulation and value directed remembering implies resource management, and consideration of prior experiences to guide metacognitive control (see also Koriati et al., 2004 for a discussion of theory-based processes in metacognition). However, the metacognitive literature says little on the impact of socio-emotional regulation in the consideration of the establishment of goals.

Uniting meta-affect and metacognition to understand older adult cognitive performance

Integrating socio-emotional factors and emotion regulation with metacognitive processes provides a stronger account of cognitive performance in later life. Recent reviews indicate that motivational selectivity remains relatively preserved or even heightened with age,

enabling older adults to prioritize personally meaningful or affectively positive information even as cognitive selectivity declines (Swirsky & Spaniol, 2019). Converging evidence argues that motivation – cognition interactions are best understood by integrating behavioral, affective, and lifespan perspectives rather than treating these constructs in isolation (Braver et al., 2014). Building on this work, the MAMC framework specifies how meta-affective monitoring and metacognitive monitoring operate in tandem to guide control decisions, including strategy selection, effort investment, and engagement, when cognitive and socio-emotional goals intersect. This joint operation yields clear predictions about when older adults will persist, shift strategies, or disengage, and it situates observed performance within a process-level account of goal negotiation. Selective Engagement Theory is consistent with this view by emphasizing cost – benefit tradeoffs in effort mobilization Hess (2014), but MAMC makes explicit how affective and metacognitive signals are monitored and integrated to shape control over time.

An important implication of this integrated view is that it explains behavior in contexts where cognitive and socio-emotional goals come into conflict. Age-based stereotype threat (ABST) provides one empirical illustration. When negative age-related stereotypes are cued, older adults often adopt more conservative response policies, including withholding answers or slowing responses, which reduces both correct and incorrect outputs while helping to maintain well-being (Fourquet et al., 2020; Thomas et al., 2018; Wong & Gallo, 2016). When opportunities to regulate in this manner are constrained, differences between high-threat and low-threat groups diminish, indicating that the effect reflects strategic control rather than loss of memory access (Thomas et al., 2018). Stereotype threat can also limit the usual gains in metacognitive calibration that accrue with task experience in value-directed remembering, consistent with the claim that meta-affective states modulate metacognitive control in real time (Fourquet et al., 2020). These results align with the prediction that meta-affective monitoring of anticipated emotional costs and metacognitive monitoring of task demands jointly determine engagement and strategy choice.

Together these findings indicate that older adults' cognitive performance cannot be understood solely in terms of structural decline or resource limitations. Instead, performance reflects continuous negotiation between cognitive and socio-emotional goals, supported by the integrated operation of meta-affective and metacognitive monitoring. This integration explains why older adults selectively allocate effort, shift strategies, or disengage depending on the perceived emotional costs and cognitive benefits of a task. It also highlights the importance of studying individual differences and contextual factors, such as task framing or personal relevance, that may amplify or attenuate these processes. By formalizing the mechanisms through which emotional and cognitive information are combined to guide control, the MAMC framework extends earlier models of motivational selectivity and provides a testable account of how older adults regulate engagement in real time across diverse cognitive contexts.

Future directions: adjudicating conflicting goals and implementing MAMC

MAMC provides a principled way to adjudicate conflicts between cognitive and socio-emotional goals by treating engagement decisions as the outcome of continuous, reciprocal exchanges between meta-affective and metacognitive monitoring and control.

Mechanistically, meta-affective monitoring estimates the current and anticipated costs and benefits for emotional wellbeing given feasible control strategies, while metacognitive monitoring estimates the current and anticipated costs and benefits for task success given cognitive resources and task demands (Nelson, 1990; Thomas et al., 2022). Control policies are selected when the integrated subjective value of a candidate action exceeds available alternatives and can shift over time as monitoring updates the estimates. This yields concrete predictions when goals are in conflict. Under stereotype threat, conservative response policies that protect affective goals can reduce both correct and false reports, even when memory access is intact. This is because the meta-affective system elevates the perceived cost of errors, and the metacognitive system adapts criterion placement accordingly (Fourquet et al., 2020; Thomas et al., 2018; Wong & Gallo, 2016). Under high perceived costs of engagement, older adults should disengage unless task meaning or value increases the perceived benefits, consistent with selective engagement accounts in aging (Hess, 2014). When value or relevance is made salient, control should shift toward effortful strategies despite higher short-term affective costs, as seen in value-directed remembering and agenda-based regulation findings (Ariel et al., 2009; Knowlton & Castel, 2022; McGillivray & Castel, 2011). MAMC therefore specifies how conflicts are resolved in real time: monitoring streams are integrated to guide control toward disengagement, reappraisal, strategy change, or persistence, with observable consequences for accuracy, confidence, response criteria, and effort allocation.

To implement MAMC empirically, simultaneous assessment of meta-affect and metacognition in older adults can be achieved with established behavioral paradigms augmented to capture both streams at the trial and session levels. As one example, researchers could first adapt standard metamemory tasks by pairing judgments of learning, confidence ratings, study-time choices, and withholding decisions with concurrent affect measures. Positive and negative affect can be assessed repeatedly with brief self-reports (e.g., PANAS short forms) and state anxiety with short STAI items, collected at block or trial granularity to measure meta-affective states as they fluctuate with task demands (Spielberger, 1983; Watson et al., 1988). This approach leverages proximal metacognitive measurement, while allowing direct tests of whether momentary affect predicts strategic shifts independent of metacognitive accuracy.

Another possibility is to embed affective manipulations into value-directed remembering or agenda-based regulation tasks. For example, researchers could couple reward or goal relevance cues with time pressure or evaluative feedback to induce affective load, then examine whether trial-level affect reports and metacognitive judgments jointly predict study selection, response caution, or persistence across cycles of practice and test (Ariel et al., 2009; Knowlton & Castel, 2022; McGillivray & Castel, 2011).

Conclusions

The Meta-Affect Metacognition (MAMC) framework directly addresses the complex relationship between management of emotional and cognitive goals. Although the MAMC framework was not developed to account for age-related changes in monitoring, control, and output, we suggest that when applied to the cognitive aging and socio-emotional literatures, inconsistent patterns of data may be reconciled, and novel ways of evaluated older adult cognitive performance emerges. The

framework asserts that emotional and cognitive goals cannot be uncoupled and to understand output and performance in one domain, researchers should also consider the other. Although there is some recent research that has examined monitoring and control of emotions (meta-affect) within the context of learning (Ackerman & Thompson, 2017; Azevedo et al., 2017) and cognitive engagement (Hess, 2014), researchers have yet to tackle the relationship and interactions between meta-affect and metacognition.

Importantly, the studies included in this review focus predominantly on Western populations, potentially limiting the applicability of findings to different cultural contexts. Additionally, this review largely synthesizes cross-sectional findings, which may limit insights into how metacognitive and emotional processes develop over time. A fruitful next step to a clearer understanding of age-related changes in cognitive processes is to examine how the evaluation of and regulation toward emotional and cognitive goals shift over the course of engagement, and how these interacting processes impact general cognitive performance, as well as how these processes change over time. We are hopeful that the synthesis of research focused on how and why older adults optimize cognitive performance and emotional states prompts researchers to test hypotheses examining how meta-affective and metacognitive processes change in the context of the home, the lab, the classroom, and/or the doctor's office.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

No new data were generated or analyzed in support of this research. All data discussed in this review are drawn from previously published studies, which are cited within the manuscript.

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