

Beyond Cognitive Decline:
Cognitive and Socioemotional Determinants of Everyday Problem Solving in Ageing

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For my mother,

who believed in me long before this journey began and whose love continues to guide me. I only wish you had been here to see this day.

For my father,

whose memory has always been a part of me. I hope you would have been proud to see this milestone.

And for my husband,

who believed in me even when I doubted myself, who walked beside me through every step of this journey, and whose unwavering love, patience, and support made this achievement possible. I could not have done this without you.

Abstract

The aim of this thesis was to investigate the contribution of cognitive, socioemotional, and person-related factors to age-group differences between younger and older adults, and to individual differences among older adults, in well-defined and ill-defined everyday problem solving.

The thesis includes three empirical studies. Study 1 involved the translation, cultural adaptation, and validation of Greek-language measures used in Studies 2 and 3. Study 2 compared younger and older adults in executive-function performance, positive and negative affect, self-efficacy, and performance on well-defined and ill-defined everyday problems. Younger adults performed better on executive-function tasks, well-defined problems, and ill-defined problems overall, but the two age groups performed comparably on interpersonal ill-defined problems. None of the cognitive or person-related variables measured in Study 2 were significantly associated with interpersonal ill-defined problem-solving performance.

Study 3 examined affective theory of mind, psychological inflexibility and experiential avoidance, divergent-thinking performance, and self-perceptions of ageing as potential contributors to interpersonal ill-defined problem solving among older adults. Lower psychological inflexibility and experiential avoidance showed the strongest independent association with better performance, while better affective theory of mind, higher divergent-thinking performance, and more positive self-perceptions of ageing also made significant independent contributions. Exploratory indirect-effect analyses indicated that creativity and self-perceptions of ageing may represent potential pathways in these associations. These cross-sectional analyses should not be interpreted as establishing causal mediation.

Overall, the findings support an integrated account of interpersonal problem solving in older adulthood, highlighting the importance of processes beyond executive-function decline. Affective theory of mind, psychological inflexibility and experiential avoidance,

divergent thinking, and self-perceptions of ageing may help explain individual differences in older adults' ability to generate safe and effective solutions to socially and emotionally complex everyday problems.

Keywords: Everyday problem solving, ill-defined problems, executive functions, positive and negative affect, self-efficacy, self-perceptions of ageing, affective theory of mind, psychological inflexibility, experiential avoidance, creativity

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Declaration

I declare that this thesis is my own work and has not been submitted in substantially the same form for the award of a degree at any other institution. Where reference has been made to the work of others, it has been appropriately acknowledged.

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Chapter 1 – General Introduction

Solving everyday problems is a vital skill that helps individuals in managing the challenges they encounter in their daily lives, both personally and professionally. The ability to analyze situations, find solutions, and make decisions is essential for the smooth flow of everyday activities and the achievement of personal, academic and professional goals.

Problems in everyday life can vary in nature and complexity. They can be practical, such as resolving a technical issue in the workplace, or personal, such as managing relationships with others. Also, many of the problems may be predictable, such as time management, while others may arise unexpectedly, requiring immediate and effective solutions (Keefer & Landau, 2016). The way people perceive a problem plays an important role in their effectiveness in solving it. A problem can cause stress and pressure, but if people see it as a challenge that offers opportunities for growth and improvement, then they can tackle it with greater confidence and effectiveness (JulieHicks & JoNell, 2004). Effective everyday problem solving allows people to face challenges on their own, without depending on others, thereby boosting their self-confidence (Burton et al., 2006).

According to Thornton et al. (2013), there are four stages through which successful problem solving occurs. The first stage is that of understanding the problem. In this stage, individuals examine the available information, as well as the relationships they have with the requirements of the problem. In the second stage, individuals search for strategies and apply them, in order to arrive at a specific plan for solving the problem. The third stage is the one where individuals apply the plan they have created in the previous stage and are particularly careful not to make any mistakes during the course of the solution. The last stage is that of reexamining the solution that individuals have arrived at, while at the same time also developing metacognitive skills, through the experience of solving the specific problem. In the stage of understanding the problem, metacognitive skills are seen in the actions that

decision-makers undertake, such as removing unnecessary information and comparing the problem with other problems they have encountered in the past (Guner & Erbay, 2021). In the reflection stage, metacognition could include second thoughts whether the designed plan has been indeed effective, whether individuals understood correctly the problem, or whether they have to re-think it (Pennequin et al., 2010).

Research in the area of problem solving in general, and everyday problem solving more specifically, has shown a distinction between well-defined and ill-defined problems (Nguyen-Thinh et al., 2013; Reed, 2016). A well-defined problem is characterized by a constrained problem space and a single correct solution (Jonassen, 2000; Mienaltowski, 2011). An ill-defined problem is a “messy” problem, with multiple possible solutions that could be equally effective and relevant. An ill-defined problem is a mirror of real-world problems where individuals have to overcome possible obstacles, creating and justifying arguments on the effectiveness and appropriateness of the solution proposed, rather than producing an algorithm solution (Jonassen, 2000; Mienaltowski, 2011).

Based on the analysis provided by Thornton and Dumke (2005), it is difficult to come up with a universal and standard measurement of effectiveness of problem-solving strategies, mainly because not all individuals have the same resources to solve them, not all pathways to be followed are the same and neither are the available alternative solutions feasible for all. In this context, it has been proposed that an alternative measure could be *problem-solving fluency*. That is, evaluating the actual and safe solutions that are available to most decision makers (Allaire & Marsiske, 2002). Although *quality of solutions* has also been said to be a valid index of efficacy in everyday problem solving, this measure is not supported by Thornton and Dumke (2005), who consider that it is actually difficult to measure quality.

Problem Solving Ability and Ageing

Previous research has explored older adults' performance on both well- and ill-defined everyday problems suggesting different patterns of performance (Allaire & Marsiske, 2002). Specifically, evidence suggests that older adults have significantly higher performance in everyday problem-solving tasks, both well- and ill-defined ones, but especially in ill-defined tasks that include both instrumental and interpersonal problems, as compared to lab-based problem-solving tasks (Allaire & Marsiske, 2002; Artistic et al., 2010; Mienaltowski, 2011). The research findings of Cutler et al. (2021) support that older people are more capable of solving ill-defined problems, such as life crises. In the study, researchers from three countries (Britain, Austria, Canada), analyzed data from the responses given in 2020 to a global survey of 46,576 people aged 18 to 99 from 67 countries. They found that - compared to younger people - older adults resolved social and other interpersonal conflicts and problems more effectively and quickly, which was attributed to their longer life and - thus longer problem-solving experience. In another relatively larger study, Chen et al. (2017) analysed data from 221 healthy adults (aged 24-93 years) from the Dallas Lifespan Brain Study, and concluded that everyday problem-solving capacity improves as younger people move towards middle age. Then, after the beginning of their 50s, crystallized ability, which is the core ability in problem solving, starts diminishing, leading to an overall diminishing in problem-solving capacity, a finding that somewhat contradicts that of Cutler et al. (2021). Another important finding is that at younger ages, it is fluid ability and not crystallized one that matters in problem solving. The authors suggested that at younger ages, people collect information and develop knowledge, so fluid reasoning is important for understanding new information. However, as people mature in age, they tend to rely on the expertise they have achieved through their experience in problem solving, which is associated with their crystallized ability.

Research on the use of strategies to solve problems has shown that older adults, as compared to young adults, combine problem-focused and emotion-focused strategies when solving problems more successfully than younger ones, which may lead to better performance and effectiveness of the solutions provided (Artistico et al., 2003; Blanchard-Fields, 2007; Diehl et al., 2005). It has been further supported that the abovementioned strategies may account for the better performance of older adults in instrumental ill-defined problems, which are more achievement oriented, and in interpersonal ill-defined problems, which are more social oriented (Marsiske & Willis, 1998; Meegan & Berg, 2002; Mienaltowski, 2011; Singh et al., 2010). In the study of Blanchard-Fields et al. (2007), it was found that older people were more problem-focused, when dealing with instrumental problems, while also becoming more avoidant when dealing with interpersonal problems, as compared with younger adults. The researchers reached the general conclusion that older people are more effective in dealing with both instrumental and interpersonal problems than younger ones, however they also concluded that this was further dependent on the nature of the problem to be dealt with. Evidence is not consistent though, for instance Yeung et al. (2012) suggested that younger adults are more likely to use problem-focused strategies in everyday problem solving, while older adults tend to regulate their emotions without adopting a specific strategy to solve the problem. The authors also found that age differences in the adoption of problem-focused strategy was moderated by future time. That is, if the problem is to be solved in the long-run, then older adults were more likely to develop problem-focused strategies as well.

Kimbler (2013) also suggested that younger and older people may differ not only on how they approach everyday problems, but also on their preference for the kind of everyday problems they occupy with. Whereas younger people choose to mostly deal with problems that emerge suddenly and need immediate resolving, older people prefer to focus on more

long-lasting everyday problems, i.e. more standard problems that they face every day and are part of the daily reality of human beings. Younger people appear to also be more impulsive in their responses to the various problems arising, whereas older ones take their time to make problem-solving decisions, mainly utilizing their knowledge and previous experience (Steinberg et al., 2008). This could be an important difference, when dealing with serious and ill-defined problems that have an impact on everyday life.

To sum up the evidence above, there are various factors related to the nature of the problems that modulate age differences in everyday problem-solving. Some of the key proposed factors in the literature as reviewed above are whether problems are well or ill-defined, whether problems suddenly emerge or are more common and long-lasting, as well as the timing when solution to a problem has to be eventually given. In addition, to the types of problems, other cognitive and personal related factors have been closely linked to age-related differences in problem solving. One of the first cognitive abilities proposed that could account for the differences between older and younger people in problem solving is the category of processes called *executive functions* (EFs).

Executive Functions, Everyday Problems Solving and Ageing

EFs are involved in almost every activity of people's daily lives. They are valuable processes that control and regulate thoughts, emotions, and behavior, leading to a productive lifestyle. They play an important role in activities that require organization, concentration and decision-making such as those in academic and work life, as well as in simple activities that people perform every day, such as preparing a meal and driving (Koziol et al., 2012). More specifically, EFs are defined as the higher cognitive functions, which are necessary for achieving goal-oriented behaviour, that is for planning, executing and implementing successfully goals and action plans (Diamond, 2013). EFs is an umbrella term that refer to a set of processes and different models have proposed different components, such as updating

in working memory, inhibition and attention control, and cognitive flexibility (Diamond, 2013). They are, therefore, of great importance for any activity that requires organizing a sequence of behaviour (e.g., cooking a meal), planning, decision-making, problem-solving, and adapting to new and changing situations where the person may not have already a predetermined set of behaviours (e.g., starting a new job).

Most authors agree that EFs consists of three main components, namely, shifting, inhibition and updating (Delis et al., 2001; Hedden & Yoon, 2006; Hull et al., Miyake et al., 2000; Pettigrew & Martin, 2014). Some authors however support that the structure of EFs may change with older age. Specifically, it has been proposed a two-factor model of EFs in older adults where updating and switching comprise a single factor and inhibition a second independent factor (e.g., Friedman & Miyake, 2004). There is support for this hypothesis from several studies investigating age-related changes in EFs (Hedden & Yoon, 2006; Hull et al., 2008; Pettigrew & Martin, 2014) and using neuroimaging (Collete and Van der Linden, 2002).

In addition, it has been proposed that cognitive performance overall but in particular EFs decline with age. Studies comparing performance of younger and older adults on tasks of EF support worse performance of older adults in various measures, like the Wisconsin Card Sorting Task (Fisk & Sharp, 2004).

Studies using other tasks that tap on the three main components of EFs such as the Stroop, verbal fluency, n-back and plus or minus tasks, have supported an age-related decline in performance (Adólfssdóttir et al., 2016; Hull et al., 2008; Shokri et al., 2016; Vaughan, 2008). However, other studies have not supported a decline with age in tasks that measure inhibition. For instance, in a meta-analysis study, Rey-Mermet and Gade (2017) concluded that there was no evidence for age-related inhibition deficit. Others have suggested that age-

related differences in inhibition are not evident when differences in speed of processing are considered (Salthouse, 2005).

As far as updating in older adults is concerned, there is also mixed evidence. While some studies have reported worse updating capacity with increasing age (Basak & Verhaeghen, 2011; Miyake et al., 2000; Raye et al., 2002; Van der Linden et al., 1994); others have not found support for differences between younger and older adults on updating (Miyake et al., 2000). Research also shows that updating capacity in older adults is not affected in a uniform way across contexts and tasks. Specifically, studies that use context-relevant tasks using stories and assessing spatial and temporal updating, found better performance for older adults in comparison to studies using typical experimental updating tasks (eg. n-back task). Therefore, research on EFs also supports the hypothesis that content resembling everyday tasks boosts performance in older adults (Artuso et al., 2016; Basak & Verhaeghen, 2011; Radvansky et al., 2003).

With regard to the contribution of EFs to problem solving, Zelazo et al., (1997) proposed that EFs are involved in the four phases of problem solving, namely representation, planning, execution, and evaluation. This problem-solving framework serves towards organizing the different aspects of executive control and explains how they can be harmonized into a single dominant structure (Zelazo & Müller, 2002). Overall, previous research has shown that inhibition, shifting, and updating capacities are significantly associated with peoples' ability to effectively solve complex problems (Agostino et al., 2010, Bindman et al., 2015. Brock et al., 2009). In general, EFs are the functions that guide humans in approaching a problem, analyzing it and solving it. Specifically, effective inhibition is important to resists distraction and focus attention on the problem to be solved (Schäfer et al., (2024). Cognitive flexibility and being able to effectively shift between representations or/and tasks is essential to adapt to new information, while at the same time also shifting their

concentration from the problem to its solution (Proctor, 2020). As far as updating is concerned, is important to identify new information that is up-to-date with the problem they have to resolve, while also identifying new alternative solutions or adjusting the solutions they have already provided to new circumstances, in order for their solution to be more effective (Komarudin & Sutadji, 2020).

There is a general agreement that cognitive abilities typically decline in healthy ageing. Older adults often show reduced brain activity in certain areas, such as medial temporal and visual areas (Grady (2008). It is clear that age-related declines in cognitive function may be linked, at least in part, to these declines in brain activity (Grady, 2008). On the other hand, it is worth noting that increased activity is observed in some areas of the brain of the elderly, compared to younger individuals, such as in the ventral and dorsal prefrontal cortex, during memory processing, or in the frontal and parietal areas, when the older adults are engaged in complex cognitive tasks (Grady, 2008). This can be interpreted as a compensatory process where additional brain regions are recruited when engaging in a demanding cognitive task to compensate for the reduced activity of the default areas supporting “knowing” (Grady, 2008). In addition, not all cognitive domains seem to be affected by age, in particular vocabulary and knowledge remain relatively intact in the older age (Kostaridou - Efklides, 2011).

The findings of the research conducted by Shean and Haskins (2013) also provide useful insights regarding problem-solving with respect to EFs, cognitive functions and ageing. More specifically, the researchers compared younger and older adults on general cognitive functioning and social cognitive ability and their relationship with practical problem solving. They concluded that both general cognitive functioning and social cognitive ability influence practical problem solving in older adults. In younger adults, the findings

indicated that only general cognitive ability influenced their practical ability to solve problems.

It has been suggested that EFs capacity cannot explain all the variance in age-related differences in problem-solving, particularly in ill-defined problems (Thornton et al., 2013; Toor et al., 2022). Other person-related factors that may change with age, such as conscientiousness and neuroticism, could explain age differences in problem-solving (Kipman et al., 2022). In addition, cognitive, socioemotional, and person-related factors—including emotion regulation, trait affect, theory of mind (ToM), creativity, self-efficacy, and self-perceptions of ageing—have been associated with problem solving and may also change across adulthood. These factors may therefore contribute to age-related and individual differences in everyday problem-solving performance (Blanchard-Fields, 2007; Carstensen et al., 2003). The following sections consider each factor separately.

Emotion Regulation, Problem Solving and Ageing

Emotion regulation is closely linked to cognition and may contribute to variability in older adults' performance on ill-defined everyday problems (Blanchard-Fields et al., 2004; Blanchard-Fields, 2007; Blanchard-Fields et al., 2007). Emotion regulation refers to the processes through which individuals influence their emotional reactions in ways that support the achievement of their goals (Niven et al., 2009). According to Koole (2009), emotion regulation is considered a form of self-regulation that is composed of some components that are common to other forms of self-regulation, such as cognitive and behavioral (Modrek & Ramirez, 2024). These common components are norms, monitoring, and power. More specifically, norms refer to some abstract ideas and thoughts that individuals have about how they would like a situation to be and how they would like to react to specific circumstances. Monitoring refers to the process of paying attention to one's own feeling and reactions to regulate behavior appropriately (Aldao et al., 2010). Finally, individuals must be able to resist

to their impulses and be able to overcome them, while also focusing on achieving long-term goals (Burman et al., 2015).

It is also important to refer to the emotion-regulation model developed by James J. Gross (1998). Based on this model, there are five strategies that individuals use to regulate their emotions: situation selection, situation modification, attentional deployment, cognitive change, and response modulation. Situation selection refers to the strategy of choosing to engage in or avoid situations that are expected to influence one's emotions. Situation modification refers to altering a situation as a means of changing its emotional impact (Gross et al., 2011). Attentional deployment refers to focusing on specific aspects of a situation in order to influence emotional responses. Cognitive change refers to modifying how one interprets a situation in order to alter its emotional impact or intensity. Finally, response modulation refers to regulating the expression of emotions after they have been elicited (Gross, 2015).

Emotion regulation strategies may be adaptive or maladaptive (Adrian et al., 2011). Adaptive strategies include acceptance, reframing negative thoughts (positive/cognitive reappraisal or putting into perspective), refocusing attention on positive or neutral things and planning. Maladaptive strategies include rumination, avoidance, and suppression (Bailey et al., 2016).

The frequent use of adaptive strategies, such *cognitive reappraisal*, typically lead to improved emotion management, through dealing with situations and following a rational process of solving them, while at the same time managing emotions (Navas-Casado et al., 2023). According to Zuckerman and Gagne (2003), the self-help strategy has positive outcomes for younger people, such as realistic beliefs about goals and performance in the tasks they are occupied with (academic, professional etc.). The frequent use of adaptive strategies has been associated with better mental health (Chervonsky & Hunt, 2019).

As far as maladaptive strategies are concerned, the frequent use of such strategies, such as *avoidance*, typically lead to negative emotional states in the long-run, although in the short-run they may offer some temporary relief from problems that have emerged (Aldao et al., 2014). The frequent use of other maladaptive strategies such as *expressive suppression* has been closely linked to psychopathology (Aldao et al., 2010; Aldao & Nolen-Hoeksema, 2010).

Emotion regulation –ER- is considered as a “special case”, because it can undermine other efforts that should be made for self-regulation (Tice & Bratslavsky, 2000). In the context of problem-solving, through ER strategies such as avoidance, some individuals manage to temporarily regulate their emotions and – thus – benefit from solving only some problems, mainly temporarily ones. However, by placing importance only on emotion regulation, other processes that need to be carried out to achieve the specific task, such as proper time management, are undermined (Güss & Starker, 2023). This results in short-term benefits being satisfied, (i.e. avoiding negative emotions) and long-term goals (e.g., solving the problem) not being achieved, resulting in negative emotions prevailing again (Dalton et al., 2025).

In their research with college students, Gross and John (2003) examined two key emotion regulation strategies in the context of emotionally evocative situations: cognitive reappraisal and expressive suppression. Cognitive reappraisal involves reinterpreting a situation in order to modify its emotional impact before the emotional response is fully generated. In contrast, expressive suppression refers to inhibiting the outward expression of emotion after the emotional response has already been initiated (Urry, 2010).

Gross and John (2003) found that individuals who reported greater use of cognitive reappraisal experienced more positive affect, better interpersonal functioning, and greater psychological well-being. In contrast, habitual use of expressive suppression was associated

with reduced positive emotion, poorer interpersonal functioning, and less adaptive psychological outcomes. These findings suggest that different emotion regulation strategies have distinct implications for emotional experience and social functioning, highlighting the importance of adaptive regulatory processes in everyday contexts.

In addition to the above emotion regulation strategies, there are also strategies for dealing with problems in everyday life. For students, problems that arise in their daily lives are related to exams, assignments, or deadlines. For professional people, everyday problems arise also as a result of deadlines, pressing tasks, work overload, lack of adequate working conditions and other workplace-related functions; all these are sources of negative emotions, such as anxiety (Brougham et al., 2009).

With regard to age-related changes in emotion regulation, it has been found that older adults are better in predicting and anticipating their emotional state and arousal, and this leads to dealing better with a situation or a problem (Nielsen et al., 2008; Urry & Gross, 2010). Studies have also suggested that older adults use more often cognitive reappraisal and therefore are able to regulate negative emotions in a more adaptive way (Liang et al., 2017). It has also been suggested that the more frequent use of adaptive emotion regulation strategies could contribute to the better performance of older adults in solving interpersonal problems, since these problems are often characterised by high emotion load and require resolution of emotional conflicts (Blanchard-Fields et al., 2004; Blanchard-Fields, 2007; Blanchard-Fields et al., 2007; Urry & Gross, 2010).

In a relevant study, Gross et al. (2011) investigated cognitive control and ER strategies abilities (detachment and positive reappraisal) in older people. They tested 41 adults within the age range of 55–72 years, who were recruited in the University of the Third Age in Beijing. Three measures of cognitive control were used; the Plus–Minus Test (Spector & Biederman, 1976), the Number Memory Test (Morris & Jones, 1990) and the Magnitude-

Size Stroop Test (Wang et al., 2009). They found that when older people face problems and challenges, they show a higher ability to regulate their emotions, as compared with younger ones. They concluded that the better ER ability of older people results in more informed and correct decisions. On the other hand, younger people tend to avoid being involved in very serious matters, and when they do they tend to be more impulsive, which may result in taking the wrong decision to solve a problem. Overall, older adults focus more on positive aspects of life and emotions and tend to ignore more and react less to negative ones. They also remember less of the negative information compared to positive (Orsega-Smith et al., 2019). This is also a result of different emotion regulation strategies used; older adults tend to have “default” strategies that they use in any circumstance, not adapting them, based on the situation (Ho, et al., 2014).

Trait Affect, Problem Solving and Ageing

According to Fredrickson, emotions are “*complex reactive tendencies (to some stimuli) that manifest themselves for relatively short periods of time*” (Fredrickson, 2001, p. 218). Fredrickson also distinguishes emotion from affect, a broader concept referring to consciously accessible feelings that encompasses emotional states, moods, physical sensations, and relatively stable affective tendencies or traits. Specifically, unlike emotion which typically the result of a reaction to a stimulus, affect is not necessarily linked to a specific stimulus or event (Fredrickson, 2001). A second difference between emotion and affect has to do with the temporal framework; emotions are usually short-lived, while the states included in the term "affect" are usually longer-lasting, without being as intense as emotions (Hamilton et al., 2017). Last but not least, emotions are usually categorized into distinct categories of emotions (e.g, the six basic emotions of happiness, anger, fear etc), while affect is commonly described in terms of broader dimensions, particularly positive and negative affect (Mathes, 2023).

In this thesis, the term *trait affect* refers to a relatively stable tendency to experience particular patterns of positive and negative affect across situations and over time (Hamilton et al., 2017). Trait affect can therefore be understood as an affective trait, rather than a short-lived emotional response to a specific event. A prominent model of trait affect was proposed by Watson and Tellegen (1985), who conceptualised positive affect and negative affect as two related but independent dimensions rather than as opposite ends of a single continuum. Within this two-dimensional model, one axis represents low to high positive affect and the other represents low to high negative affect. Only the top of each axis indicates some emotional arousal, while its bottom indicates absence of emotional involvement (e.g. calm for the negative dimension, boredom for the positive dimension) (Thompson, 2007). The dimensions of valence and arousal are rotated 45 degrees on these axes. Positive affect represents the individual's mood for life, while negative affect represents the extent to which the individual reports a feeling of dissatisfaction or upset (Watson & Tellegen, 1985). Within this two-dimensional model, positive affect can be understood as a dimension ranging from excitement, self-confidence, and cheerfulness at the high end to boredom, lethargy, and fatigue at the low end. Negative affect ranges from nervousness, anxiety, and worry at the high end to relaxation, calmness, and self-control at the low end (Díaz-García et al., 2020).

In the context of problem solving, it has been proposed that positive affect can improve problem-solving skills and help individuals understand and analyze new information. In younger people, especially students, positive affect has been associated with perfectionism (Isen, 2008). Perfectionism, which is characterized by very high demands on oneself, can in turn positively influence adjustment to demanding situations, such as demanding academic tasks, when individuals are characterized by passion for what they do and have a positive emotional state towards the academic or non-academic problems that may prevail (Zuckerman & Gagne, 2003). On the contrary, when individuals feel an internal

pressure to be perfect, because this is an indicator of their personal worth, this in turn activates negative affect and contributes negatively to adjustment to demanding situations, such as adjustments to problems that have to be solved (Çapan, 2010).

Most researchers agree with the general distinction proposed in the Lazarus and Folkman (1984) model between problem-focused strategies that involve actively dealing with the problem and emotion-focused strategies that involve reducing the intensity of anxiety and stress experienced at the moment of resolving the problem. Emotion-focused strategies involve passive engagement with the problem through bringing the problem back into thought (reminiscence), maintaining negative affect, and avoiding it, whereas problem-focused ones involve a more adaptive strategy, such as accepting the problem and adapting to the new situation (Salvi & Bowden, 2020). It follows from the above that trait affect can positively influence problem-solving, either when problem-focused or emotion-focused strategies are employed (Hughes et al., 2020).

While the prevailing perception in public opinion wants the silver citizens to be presented as lonely with no significant social help; contemporary research supports the improvement of emotional experience as age advances (Carstensen et al., 2011; Carstensen et al., 2000). The results of recent research contradict the established view of the negative mood that governs old age, emphasizing the higher prevalence of positive mood. Research shows that the presence of clinical symptoms, including depression, anxiety disorders, and dysthymia, is now more common in younger adults, as compared to older ones (Moraitou & Papantoniou, 2012; Moraitou et al., 2013). In the context of problem-solving that is examined in this thesis, a fundamental study is the empirical review of Blanchard-Fields (2009), whose aim was to examine how life experiences, social interactions, beliefs, and emotions influence the motivation of people to process information in their daily life. Research findings indicate that older people have better ability not only to control their emotional experience, but also to

utilize it in a flexible way, when it comes to making decisions. Trait affect and emotion regulation are related but distinct constructs. Trait affect concerns individuals' relatively stable tendency to experience positive and negative affect, whereas emotion regulation concerns the processes used to modify emotional responses. Both may influence how individuals perceive and respond to everyday problems.

Theory of Mind, Problem Solving and Ageing

Self-awareness and the ability to represent mental states are considered core characteristics of human social cognition. The concept of theory of mind (ToM), introduced by Premack and Woodruff (1978), refers to the ability to understand one's own and others' mental states, including beliefs, intentions, desires, and emotions. As a dimension of social cognition, ToM enables individuals to interpret behaviour in terms of underlying psychological processes (Sanfey, Civali, & Vavra, 2015; Haroush & Williams, 2015).

ToM has been linked to everyday problem solving, particularly in socially and emotionally complex contexts (Curry & Chesters, 2012; Viana et al., 2023). For example, performance on the "Reading the Mind in the Eyes" task (Baron-Cohen et al., 2001), which measures the ability to identify subtle emotional states, has been linked to effective social functioning. The ability to infer emotional states from limited cues is therefore likely to play a role in navigating interpersonal everyday problems.

With regard to age difference on ToM capacity there are mixed findings. Earlier research suggested that ToM declines with age, partly because it relies on EFs and cognitive control processes that are argued above have been suggested to decline with ageing (Sodian & Frith, 2008; Vilenskaya & Lebedeva, 2017). Supporting this view, Moran (2013) reported age-related declines in ToM performance associated with reductions in EFs performance and fluid intelligence. Similarly, Rakoczy et al. (2012) and Bernstein et al. (2011) found poorer

performance of older adults in tasks involving complex mental state attribution, even after accounting for language ability and processing speed.

However, other studies suggest that certain components of ToM, particularly affective ToM, may be relatively preserved in older adults. Happe et al. (1998) reported intact or even improved performance in tasks requiring mental state reasoning despite age-related declines in non-social cognitive tasks. This pattern has been interpreted as reflecting the influence of accumulated social knowledge and crystallized abilities, which may support aspects of social understanding in later life (Duval et al., 2011; Moran, 2013).

In terms of underlying mechanisms, inhibition has been proposed as a key contributor to ToM performance, particularly in affective contexts (Perner et al., 2002). Given that EFs processes such as inhibition are also associated with everyday problem solving, it is plausible that ToM may be linked to problem-solving ability as well. Although research directly examining this association remains limited, Otsuka et al. (2021) found that inhibitory processes played a significant role in supporting ToM-related problem solving in older adults.

Overall, the age-related pattern observed in affective ToM — which in some studies appears relatively preserved — resembles findings in interpersonal ill-defined everyday problem solving, where older adults often perform comparably to younger adults (Cavallini et al., 2013; Wang & Su, 2013; Otsuka et al., 2021). This parallel pattern suggests that affective ToM may be relevant to understanding interpersonal problem-solving performance in later life. However, the precise nature of this relationship remains to be empirically tested.

Creativity, Problem Solving and Ageing

Creativity refers to the ability to produce ideas, solutions, or products that are both novel and valuable (Glăveanu, 2019). It involves imagination, critical thinking, and practical application, allowing individuals to approach situations from alternative perspectives and generate useful outcomes (Amabile, 2017; Gielen, 2013; Runco, 2004; Haase et al., 2023). In

everyday contexts, creativity is closely linked to the ability to generate flexible and effective responses to complex situations.

Creativity has been associated with everyday problem solving and, in particular, with ill-defined everyday problems (Marsiske & Willis, 1998; Kim et al., 2007). Gilhooly et al. (2015) suggest that creativity enables the generation of new ideas, while critical thinking supports the evaluation and refinement of those ideas. Although creativity and critical thinking are distinct—divergent and convergent processes, respectively (Lai, 2011; Birgili, 2015)—both contribute to effective problem solving. Creative thinking allows individuals to move beyond stereotypical approaches and consider alternative possibilities (Clarke, 2019; Kraft, 2005).

The conceptual link between creativity and problem solving has been formalized in the Creative Problem-Solving (CPS) model (Osborn, 2001; Sousa et al., 2010). The CPS framework emphasizes the balance between divergent and convergent thinking in generating and refining solutions (Phillips, 2004). Research suggests that CPS processes may be particularly relevant in ill-defined problems since they require restructuring, reinterpretation, and flexible thinking (Casakin, 2002; Abdulla & Cramond, 2018).

With respect to ageing, evidence regarding changes in creativity is mixed. Some research suggests that creativity can remain stable or even increase in later life, particularly when individuals remain engaged in creative activities (Flood & Phillips, 2007). For example, Wimmer (2016) examined age differences in divergent thinking tasks and reported declines only in certain components of creativity associated with fluid cognitive processes. Marsiske and Willis (1998) and Blanchard-Fields et al. (2007) in their studies, asked older and younger adults to generate solutions to everyday interpersonal and instrumental problems, and evaluated performance in terms of the number and quality of solutions produced. They concluded that although some aspects of creativity—such as fluency and

processing speed—may decline, other components, such as the quality, relevance, and contextual appropriateness of solutions, remain preserved or may even improve in older adults, allowing them to benefit from their creative capacities in everyday problem-solving contexts.

Age-related findings on originality and semantic fluency are similarly nuanced. Murphy and Castel (2021) reported comparable overall performance between younger and older adults in semantic fluency tasks, although retrieval fluency tended to decline with age. Some evidence suggests that age-related changes in inhibition may influence creative output, potentially contributing to differences in originality (Carpenter et al., 2020). Furthermore, matched or even higher levels of creativity in older adulthood have been attributed to accumulated experience and life knowledge, which may contribute to well-being and life satisfaction (Hickson & Housley, 1997).

Overall, the literature suggests that creativity may play an important role in everyday problem solving. In particular, fluency, flexibility, and originality have been linked to performance in ill-defined everyday problems (Marsiske & Willis, 1998; Skalicky et al., 2017). However, the evidence on creative capacities in the older age remains complex and multifaceted. Given its association with flexibility, originality, and adaptive thinking, creativity represents a theoretically relevant factor in understanding age-differences in performance in ill-defined interpersonal problem-solving contexts.

Self-Perceptions of Ageing and Problem Solving

The definition of successful ageing depends to a significant extent on how older adults themselves define the ageing process, including their expectations regarding their physical and mental condition (Liochev, 2015). Theories of ageing emphasize the importance of expectations about activities and behaviors appropriate to later life (Scheid & Brown, 2010). Individual life experiences further shape perceptions of ageing, as subjective

evaluations of health and functioning influence how success in ageing is defined (Teater & Chonody, 2020). In addition, the broader social context contributes to shaping the ageing process through social expectations and age-related roles (Brooks, 2010; Chonody & Teater, 2018). The construct of self-perceptions of ageing refers to individuals' beliefs about their physical and mental functioning and their capacity for healthy ageing (Sarkisian et al., 2001). It is often observed that older adults do not equate successful ageing exclusively with high physical functioning (Nascimento et al., 2022). Although ageing is accompanied by biological and neurocognitive changes, engagement in social activities and meaningful roles may buffer negative outcomes (Kuh et al., 2014; Collerton et al., 2012). Such engagement depends partly on older adults' confidence in their social roles, as well as societal support for their functional well-being (García-Lara et al., 2017; Stafford et al., 2011).

Stereotypes surrounding old age shape both societal expectations and the expectations older adults hold about themselves (Dionigi, 2015). Negative societal narratives may contribute to pessimistic self-perceptions of ageing (Bugental & Hehman, 2007; Levy & Myers, 2004). However, research indicates that many older adults report satisfaction with their ageing and maintain a youthful subjective age identity (Gana et al., 2004; Rubin & Berntsen, 2006).

Positive ageing expectations have been associated with better subjective well-being, health, and longevity (Barrett, 2003; Steverink et al., 2001; Westerhof et al., 2012; Diehl et al., 2014; Diehl & Wahl, 2010; Levy et al., 2002a; Levy et al., 2002b). Studies also suggest that positive self-perceptions and perceived control may benefit cognitive functioning (Demakakos et al., 2006; Levy et al., 2002a; Levy et al., 2002b; Levy et al., 2016), although this remains an evolving area of research. Within this framework, examining the relationship between self-perceptions of ageing and everyday problem solving becomes particularly

relevant, especially given established links between self-perceptions, emotion regulation, and well-being (Mather, 2012; Orth et al., 2010).

In the context of problem solving, positive self-perceptions of ageing have been associated with greater resilience and adaptive coping when facing everyday challenges (Diehl et al., 2014; Westerhof et al., 2012). Older adults who evaluate their ageing more positively may demonstrate greater stability and persistence when dealing with complex or ill-defined problems (Fiacco et al., 2020). Furthermore, research suggests that positive evaluations of one's own ageing are linked to better perceived health and well-being (Karatas & Tagay, 2012; Lu et al., 2019), which may support adaptive functioning in later life. Taken together, these findings indicate that the construct of self-perceptions of ageing represents a theoretically relevant factor in understanding everyday problem-solving performance in older adulthood.

Self-efficacy, Problem Solving and Ageing

Self-efficacy refers to individuals' beliefs in their ability to organize and execute the actions required to achieve desired goals (Bandura, 2008; Hartelt & Martens, 2024).

According to socio-cognitive theory, self-efficacy influences the choices individuals make, the effort they invest, and their persistence in the face of difficulties (Bandura, 2010).

Individuals with stronger self-efficacy beliefs are more likely to approach challenging situations as manageable tasks rather than as threats, thereby sustaining effort and engagement (Porter et al., 2003; Luszczynska & Schwarzer, 2005; Lippke et al., 2009).

In the context of problem solving, self-efficacy refers to the belief that one possesses the necessary skills to manage challenges, organize action plans, and effectively deal with specific situations (Geifman & Raban, 2015). Importantly, self-efficacy reflects perceived competence rather than objective ability, meaning that individuals' performance may be influenced not only by their actual skills but also by their beliefs about those skills.

With regard to ageing, findings concerning age-related changes in self-efficacy are mixed. Some evidence suggests that self-efficacy may remain stable or even increase in later life, particularly when supported by accumulated experience and adaptive coping strategies (Wu et al., 2023). For example, Wu et al. (2023) reported that modified problem-solving therapy reduced depressive symptoms and increased self-reported efficacy in everyday problem management among older adults. Similarly, Hernandez (2021), in a qualitative study, described cases in which older adults maintained strong beliefs in their self-efficacy despite experiencing cognitive decline, supported by coping strategies and social resources. However, such findings should be interpreted cautiously given small or context-specific samples.

The relationship between self-efficacy and problem solving appears to be influenced by both age and the nature of the problem. Greater life experience and domain-specific knowledge may support confidence in decision-making and everyday problem solving in later life (Finucane, et al., 2005). Allaire and Marsiske (1999) further suggested that older adults may demonstrate strengths in anticipating social aspects of problems, which may contribute to effective problem resolution. However, self-efficacy does not depend solely on chronological age. Research indicates that individuals tend to report higher self-efficacy when dealing with problems that are personally relevant or age-congruent (Artistico et al., 2003; Artistico et al., 2010). Thus, self-efficacy in problem solving may reflect the interaction between personal experience, problem characteristics, and contextual relevance rather than age alone. Despite evidence linking self-efficacy to adaptive functioning, its specific contribution to interpersonal ill-defined everyday problem solving in older adulthood remains underexplored.

The Present Thesis

To sum up, there is evidence suggesting that older adults may perform equally to, and in some contexts even better than, younger adults in certain types of everyday problem solving (Allaire & Marsiske, 2002; Artistic et al., 2003; Mienaltowski, 2011). Factors beyond age-related cognitive decline, including socioemotional and person-related factors, should also be considered when examining age differences in everyday problem-solving ability. In this chapter, I have reviewed some of the key factors in the literature that have been related to problem solving ability and that seem also to change with age. These variables, however, do not work in isolation, and may influence each other and work in combination to influence problem-solving ability. In line with this hypothesis, Hamilton et al. (2017) examined the combined contribution of trait affect and emotion regulation to the generation of interpersonal events in a sample of 304 adolescents. They found that higher positive affect helped individuals to better control their emotions, thereby leading in turn to the generation of positive interpersonal events, as well as higher willingness and motivation of individuals to be involved in them. In contrast, higher negative affect was correlated with less intention to be involved in interpersonal events. It could be concluded from this finding that individual with higher positive trait affect, have greater emotion regulation and better problem-solving ability.

Relationships have also been identified between ToM and trait affect, as well as emotion regulation. In fact, a leading theory in the field of lifelong emotional development is the theory of socioemotional selectivity (Carstensen, Fung, & Charles, 2003). According to this theory, when people move away from the idea of an "unlimited lifespan" and realize that their remaining life span is decreasing, they redefine their priorities, set short-term goals and focus on the emotional well-being of the present. This theory suggests that older age is associated with an increase in the motivation for emotional balance, and a change in the way

they cognitively process positive and negative information and approach their problems (Carstensen et al., 2003; Moraitou & Efklides, 2007).

Combined results have also been found regarding ToM, creativity and problem solving. It has been found that basic ToM skills are positively associated with creativity (Barbot, Lubart, & Besançon, 2016). People with better ToM skills appear to have higher performance in creativity and innovativeness, which in turn are important determinants of effective decision making and problem solving (Barbot, Lubart & Besançon, 2016).

Osmani (2016) examined how self-perceptions of ageing and cognitive functioning relate to decision making and problem solving. The findings suggested that although certain cognitive functions decline with age, changes in decision-making strategies are more strongly associated with how older adults perceive their ageing. In particular, older adults who perceive limited time and reduced opportunities for recovery may adopt more conservative and compensatory decision-making strategies, such as preferring group decisions over individual ones.

Baron and Le Breck (1987) further suggested that age-related declines in cognitive function are not necessarily responsible for reduced problem-solving performance in older adults. Instead, they proposed that older adults may adopt more conservative strategies, such as seeking less information, partly due to their self-perceptions of ageing. In contrast, Roberts and Allen (2016) argued that declines in certain cognitive and sensory processes may undermine problem-solving capacity, and that negative perceptions of self-efficacy and ageing may further contribute to reduced performance. Together, these findings suggest that cognitive processes, self-perceptions of ageing, and self-efficacy should all be considered when examining decision making and problem solving in older adulthood.

There are also important research gaps in relation to age-related changes in the ability to solve well and ill-defined problems. More specifically, there is mixed evidence regarding

the contribution of declines in EFs to problem-solving ability, especially in ill-defined problems, in older adults. There is also limited research examining the relationship between variables such as creativity and self-efficacy and well- versus ill-defined problem-solving capacity across younger and older adults.

In light of previous research findings and the research gaps identified above, the aim of this thesis is to investigate factors contributing to problem-solving ability in older people, both in well and ill-defined problems. More specifically, this thesis addressed the following research questions:

RQ1: Is the performance of older adults worse than younger adults in both well-defined and ill-defined problems? Are older adults better than young adults in dealing with interpersonal ill-defined problems? (Study 2)

RQ2: Do EFs, affect and self-efficacy contribute to the performance of older adults and younger adults in well-defined and ill-defined problems? (Study 2)

RQ3: Do socio-cognitive, regulatory, cognitive, and self-related factors—including affective ToM, psychological inflexibility and experiential avoidance, creativity, and self-perceptions of ageing—contribute to interpersonal ill-defined problem-solving ability in older adults?

Based on the reviewed literature, it is expected that problem-solving performance in older adulthood will depend less on cognitive decline per se and more on the nature of the problem (ill-defined versus well-defined) and relevant socioemotional factors. It is anticipated that older adults may demonstrate preserved performance in ill-defined interpersonal problems, whereas younger adults may perform better in well-defined problems requiring rapid and structured responses.

Chapter 2 presents a validation study of the Greek versions of Everyday Problem-Solving Inventory (EPSI), Open Ended Everyday Problems Test (OEEPT) and Personal

Experience of Ageing Scale (PEAS). Chapter 3 presents an empirical study investigating the relationship between age, executive functions, as well as person-related factors (trait affect and self-efficacy) and problem-solving ability in a sample of younger and older adults. Chapter 4 presents an empirical study investigating the contribution of affective ToM, psychological inflexibility and experiential avoidance, creativity, and self-perceptions of ageing to interpersonal ill-defined problem-solving ability in older adults. Finally, Chapter 5 provides a general discussion on the research findings, the limitations of the thesis and implications for future research.

Chapter 2 – Study 1

Introduction

Everyday Problem Solving

Examination of everyday problem solving and everyday competence suggests a similar complexity to that of executive functioning. The multicomponent structure, the variety of abilities involved in everyday living and the highly complex nature of the construct of everyday problem solving (Mienaltowski, 2011) seems to be the key in assessing older adults from a different and more relevant perspective.

Research in the area of problem solving in general, and everyday problem solving more specifically, has shown a distinction between well-defined and ill-defined problems. A well-defined problem is characterized by a constrained problem space and a single correct solution (Jonassen, 2000; Mienaltowski, 2011). An ill-defined problem is a “messy” problem, with multiple possible solutions that could be equally effective and relevant. An ill-defined problem is a mirror of real-world problems that asks individuals to overcome possible obstacles, creating and justifying arguments on the effectiveness and appropriateness of the solution proposed, rather than producing an algorithm solution (Jonassen, 2000; Mienaltowski, 2011).

Previous research has explored older adults’ performance on both well- and ill-defined everyday problems suggesting different patterns of performance (Allaire & Marsiske, 2002). Specifically, evidence suggests that older adults have significantly higher performance in everyday problem-solving tasks, both well- and ill-defined ones, but especially in ill-defined tasks that include both instrumental and interpersonal problems, compared to lab-based problem-solving tasks (Allaire & Marsiske, 2002; Artistico et al., 2010; Mienaltowski, 2011).

Research examining age differences in everyday problem solving suggests that older adults may perform comparably to, and in some contexts even better than, younger adults in certain types of ill-defined problems, particularly those with interpersonal content (Allaire & Marsiske, 2002; Artistico et al., 2003; Mienaltowski, 2011; Chen et al., 2017). Such findings have been attributed to older adults' tendency to combine problem-focused and emotion-focused strategies, which may enhance the effectiveness of their solutions in socially complex contexts (Artistico et al., 2003; Blanchard-Fields, 2007; Diehl et al., 2005; Marsiske & Willis, 1998; Meegan & Berg, 2002; Singh et al., 2010).

Self-Perceptions of Ageing

Self-perceptions of ageing have been found to be related to overall well-being, health and longevity (Diehl et al., 2014; Diehl & Wahl, 2010; Levy et al., 2002a; Levy et al., 2002b; Steverink et al., 2001; Westerhof et al., 2012). Recent evidence suggests that positive self-perceptions and perceived control is beneficial to health overall (Demakakos et al., 2006; Levy et al., 2002a; Levy et al., 2002b; Levy et al., 2016). Additionally, psychological benefits have also been found for older individuals with positive self-perceptions, for whom depressive symptoms and negative emotions are significantly lower (Wurm & Benyamini, 2014; Wurm & Tomasik, 2008). Psychological, as well as health benefits, in combination, seem to also extend the positive outcomes, extending to cognitive functioning as well (Demakakos et al., 2006; Levy et al., 2002a; Levy et al., 2002b; Levy et al., 2016).

Current Study

The importance of everyday problem solving and self-perceptions of ageing for understanding older adults' everyday functioning, combined with the lack of relevant measures available in Greek, prompted the present validation study.

Primarily, the study developed Greek versions of two measures of ill-defined

everyday problem solving: the Everyday Problem-Solving Inventory (EPSI), originally created by Cornelius and Caspi (1987), and the Open-Ended Everyday Problem-Solving Test (OEEPT), developed by Allaire and Marsiske (1999) as a shorter measure focusing on functional everyday problems. For the development of the Greek versions of both tools, cultural adaptation following instruction by Geisinger (1994) and forward-backward translation following original instruction by Brislin (1970) was used to effectively communicate the problems presented while accurately reflecting the real-life situation in Greece.

Furthermore, the study completed the creation of the Greek version of the Personal Experience of Ageing Scale (PEAS), originally created by Steverink et al. (2001). Specifically, the original English scale was translated in Greek using the forward-backward translation method, following original instructions by Brislin (1970).

Finally, the psychometric properties of the Greek EPSI, OEEPT, and PEAS were examined, including reliability, construct validity, and the factor structure of each instrument. More specifically, the current study addressed the following research questions:

1. Is the Greek Everyday Problem-Solving Inventory a reliable and valid measure of ill-defined everyday problem-solving ability in younger and older Greek adults?
2. Is the Greek Open-Ended Everyday Problem-Solving Test a reliable and valid measure of the ability to solve ill-defined everyday problems in younger and older Greek adults?
3. Is the Greek Personal Experience of Ageing Scale a reliable and valid measure of self-perceptions of ageing?

Method

Participants

A sample of 115 ($N=115$) participants were recruited for the current study using non-probability convenience sampling, following previous studies that have assessed psychometric properties of EPSI (Cornelius & Caspi, 1987; Allaire & Marsiske, 2002). From the overall sample, 49.6% were females and 50.4% were males with their age ranging from 18 to 77 years ($M=44.90$, $SD=19.94$). Due to interest of the study for younger and older adults, the sample included two age groups, with 52.2% ($n=60$) being younger adults (50% males, 50% females), from 18-35 years ($M=27.28$, $SD=5.81$); and 47.8% ($n=55$) being older adults (49% females, 51% males), from 50 to 77 years of age ($M=64.13$, $SD=8.99$), following previous studies (Thornton et al., 2013; see Table 1).

Out of the original sample that completed the first phase of the study, 47 participants ($N=47$) were tested again after 2 weeks for test-retest reliability purposes. Their age ranged from 18 to 75 years ($M=44.62$, $SD=19.56$). Concerning the age groups, 53.2% were younger adults (40% females, 60% males), from 18 to 35 years ($M=27.64$, $SD=5.10$); and 46.8% were older adults (22.7% females, 77.3% males), from 50 to 75 years ($M=63.91$, $SD=8.68$).

Participants in the younger group were recruited through announcements distributed at the university where the researcher is currently employed. Interested individuals accessed an online link to complete the questionnaires voluntarily.

Participants in the older adult group were recruited through local Centres for Open Protection of the Elderly (KAPI) in Greece. Following permission from centre administrators, an announcement containing the online study link was shared with members. Individuals who wished to participate accessed the link independently and completed the questionnaires voluntarily. No personal contact information was accessed directly by the researcher.

Table 1
Participant Demographic Characteristics in Study 1

Characteristic	Overall Sample (<i>N</i> = 115)	Younger Adults (<i>n</i> = 60)	Older Adults (<i>n</i> = 55)
Age, <i>M</i> ($\pm$ <i>SD</i>)	44.90 ($\pm$ 19.94)	27.28 ($\pm$ 5.81)	64.13 ($\pm$ 8.99)
Age range	18–77	18–35	50–77
Female, <i>n</i> (%)	57 (49.6%)	30 (50.0%)	27 (49.1%)
Male, <i>n</i> (%)	58 (50.4%)	30 (50.0%)	28 (50.9%)

Materials

Everyday Problem-Solving Inventory (EPSI). The original EPSI comprises of 48 ill-defined everyday problems from six different categories of everyday life (Cornelius & Caspi, 1987). For the current study, out of the 48 original problems, 24 were used, covering all six categories identified in the original version, 4 problems from each category, home, consumer, health information, family, friends, following previous studies (Blanchard-Fields et al., 2007).

The 24 problems selected underwent translation and cultural adaptation in the Greek language following suggestions of Geisinger (1994). Two psychologists, with expertise in psychometrics, served as independent experts of both Greek and English languages for the adaptation process that involved cultural as well as linguistic forward-backward translation and adaptation (Brislin, 1970).

The 24 problems were also further categorised as either instrumental, interpersonal or mixed; 10 problems were classified as instrumental, seven as interpersonal and finally 7 as mixed, following definitions from previous studies (Blanchard-Fields et al., 2007). In comparison to the original version of EPSI that provided the participants possible solutions to choose from, in the current study, participants were required to generate instead as many safe and effective solutions they could think of, as proposed by previous studies (Allaire &

Marsiske, 1999; Marsiske & Willis, 1995). Scoring was based on counting the number of safe and effective solutions produced, that resulted in a *solution fluency score* for each participant, based on instructions provided by Denney and colleagues (Denney & Pearce 1989; Denney et al., 1992). Two independent psychologists coded and counted, based on the above instructions, the answers of the participants across both administrations. The higher the fluency score obtained, the better the problem-solving ability (see Appendix A).

Open-Ended Everyday Problem-Solving Test (OEEPT). The original OEEPT comprises of six ill-defined open-ended everyday problems (Allaire & Marsiske, 1999), covering 3 functional domains; medication use, financial management/planning, and nutrition/food use and preparation. For the current study, all problems were used and underwent translation and cultural adaptation in the Greek language following suggestions of Geisinger (1994). Two independent bilingual (Greek-English) psychologists, with expertise in psychometrics, were recruited for the adaptation process that involved cultural as well as linguistic forward backward translation and adaptation (Brislin, 1970).

As in the original version of the instrument, participants were asked to generate as many safe effective solutions as possible. Scoring for the OEEPT reflects solution fluency, involving counting the number of safe and effective solutions produced by the participant. For the current study, the *solution fluency score* was calculated, two independent psychologists were employed to code and count, based on the above instructions, the answers of the participants, across both administrations. The higher the fluency score obtained, the more effective problem-solving ability (see Appendix B).

Personal Experience of Ageing Scale (PEAS). The original PEAS comprises of 12 questions assessing personal experience on ageing through three different factors, physical decline, social loss and continuous growth (Steverink et al., 2001). Each factor is measured

through 4 questions, items 1 to 4 assess self-perceptions on physical decline, items 5 to 8 assess self-perceptions on social loss and items 9 to 12 assess self-perceptions on continuous growth. All questions are answered using a 4-point Likert scale (1: *completely true*, 4: *completely not true*). A score for each factor can be calculated by adding up answers to all items, which higher scores indicating more negative self-perceptions on ageing for the physical decline and social loss factors, and more positive self-perceptions on ageing for the continuous growth factor. A total score representing the overall self-perceptions on ageing can be calculated by the reversing items 1 to 8 (physical decline and social loss factors) and adding up with the remaining items. Higher total scores suggest more positive self-perceptions towards one's ageing.

In the current study, PEAS was translated in the Greek language following suggestions of Brislin (1970). Two independent bilingual psychologists were recruited for the successful completion of the forward backward translation (see Appendix C).

Procedure

The current study was approved by the Research Ethics Committee of the University of Sheffield (application reference number: 020868) (see Appendix D). The study was created using the LimeSurvey platform, and an online link for participation was distributed via institutional announcements. Participation was voluntary and strictly anonymous.

Upon accessing the link, participants were presented with an information sheet describing the study procedures, including both the initial assessment and the planned retest phase (see Appendix E and F). Participants provided online informed consent before proceeding. They were asked to report demographic information (gender and age) and to create a personal three-digit numerical code, which would be entered again during the second phase in order to match responses while preserving anonymity.

Following completion of the demographic questions, participants completed the EPSI, the OEEPT, and the PEAS. At the end of the survey, they were presented with debriefing information and reminded that they would be invited to complete the same questionnaires again after two weeks as part of the retest procedure. Participants were reminded of the retest phase through a follow-up announcement distributed via the same institutional channels.

Two weeks after the initial assessment, participants were invited to complete the same survey again using the same online link. During this second phase, participants were again presented with the information sheet and provided consent before entering their three-digit code and completing the three instruments. A total of 47 out of the original 115 participants voluntarily completed the retest phase.

Results

Preliminary Analyses & Assumptions

Prior to the main analyses, the study variables were examined for outliers and deviations from normality. For the correlational analyses, scatterplots were inspected to assess linearity and identify potentially influential bivariate outliers. Pearson's correlations were used where the relevant assumptions were met, whereas Spearman's rank-order correlations were used where these assumptions were not satisfied. For the independent-samples t-tests, the distributions of scores within each age group were examined and homogeneity of variance was assessed using Levene's test. Where the assumption of equal variances was violated, Welch's t-test was reported. Before conducting the principal component analyses, sampling adequacy and factorability were assessed using the Kaiser–Meyer–Olkin statistic and Bartlett's test of sphericity.

EPSI Reliability and Validity

Cronbach's Alpha

Reliability of EPSI was assessed using Cronbach's alpha coefficient. For the current study the alpha coefficient for EPSI on the overall sample was $\alpha=.913$. To further analyse internal consistency of the instrument, alpha coefficients were calculated separately for younger and older adults yielding similar results, younger adults $\alpha=.885$ and older adults $\alpha=.905$.

Further, alpha values were also calculated for each of the 3 main categories of problems, instrumental, mixed and interpersonal, both for the overall sample and differently for each age group. Regarding the overall sample, alpha values for instrumental, mixed and interpersonal problems were satisfactory, $\alpha=.932$, $\alpha=.901$ and $\alpha=.762$ respectively.

Results for internal consistency of the individual categories were also confirmed by the alpha coefficients obtained separately for younger and older adults, where in younger adults $\alpha=.932$, $\alpha=.891$ and $\alpha=.832$ were obtained for instrumental, mixed and interpersonal problems respectively. Finally, for older adults $\alpha=.847$, $\alpha=.815$ and $\alpha=.647$ were obtained for the same categories respectively.

Test Retest Reliability

Test retest reliability with 2-weeks interval was assessed for EPSI total score, as well as for EPSI instrumental score, EPSI mixed score and EPSI interpersonal score, for the overall sample and separately for the two age groups.

A series of Pearson's Correlations were used to assess the relationship between EPSI total score, first and second phase administrations, as well as EPSI instrumental, mixed and interpersonal scores, first and second phase administrations.

Regarding the overall sample, the results for EPSI total score suggested stability across time, $r(46)=.910$, $p<.001$. Results were further confirmed for all sub-scores of EPSI,

instrumental $r(46)=.932, p<.001$, mixed $r(46)=.776, p<.001$ and interpersonal $r(46)=.836, p<.001$.

Same analyses were also conducted separately for each age group confirming the above-mentioned results. More specifically, in the younger adults group, Pearson's and Spearman's Correlations were conducted to assess relationship between EPSI total score $r(24)=.909, p<.001$, as well as EPSI instrumental $r_s=.927, p<.001$, EPSI mixed $r(24)=.773, p<.001$ and EPSI interpersonal $r(24)=.874, p<.001$.

Finally, concerning the older adults group, a series of Pearson's and Spearman's Correlations were also conducted to assess again the relationship between EPSI total score $r(21)=.893, p<.001$, as well as EPSI instrumental $r_s=.844, p<.001$, EPSI mixed $r(21)=.735, p<.001$ and EPSI interpersonal $r(21)=.861, p<.001$.

Construct Validity: Associations With Age

Assessment of construct validity of EPSI total was firstly conducted through correlations with age, since based on previous evidence, fluency of response in EPSI is negatively related with age in a moderate way, with only contradictory evidence concerning interpersonal problems, where age is not yet found to be related.

Four Pearson's Correlations were conducted to assess the relationship of age and EPSI total score, $r(114)=-.425, p<.001$, EPSI instrumental score $r(114)=-.371, p<.001$, EPSI mixed score $r(114)=-.404, p<.001$ and EPSI interpersonal score $r(114)=-.119, p=.204$. Pattern of results suggests agreement with previous studies on the relationship of age and EPSI, confirming construct validity.

Construct Validity: Age-Group Differences

To further assess construct validity of EPSI, using contrasted groups evidence in support of it, a series of independent-sample t -tests were conducted to compare younger and older adults on EPSI total, EPSI instrumental, EPSI mixed and EPSI interpersonal, to confirm previously discussed evidence and support the evidence collected of changes with age.

Significantly higher scores were obtained for the younger adults group in EPSI total $t(113)=5.819, p<.001$, EPSI instrumental $t(83.37)=5.154, p<.001$ and EPSI mixed $t(92.62)=5.769, p<.001$. Non-significant differences between younger and older adults were obtained in EPSI interpersonal $t(113)=1.119, p=.266$, showing similar direction of results, while confirming construct validity.

Construct Validity: Convergent Evidence

Finally, four Pearson's Correlations were conducted to assess the relationship between EPSI total, EPSI instrumental, EPSI mixed and EPSI interpersonal with OEEPT score in order to collect convergent evidence of construct validity. Results confirmed previous evidence showing significant moderate positive relationships between EPSI total with OEEPT $r(114)=.364, p<.001$, EPSI instrumental with OEEPT $r(114)=.313, p=.001$ and EPSI mixed with OEEPT $r(114)=.341, p<.001$. Non-significant relationship was observed between EPSI interpersonal with OEEPT $r(114)=.118, p=.211$. The non-significant association between EPSI interpersonal scores and OEEPT performance provides further evidence that interpersonal problems may represent a distinct domain of everyday problem solving.

Construct Validity: Factor Analysis

A principal component analysis (PCA) was conducted on the 24 items of the Everyday Problem-Solving Inventory (EPSI). Sampling adequacy was acceptable, KMO = .806, and Bartlett's test of sphericity was significant, $\chi^2(276) = 1815, p < .001$, indicating that

the correlation matrix was suitable for PCA. The number of components retained was determined using parallel analysis, inspection of the scree plot, eigenvalues, and the interpretability of the solution. Three components were retained, with initial eigenvalues of 8.40, 3.01, and 2.71. Direct Oblimin rotation produced a clear three-component structure corresponding to the instrumental, mixed, and interpersonal problem categories. Instrumental-item loadings ranged from .676 to .855, mixed-item loadings from .698 to .881, and interpersonal-item loadings from .527 to .799. The components explained 26.7%, 19.6%, and 12.6% of the variance, respectively, accounting for 58.8% of the total variance. Inter-component correlations ranged from .114 to .375, indicating that the dimensions were related but distinct. The complete component-loading matrix is presented in Table 2.

Table 2
Principal Component Analysis — Component Loadings for the EPSI Scale

Item	Component 1	Component 2	Component 3	Uniqueness
EPSI 1 instrumental_home	0.686			0.380
EPSI 2 instrumental_consumer	0.779			0.324
EPSI 3 instrumental_home	0.834			0.329
EPSI 4 instrumental_home	0.755			0.295
EPSI 5 instrumental_home	0.855			0.332
EPSI 6 instrumental_work	0.840			0.304
EPSI 7 instrumental_information	0.676			0.429
EPSI 8 instrumental_work	0.676			0.393
EPSI 9 instrumental_information	0.828			0.271
EPSI 10 instrumental_information	0.771			0.472
EPSI 11 mixed_friend		0.706		0.322
EPSI 12 mixed_consumer		0.819		0.306
EPSI 13 mixed_consumer		0.817		0.242
EPSI 14 mixed_consumer		0.766		0.393
EPSI 15 mixed_work		0.749		0.492
EPSI 16 mixed_family		0.698		0.434
EPSI 17 mixed_information		0.881		0.253
EPSI 18 interpersonal_friend			0.645	0.553
EPSI 19 interpersonal_friend			0.636	0.605
EPSI 20 interpersonal_friend			0.527	0.645

Item	Component 1	Component 2	Component 3	Uniqueness
EPSI 21 interpersonal_work			0.531	0.640
EPSI 22 interpersonal_family			0.532	0.531
EPSI 23 interpersonal_family			0.642	0.559
EPSI 24 interpersonal_family			0.799	0.377

OEEPT Reliability and Validity

Cronbach's Alpha

Reliability of OEEPT was assessed using Cronbach's alpha coefficient. For the current study the alpha coefficient for OEEPT on the overall sample was $\alpha=.844$. To further analyse internal consistency of the instrument, alpha coefficients were calculated separately for younger and older adults yielding similar results, younger adults $\alpha=.753$ and older adults $\alpha=.825$.

Test Retest Reliability

Test retest reliability with 2-weeks interval was assessed for OEEPT for the overall sample and separately for the two age groups.

Three Pearson's Correlations were conducted revealing stability across time for the overall sample, $r(46)=.676, p<.001$, as well as for older adults, $r(21)=.716, p<.001$. Although the strength of the coefficient was smaller for younger adults, it was significant, $r(24)=.397, p=.050$.

Construct Validity: Associations With Age

Assessment of construct validity of OEEPT was firstly conducted through correlations with age, since based on previous evidence, fluency of response in OEEPT is negatively related with age in a moderate way.

A Pearson's Correlation was used to assess the relationship of OEEPT with age, revealing a significant moderate negative relationship $r(114) = -.497, p < .001$, confirming previous evidence supporting the relation between everyday problem solving performance and age.

Construct Validity: Age-Group Differences

To further assess construct validity of OEEPT, using contrasted groups evidence in support of it, an independent-samples t -test was conducted to compare younger and older adults on OEEPT score fluency, to confirm previously discussed evidence and support the evidence collected of changes with age.

Significantly higher scores were obtained for the younger-adult group in OEEPT $t(113) = 6.423, p < .001$, showing similar direction of results, while confirming construct validity.

Construct Validity: Factor Analysis

A PCA was conducted on the six items of the Open-Ended Everyday Problem-Solving Test (OEEPT). Sampling adequacy was good, $KMO = .869$, and Bartlett's test of sphericity was significant, $\chi^2(15) = 237, p < .001$. Parallel analysis, inspection of the scree plot, and the interpretability of the solution supported retention of one component. This component had an eigenvalue of 3.38 and accounted for 56.25% of the total variance. All six items loaded strongly on the component, with loadings ranging from .706 to .835, supporting a unidimensional structure in the present sample. The complete component-loading matrix is presented in Table 3.

Table 3
Principal Component Analysis — Component Loadings for the OEEPT Scale

Item	Component 1	Uniqueness
OEEPT 1	0.723	0.477
OEEPT 2	0.706	0.502
OEEPT 3	0.835	0.303
OEEPT 4	0.726	0.473

Item	Component 1	Uniqueness
OEEPT 5	0.729	0.469
OEEPT 6	0.774	0.401

PEAS Reliability and Validity

Cronbach's Alpha

Reliability of PEAS was assessed using Cronbach's alpha coefficient. For the current study the alpha coefficient for PEAS total on the overall sample was $\alpha=.921$. To further analyse internal consistency of the scale, alpha coefficients were calculated separately for younger and older adults yielding similar results, younger adults $\alpha=.890$ and older adults $\alpha=.874$.

Further, alpha values were also calculated for each of the 3 subscales of PEAS, namely physical decline, social loss and continuous growth, both for the overall sample and differently for each age group. Regarding the overall sample, alpha values for physical decline, social loss and continuous growth were satisfactory, $\alpha=.789$, $\alpha=.767$ and $\alpha=.864$ respectively.

Results for internal consistency of the subscales were also confirmed by the alpha coefficients obtained separately for younger and older adults, where in younger adults $\alpha=.744$, $\alpha=.739$ and $\alpha=.736$ were obtained for physical decline, social loss and continuous growth respectively. Finally, for older adults $\alpha=.711$, $\alpha=.640$ and $\alpha=.808$ were obtained for the same categories respectively.

Test Retest Reliability

Test retest reliability with 2-weeks interval was assessed for PEAS total score, as well as for PEAS physical decline, PEAS social loss and PEAS continuous growth, for the overall sample and separately for the two age groups.

A series of Pearson's Correlations were used to assess the relationship between PEAS total, first and second phase administrations, as well as PEAS physical decline, social loss and continuous growth, first and second phase administrations.

Regarding the overall sample, the results for PEAS total score suggested stability across time, $r(46)=.834, p<.001$. Results were further confirmed for all subscales of PEAS, physical decline $r(46)=.818, p<.001$, social loss $r(46)=.852, p<.001$ and continuous growth $r(46)=.744, p<.001$.

Same analyses were also conducted separately for each age group confirming the above-mentioned results. More specifically, in the younger adults group, Pearson's and Spearman's Correlations were conducted to assess relationship between PEAS total score $r(24)=.654, p<.001$, as well as PEAS physical decline $r_s=.460, p=.021$, PEAS social loss $r(24)=.775, p<.001$ and PEAS continuous growth $r(24)=.498, p=.011$.

Finally, concerning the older adults group, a series of Pearson's and Spearman's Correlations were conducted to assess relationship between PEAS total score $r(21)=.859, p<.001$, as well as PEAS physical decline $r_s=.680, p<.001$, PEAS social loss $r(21)=.823, p<.001$ and PEAS continuous growth $r(21)=.689, p=.011$.

Construct Validity: Factor Analysis

A PCA was conducted on the 12 items of the Personal Experience of Ageing Scale (PEAS), with physical-decline and social-loss items reverse-scored so that higher scores consistently represented more positive self-perceptions of ageing. Sampling adequacy was excellent, KMO = .933, and Bartlett's test of sphericity was significant, $\chi^2(66) = 693, p < .001$. Parallel analysis, inspection of the scree plot, and the interpretability of the solution supported retention of one component. The component had an eigenvalue of 6.45 and accounted for 53.72% of the total variance. Item loadings ranged from .646 to .808,

supporting a broad overall self-perceptions-of-ageing dimension in the present sample. The complete component-loading matrix is presented in Table 4.

Table 4
Principal Component Analysis — Component Loadings for the PEAS Scale

Item	Component 1	Uniqueness
PEAS 1 PD	0.789	0.378
PEAS 2 PD	0.647	0.582
PEAS 3 PD	0.691	0.523
PEAS 4 PD	0.732	0.464
PEAS 5 SL	0.684	0.532
PEAS 6 SL	0.692	0.521
PEAS 7 SL	0.646	0.582
PEAS 8 SL	0.738	0.455
PEAS 9 CG	0.779	0.393
PEAS 10 CG	0.792	0.373
PEAS 11 CG	0.808	0.347
PEAS 12 CG	0.772	0.404

Discussion

The aim of the current study was to create and validate the Greek versions of EPSI, OEEPT and PEAS. Cultural adaptation and forward-backward translation were successfully completed for the EPSI, OEEPT, and PEAS. Results of the validation study indicated good psychometric properties across all three instruments and were broadly consistent with findings reported for the original English versions.

More specifically, regarding the Greek EPSI, reliability was assessed using Cronbach's alpha and test-retest reliability, both for the overall scale and separately for the three problem types. Results showed good levels of reliability and were broadly consistent with findings reported for the original English version of the EPSI (Marsiske & Willis, 1995). Construct validity was further assessed through associations with age, age-group differences, convergent evidence, and principal component analysis. The PCA supported a three-

component structure corresponding to instrumental, mixed, and interpersonal problems, in line with the conceptual organisation of the instrument (Cornelius & Caspi, 1987). The moderate associations among the components further suggested that, although related, the three problem types represent distinguishable aspects of ill-defined everyday problem solving. Taken together, these findings supported the reliability and construct validity of the Greek EPSI and suggest that the cultural adaptation and translation process preserved the intended structure of the measure.

Similar procedures were followed to assess the psychometric properties of the OEEPT, and the findings supported the reliability and validity of the Greek version. The PCA indicated a one-component structure, with all six items loading strongly on a common component. This finding suggests that the different everyday scenarios assess a common construct and supports the use of an overall OEEPT score, consistent with its intended use as a measure of open-ended everyday problem-solving performance (Allaire & Marsiske, 1999). Together with the satisfactory internal consistency and test-retest reliability, the findings provide support for the internal coherence of the Greek version of the OEEPT.

Finally, the reliability and validity of the Greek PEAS were assessed using Cronbach's alpha, test-retest reliability, and principal component analysis. Results indicated that the internal consistency of the Greek PEAS was higher than that reported for the original version (Steverink et al., 2001), while test-retest reliability further confirmed the overall stability of the scale. The PCA supported a one-component structure in the present sample, with all items loading strongly on a common component. Although the original measure was organised around three domains—physical decline, social loss, and continuous growth—the present findings suggest that these domains may also reflect a broader overall dimension of self-perceptions of ageing. This difference may reflect characteristics of the mixed-age Greek sample, cultural or linguistic influences associated with the adaptation process, or the use of

PCA, which identifies components based on total item variance rather than testing a prespecified latent-factor model. The findings therefore support the use of the total PEAS score in the present study, while the three-domain structure remains theoretically relevant. Given the sample size and the inclusion of both younger and older adults, the one-component solution should be interpreted as specific to the present sample and examined further in larger Greek samples using confirmatory factor analysis.

In conclusion, the current study successfully developed and validated the Greek versions of EPSI, OEEPT, and PEAS, demonstrating that these culturally adapted instruments display good psychometric properties in the present Greek sample. The good levels of reliability and validity across all three scales, assessed through a range of methods including Cronbach's alpha, test-retest reliability, construct validity, and principal component analyses, underline the effectiveness of the translation and adaptation process. These findings highlight the utility of these Greek versions for future research and practical applications, establishing them as reliable tools for assessing the intended constructs in Greek-speaking populations.

Chapter 3 – Study 2

Introduction

The demographic change reflected in the increasing proportion of older adults in the population (United Nations, 2019) has brought to light the importance of examining the impact of age on cognitive and everyday functioning. It is widely agreed that there is an age-related decline in various domains of cognitive functioning such as working memory, episodic memory, and executive functioning (Frailey & Salthouse, 2011); however, ageing does not necessarily affect all functions to the same degree or in the same way. There is substantial evidence indicating that age-related declines are moderated by other important factors such as motivation, emotional state, and self-perceptions of ageing, as well as situational factors (Levy, 2003; Zacks & Hasher, 2006).

Executive Functioning

Research has repeatedly established a pattern of vulnerability of EFs to ageing. Analysis of external stimuli, goal-setting and strategies to reach goals, preparation for action and execution of plans are key cognitive processes involved in almost all actions of daily living and seem to be affected by ageing (Shokri et al., 2016).

Previous research has focused on three main processes proposed to underlie the umbrella term of EFs, namely, shifting, inhibition and updating (Delis et al., 2001; Hedden & Yoon, 2006; Hull et al., Miyake et al., 2000; Pettigrew & Martin, 2014). Other models, focusing on EF structure in older adults, support the existence of a two-factor model, where updating and switching comprise one factor and inhibition a second independent latent factor (two-factor models; e.g., Friedman & Miyake, 2004;). There are several studies that support a two-factor model of EFs in older adults where updating and shifting are a one unified factor and inhibition of proactive interference, a second factor, while the two being related (Hedden & Yoon, 2006; Hull et al., 2008; Pettigrew & Martin, 2014). The hypothesis of shifting and

updating relating to a single latent factor in older adults has been supported by neuroimaging studies as well. For instance, Collete and Van der Linden (2002) found that functional activity in the pre-frontal cortex of older adults was very similar during tasks that measured shifting and updating. Other studies have supported that younger and older adults may rely on different EFs when performing complex tasks; while older adults seem to rely more on updating and less on inhibition (Hull et al., 2008; Hedden & Yoon, 2006; Pettigrew & Martin, 2014; Vaughan, 2008); younger adults seem to equally rely on all three processes (Hull et al., 2008; Salthouse et al., 2003; Salthouse & Miles, 2002).

A substantial body of research has examined the influence of age on executive-function performance in younger and older adults; however, the findings are mixed. Some studies comparing performance of younger vs older adults support worse performance of older adults in various neuropsychological measures of EFs, like the Wisconsin Card Sorting Task (Fisk & Sharp, 2004). However, there is also evidence showing that actual age-related variability in EFs is not that prominent when age-related variation in processing speed is considered (Salthouse, 2005).

Other studies that used experimental tasks that tap on specific executive-function processes (e.g. Stroop test, verbal fluency, n-back verbal and nonverbal tasks, plus or minus task) have revealed once again a cognitive decline, and a worsening of performance for older adults, compared to younger ones (Hull et al., 2008; Shokri et al., 2016; Vaughan, 2008).

With regard to inhibition, while several studies support a decline on inhibitory processes in older adults (Adólfssdóttir et al., 2016), a meta-analysis by Rey-Mermet and Gade (2017) concluded that there are no age-related inhibition changes when analysing data from the Stroop and the Simon tasks. Across studies, findings suggest that even if age differences on inhibition are observed, there are significantly smaller than expected. Also, it

has been found that as observed with EFs overall, inhibition is highly depended on processing speed. When variance in processing speed is considering the gap between younger and older adults on inhibition performance narrows (Rush et al., 2006).

With regard to age-related changes in updating, the evidence is also mixed. There are studies that support a positive correlation between age and performance in tasks measuring updating (Basak & Verhaeghen, 2011; Miyake et al., 2000; Raye et al., 2002; Van der Linden et al., 1994). Other studies report a similar pattern to that of inhibition, with some empirical evidence confirming difference in updating between younger and older adults (Miyake et al., 2000). Research also shows that age-difference in updating are moderated by other factors. For instance, studies that use context-relevant tasks such as stories to measures spatial and temporal updating have found better performance in older adults in relation to studies that use experimental updating tasks (eg. N-back task). It has been suggested that content resembling everyday tasks boosts performance of older adults in updating (Artuso et al., 2016; Basak & Verhaeghen, 2011; Radvansky et al., 2003).

Problem Solving

Differences in problem solving abilities across age groups have been established across various studies. The same applies in regards to the exploration of the contribution of working memory and EFs to problem solving performance across ages (Dobson, 2000; Hull et al., 2008; Mienaltowski, 2011; Shokri et al., 2016). Given that context and its potential contribution has been discussed previously in relation to updating and inhibition, it is important to consider the role of context when investigating age differences in problem solving abilities (Hull et al., 2008; Mienaltowski, 2011; Shokri et al., 2016).

Research suggests that context is an important moderator of age differences in problem-solving abilities. Models of cognitive ageing propose that age-related declines in the

ability to process and maintain contextual information underlie differences between younger and older adults in inhibition and updating (Braver & Barch, 2002; Braver et al., 2005; Schmitt et al., 2014). However, context appears to affect not only cognitive processes, but also everyday problem-solving performance (Artistico et al, 2003; Artistico et al., 2010; Thornton et al., 2013). Specifically, several studies report reduced or even lack of age-related differences when older adults solve context-relevant, ecologically valid, ill-defined everyday problems; although younger adults typically outperform older adults on decontextualized, laboratory-based tasks (Crawford & Channon, 2002; Artistico et al., 2010; Thornton et al., 2013).

The most prominent hypothesis used to explain the differential age pattern for laboratory-based versus context-relevant problem-solving tasks proposes that differences in encoding and activation of information between younger and older adults are central (Kim et al., 2007; Weeks & Hasher, 2014). Research on convergent thinking has shown that age-related declines in performance may stem not only from deterioration in inhibition and updating but also from increased distractibility, which disrupts both the initial encoding of task-relevant information and the activation of that information during problem solving (Lustig et al., 2007). Older adults' greater susceptibility to distraction leads to the intrusion of irrelevant information, producing weaker, less stable mental representations during demanding, decontextualized tasks (Healey, 2008). Because laboratory tasks typically require the precise encoding and maintenance of novel or arbitrary information, distractibility disproportionately impairs performance of older adults in these settings.

In contrast, context-relevant or everyday problems rely more heavily on well-established knowledge structures, accumulated experience, and self-generated cues that older adults can more readily activate. This reduces the need for controlled, distraction-sensitive encoding processes and helps preserve performance despite age-related cognitive decline

(Blanchard-Fields, 2007; Radvansky et al., 2003). Research further indicates that person-related factors may also contribute to this differential pattern. Two such factors—life experience and vocabulary abilities—tend to improve or remain stable with age (Crawford & Channon, 2002; Dobson, 2000; Verhaeghen, 2003). These strengths confer particular advantages in everyday problem solving, where tasks are meaningful, familiar, and embedded in real-world contexts. Older adults' accumulated life experience enables them to draw on stored schemas and previously successful strategies, thereby reducing reliance on fluid cognitive operations such as inhibition and updating (Denney, 1989). Similarly, greater vocabulary and semantic knowledge enhance comprehension and reasoning in meaningful contexts but offer minimal benefit in laboratory tasks that are unfamiliar, abstract, and intentionally stripped of contextual cues (Salthouse, 2005; Verhaeghen, 2003). Together, these findings suggest that cognitive mechanisms, such as encoding and activation processes, and experiential resources, such as life experience and vocabulary, jointly contribute to the distinct age-related patterns observed across laboratory-based and context-relevant problem-solving tasks.

Another factor that could account for age-related differences in problem solving ability – both in laboratory-based and context-relevant problem-solving tasks – is the type of strategy adopted to approach it. Previous research has shown that the type of strategy used and the requirement to switch between strategies influence problem-solving performance, with these effects varying as a function of age (Allaire & Marsiske, 2002; Ardiale et al., 2012; Artistic et al., 2010; Mienaltowski, 2011). More specifically, when both younger and older adults were instructed to use the same strategy to solve consecutive arithmetic problems, performance between the two age groups was equated. Similarly, when participants were instructed to switch between two different methods, neither age group showed a performance advantage; both young and older adults exhibited comparable switch

costs. In contrast, when the cognitive load increased and participants were required to switch between three different approaches, only older adults showed a marked decline in performance (Ardiale et al., 2012).

Overall, laboratory-based tasks may provide an incomplete assessment of older adults' problem-solving abilities because they often contain limited contextual information and ecological relevance. Therefore, the present study also employed everyday problem-solving measures (Wetherell et al., 2002).

Everyday Problem Solving

Examination of everyday problem solving and everyday competence suggests a similar complexity to that of EFs (Rotenberg & Dawson, 2022). The multicomponent structure, the variety of abilities involved in everyday living and the highly complex nature of the construct of everyday problem solving seems to be the key in assessing older adults from a different and more relevant perspective (Cahn-Weiner et al., 2002; Davidson & Sternberg, 2003; Marsiske & Willis 1995). Everyday problem ability also depends upon EFs but research suggests that they are only moderately related, and that other factors play an important role (Allaire & Marsiske, 2002; Anderson & Craik, 2017; Diehl & Willis, 2003; Willis 1996).

Research in the area of problem solving in general, and everyday problem solving more specifically, has shown a distinction between well-defined and ill-defined problems. A well-defined problem is characterized by a constrained problem space and a single correct solution (Jonassen, 2000; Mienaltowski, 2011). An ill-defined problem is a “messy” problem, with multiple possible solutions that could be equally effective and relevant. An ill-defined problem is a mirror of real-world problems that asks individuals to overcome possible obstacles, creating and justifying arguments on the effectiveness and appropriateness of the

solution proposed, rather than producing an algorithm solution (Jonassen, 2000; Mienaltowski, 2011).

The research discussed above on the differences between younger and older adults has predominantly used well-defined problems and lab based problem-solving tasks, and reported better performance of younger adults (Mienaltowski, 2011). Yet, the potential contribution of EFs to performance in ill-defined problem solving in older adults has received little attention (Mienaltowski, 2011).

Few studies have directly compared older adults' performance on both well- and ill-defined everyday problems within the same design, while also contrasting these with laboratory-based well-defined tasks (Allaire & Marsiske, 2002). Specifically, evidence suggests that older adults often show relatively preserved performance in everyday problem-solving tasks—both well- and ill-defined—particularly in ill-defined tasks that include instrumental and interpersonal problems, compared to performance on laboratory-based, decontextualized tasks (Allaire & Marsiske, 2002; Artistic et al., 2010; Mienaltowski, 2011).

Other factors than EFs may account for the better performance of older adults in ill-defined tasks. More specifically, performance in this type of problem-solving tasks should be seen through the perspective of motives involved, the individual ways of thinking and acting, the different contextual, environmental and social factors that influence performance, as well as the experience and knowledge involved (Artistic et al., 2003; Blanchard-Fields, 2007; Diehl et al., 2005; Marsiske & Willis, 1998; Meegan & Berg, 2002; Mienaltowski, 2011; Singh et al., 2010).

Research on person-related influences on everyday problem solving has highlighted the potential roles of trait affect and emotion regulation (Blanchard-Fields, 2007, 2009;

Blanchard-Fields et al., 1995, 2004, 2007), as well as self-efficacy (Allaire & Marsiske, 2002).

Some of the person-related factors that may influence problem solving ability are trait affect and self-efficacy and control, (Artistico et al., 2003; Diehl et al., 2005; Isaacowitz & Smith, 2003; Levy et al., 2002b; Marsiske & Willis, 1998; Meegan & Berg, 2002; Ready et al., 2011; Singh et al., 2010; Steverink et al., 2001). There is evidence showing that positive and negative affect may be differentially affected by ageing (Lawton et al., 1993). It is generally agreed that there is a trend for a small decrease in positive affect from mid-60s to mid-80s, as well as a gradual decrease in negative affect until the age of 60 (Charles et al., 2001; Stacey & Gatz, 1991). Furthermore, older adults reported less frequent overall negative affect than younger adults (Isaacowitz & Smith, 2003; Ready et al., 2001; Ready et al., 2016). In addition, it has been found that positive affect may remain relatively stable in older adulthood, whereas negative affect may be less frequent and less persistent (Carstensen et al., 2000).

With regard to problem solving, research shows that when older adults are presented with emotionally salient, interpersonal, and ill-defined problems, they often perform as well as—or even better than—younger adults, despite showing disadvantages on more abstract or non-emotional laboratory tasks (Allaire & Marsiske, 2002; Artistico et al., 2003; Mienaltowski, 2011). In one of the key studies, Blanchard-Fields (2007) demonstrated that older adults tend to select more effective emotion-regulation strategies (e.g., distancing, avoidance, accommodation) and generate more contextually adaptive solutions when solving interpersonal everyday problems; whereas younger adults tend to rely more heavily on problem-focused strategies even when these are less effective in emotionally charged situations. This advantage, however, appears specific to emotionally meaningful interpersonal contexts and is not observed for well-defined or purely cognitive problem-solving tasks.

Additional work reinforces this pattern. Blanchard-Fields et al. (1997) found that older adults performed better than younger adults on interpersonal conflicts requiring emotion management, whereas the opposite was observed for instrumental, non-emotional problems. Similarly, Artistico et al. (2003) and Thornton et al. (2013) showed that older adults' performance improves when everyday problems are high in personal relevance or emotional meaning, suggesting that affective context shapes strategy selection and effectiveness. Taken together, these findings support the idea that shifts in emotional motivation and emotion-regulation goals across the lifespan play a central role in shaping everyday problem-solving performance.

Given that emotional experience, emotional complexity, and emotion-regulation abilities show systematic age-related changes (Ready et al., 2001; Ready et al., 2016), it becomes important to investigate how these affective changes influence older adults' everyday problem-solving abilities. Although prior studies highlight that emotional context can support problem solving in later life, this work has focused primarily on interpersonal or conflict-laden scenarios, leaving open the question of how broader affective processes influence problem solving in other everyday domains (Blanchard-Fields, 2007; Blanchard-Fields et al., 2004; Mienaltowski, 2011). This research gap suggests the need for more systematic investigation into the interplay between affective changes and everyday problem solving in older adults.

Positive and negative affect were therefore examined as separate person-related factors because they may show different associations with everyday problem-solving performance. Positive affect may support engagement, persistence, and flexible responding, whereas negative affect may influence attention, threat appraisal, and responses to emotionally demanding situations (Carstensen et al., 2000; Isaacowitz & Smith, 2003; Ready et al., 2011). Examining both dimensions separately also allowed the present study to

determine whether their associations differed according to problem type, particularly between structured well-defined problems and more ambiguous ill-defined everyday problems.

Self-efficacy, defined as the individual's belief in their ability to execute the actions required to manage prospective situations (Bandura, 1997), varies across the lifespan (Lachman & Weaver, 1998), and has also been linked to problem-solving performance (Artistico et al., 2003; Bandura, 1997). Research indicates that younger adults often report higher levels of general self-efficacy than older adults, particularly in domains that rely heavily on cognitive speed, novel learning, or technological proficiency (Czaja et al., 2006; Lachman et al., 2011). For example, Lachman et al. (2011) found that younger adults demonstrated greater confidence in novel learning environments and in work-related tasks requiring rapid adaptation.

This age difference in perceived competence is relevant to problem solving because self-efficacy shapes the strategies individuals select, their persistence in the face of difficulty, and their willingness to engage with challenging tasks. Higher self-efficacy is consistently associated with better problem-solving performance (Bandura, 1997; Artistico et al., 2003). Therefore, younger adults' higher self-efficacy—especially in cognitively demanding or unfamiliar contexts—may partially explain why they tend to perform better on laboratory-based problem-solving tasks, which often require rapid processing, comfort with novel material, and sustained engagement. Conversely, lower self-efficacy in older adults may lead to reduced engagement, avoidance of effortful strategies, or lower persistence, which can negatively affect performance despite the fact that older adults often excel in context-relevant, familiar, or emotionally meaningful problem-solving situations.

However, this age-related trend in self-efficacy does not hold across all domains of functioning. Research shows that while older adults report lower self-efficacy in fluid-

cognition domains—such as tasks involving rapid processing, new technology, or unfamiliar problem formats (Czaja et al., 2006; Lachman & Weaver, 1998)—they frequently report equal or higher self-efficacy in experience-based, emotionally meaningful, and socially embedded domains (Diehl et al., 2012; Infurna et al., 2011). Here, “context” refers specifically to the context of the problem-solving task—that is, whether the problem requires crystallized knowledge, emotion regulation, or interpersonal competence, areas where older adults often feel more capable.

For example, Diehl et al. (2012), using self-report measures of domain-specific self-efficacy in a sample of midlife and older adults, found that older adults reported higher self-efficacy in managing interpersonal conflict, coping with emotional stressors, and navigating daily social challenges, reflecting the advantages of accumulated life experience and emotional maturity. Similarly, Infurna et al. (2011), in a longitudinal study examining perceived control and domain-specific self-efficacy in adults aged 40–85, found that older adults maintained or increased self-efficacy in domains related to emotional well-being, self-regulation, and social functioning, even as confidence in cognitively demanding domains declined.

Older adults also show higher self-efficacy in certain everyday problem-solving tasks, particularly when the problems are ill-defined, interpersonal, or embedded in familiar contexts. Studies using scenario-based everyday problem-solving measures (e.g., Artistic et al., 2003; Diehl & Willis, 2003; Neely et al., 2018) consistently show that older adults, express greater confidence and perform more effectively on tasks requiring emotion regulation, conflict management, or practical reasoning, whereas younger adults perform better on novel, fast-paced, or abstract tasks. For instance, Blanchard-Fields (2007) demonstrated that in interpersonal everyday conflicts, older adults selected more effective emotion-regulation strategies and showed greater confidence than younger adults. Likewise,

Sargent-Cox et al. (2012) and Singh et al. (2010) found that older adults' self-efficacy in domains such as health management, financial decision-making, and social problem solving predicted more adaptive strategies and better functional outcomes.

These findings suggest that self-efficacy in later life is not globally diminished but rather redistributed across domains in ways that reflect lifelong learning, emotional development, and crystallized intelligence. However, a key research gap remains: although studies indicate that domain-specific self-efficacy shapes everyday problem-solving performance, most work has not directly compared self-efficacy across different types of problems. Specifically, very few studies have examined how self-efficacy relates to performance on well-defined (structured) versus ill-defined (ambiguous, context-rich) problems across age groups (Allaire & Marsiske, 2002; Artistic et al., 2010; Mienaltowski, 2011). Existing studies often rely on either laboratory-based well-defined tasks or interpersonal ill-defined vignettes, but studies rarely include both types of problems within the same design. Thus, it remains unclear whether self-efficacy differentially predicts performance depending on the problem type, and whether this factor helps explain the age-related divergence between laboratory-based and context-relevant problem-solving abilities in older adults.

Current Study

The current study examined age-related differences in well-defined and ill-defined everyday problem solving and investigated the contributions of executive functions, trait affect, and self-efficacy to performance across these problem types. More specifically, the study addressed the following research questions and hypotheses:

RQ1: To what extent do younger and older adults differ in executive-function performance, positive and negative affect, self-efficacy, and performance on well-defined and ill-defined everyday problems?

RQ2: How do younger and older adults differ in their use of emotion-focused and problem-focused strategies when solving ill-defined everyday problems?

RQ3: To what extent do executive functions—working-memory updating and inhibition—and person-related factors—trait affect and self-efficacy—predict performance on well-defined and ill-defined everyday problems after accounting for age?

It is expected that:

1. Younger adults will demonstrate better performance than older adults on tasks assessing working-memory updating and interference control.
2. Younger adults will perform better than older adults in well-defined everyday problems, however, no differences are expected overall in ill-defined problems.
3. Older adults will perform better than younger adults in ill-defined interpersonal everyday problems.
4. Older adults will report more frequent use of emotion-focused strategies and less frequent use of problem-focused strategies than younger adults during everyday problem solving.
5. Older adults will report higher levels of positive affect and lower levels of negative affect than younger adults.
6. Age differences in self-efficacy and its association with everyday problem-solving performance were examined on an exploratory basis.

7. Executive-function performance, specifically working-memory updating and inhibition, will significantly predict performance on well-defined everyday problems, whereas trait affect and self-efficacy are expected to show stronger associations with performance on ill-defined everyday problems.

Method

Participants

An overall sample of 220 ($N=220$) participants was recruited for the current study using non-probability convenience sampling and snowball sampling.

Two a priori power analyses were conducted using G*Power 3.1 (Faul et al., 2009). For the 2×3 mixed-design ANOVA examining age group and problem type, a medium effect size ($f = .25$), $\alpha = .05$, and power of .80 indicated a required sample of 142 participants. This effect size is consistent with previous research showing moderate age-related differences and context effects in everyday and complex problem solving (Allaire & Marsiske, 2002; Artistic et al., 2003; Mienaltowski, 2011; Thornton & Dumke, 2005; Thornton et al., 2013).

A second a priori power analysis was conducted for the hierarchical regression models predicting well-defined and ill-defined problem-solving performance. Assuming a medium effect ($f^2 = .15$), $\alpha = .05$, and power of .80, the required sample size was 77. This estimate is supported by studies demonstrating moderate associations between executive functions, affect, self-efficacy, and complex problem-solving performance across adulthood (Allaire & Marsiske, 2002; Artistic et al., 2003; Chen, 2017; Humes et al., 2022; Idowu & Szameitat, 2023).

Due to the aims of the study, two subgroups were identified, and separately recruited. The younger adults group comprised of 115 individuals ($n = 115$, 47.8% males, 52.2% females), from 18-35 years ($M=26.42$, $SD=5.37$; $Mdn=26$ years). The older adults subgroup

comprised 105 individuals ($n = 105$; 44.8% males, 55.2% females), aged 56 to 81 years ($M = 70.23$, $SD = 7.10$; $Mdn = 72$ years).

The age ranges of 18–35 years for younger adults and 56 years and above for older adults were defined a priori to create two clearly separated comparison groups. Although 56 years is below the commonly used threshold of 65 years for older adulthood, 76.2% of participants in this group were aged 65 years or older and 56.2% were older than 70 years. The group was therefore treated as predominantly older adulthood while acknowledging that it also included a smaller number of participants in later midlife.

Age was treated categorically in analyses comparing the predefined groups, whereas chronological age was retained as a continuous variable in the regression analyses to preserve variability across the full age range. The age groups were broadly comparable in size (115 younger and 105 older adults), and the modest difference in group size was not considered substantial; where homogeneity of variance was violated, Welch's correction was used to reduce the influence of unequal variances and group sizes.

Concerning education, in the case of younger adults, 13% had completed high school, 40% had obtained Bachelor's degree and finally, 47% were current University students. In the case of older adults, 36.2% had completed high school, 40% had obtained Bachelor's degree and finally 23.8% had obtained a Master's degree (see Table 5).

Participants in the younger group were recruited from the university where the researcher is currently employed. Recruitment was conducted through announcements and direct invitations to students, and participation was entirely voluntary.

Participants in the older adult group were recruited through local Centres for Open Protection of the Elderly (KAPI) in Greece. The researcher contacted the administrators of these centres to request permission to conduct the study. Following approval, centre staff

informed members about the scheduled sessions, and interested individuals volunteered to participate. No personal contact information was accessed directly by the researcher without institutional permission.

Table 5
Participant Demographic Characteristics by Age Group in Study 2

Characteristic	Younger Adults (<i>n</i> = 115)	Older Adults (<i>n</i> = 105)
Age, M ($\pm$ SD)	26.42 ($\pm$ 5.37)	70.23 ($\pm$ 7.10)
Median age	26	72
Age range	18–35	56–81
Female, <i>n</i> (%)	60 (52.2%)	58 (55.2%)
Male, <i>n</i> (%)	55 (47.8%)	47 (44.8%)
High school, <i>n</i> (%)	15 (13.0%)	38 (36.2%)
Bachelor's degree, <i>n</i> (%)	46 (40.0%)	42 (40.0%)
Current university student, <i>n</i> (%)	54 (47.0%)	—
Master's degree, <i>n</i> (%)	—	25 (23.8%)

Note. Percentages may not total 100 due to rounding. In the older-adult group, 76.2% were aged 65 years or older and 56.2% were older than 70 years.

Materials

Montreal Cognitive Assessment (MoCA). The Greek version of the MoCA was used as a cognitive screening measure to identify participants whose scores fell below the cut-off associated with possible mild cognitive impairment (Nasreddine et al., 2005; Konstantopoulos et al., 2016). The MoCA assesses six cognitive domains, executive functioning, visuospatial abilities, short-term memory, working memory, language and temporal/spatial orientation. The number of correct responses is recorded, with a maximum score of 30 suggesting better cognitive performance. The cut-off score based on Greek normative data is 25 out of 30 (Konstantopoulos & Vogazianos, 2019). Previous studies have confirmed good psychometric properties of the original version, $\alpha=.903$ (Freitas et al., 2013)

as well as the Greek version, $\alpha=.710$ (Konstantopoulos & Vogazianos, 2019) (see Appendix G).

Everyday Problems Test (EPT). The Greek translation of EPT was used in order to assess performance on well-defined everyday problems (Willis & Marsiske, 1993; Marsiske & Willis 1995; Pavlidis, 2021). The Greek version, as the original one, comprises of 28 items, each one addressing a different everyday problem. Examples include interpreting a cooking recipe or instructions for using medication and then answering related multiple-choice questions. The specific test was used as a measure of well-defined everyday problem solving, due to the nature of the questions included, the format that is straightforward for older individuals, as well as the clear scoring procedure with a single correct response per question (a pre-requisite for well-defined everyday problem solving). Participants need to select the right solution out of the options provided. Each item has a single correct answer. The score is obtained by adding up the number of correct responses provided, with higher scores indicating better performance on well-defined everyday problems. Previous studies have reported good psychometric properties of both the original version ($\alpha=.89$; Willis & Marsiske, 1993;) and the Greek version ($\alpha=.884$; Pavlidis, 2021) (see Appendix H).

Everyday Problem-Solving Inventory (EPSI). The Greek version of EPSI was employed to assess performance on ill-defined everyday problems. The Greek version of EPSI comprises of 24 everyday ill-defined problems, covering all six categories (including each 4 problems) identified in the original version; home (“*There have been a number of burglaries near your home in recent months. What do you do?*”), consumer (“*You would like to buy a birthday gift for a friend but cannot afford it at the time. What do you do?*”), information (“*You are completing your income tax but find it difficult to interpret some of the instructions. What do you do?*”), health (“*Your doctor tells you to only eat foods low in fat. What do you do to determine if a particular food at the super market is low in fat?*”), family

(*“You have an argument with someone from your immediate family (child, sibling or other) about an issue that is important to you. What do you do?”*) and friends (*“You lost or broke an expensive item that you borrowed from someone. What do you do?”*). The 24 problems were further classified as instrumental, (*“A complicated form that you completed was returned because you misinterpreted the instructions on how to fill it out. What would you do?”*), interpersonal, (*“You have done something that offended one of your friends. What would you do?”*), or mixed, (*“You would like to buy a birthday gift for a friend but cannot afford it at the time. What would you do?”*). Ten problems were classified as instrumental, seven as interpersonal, and seven as mixed.

In comparison to the original version of EPSI that provided the participants possible solutions to choose from, in the Greek version of EPSI participants were required to generate instead as many safe and effective solutions they can think of, as proposed by Allaire and Marsiske (1999) for a similar instrument, the Open-Ended Everyday Problem-Solving Test (OEEPT). Responses were scored using solution fluency, defined as the number of safe and effective solutions generated for each problem. Two independent scorers coded participants' responses according to the criteria described by Denney and colleagues (Denney & Pearce, 1989; Denney et al., 1992). Higher scores indicated greater solution fluency and therefore better performance on ill-defined everyday problems. Participants also rated the extent to which they used emotion-focused and problem-focused strategies when attempting to solve each problem. Four items were rated on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very much*). Two items assessed emotion-focused strategy use, (*“When I tried to resolve the problem I focused on how I feel in order to come up with a solution.”* and *“When I tried to resolve the problem I focused on regulating my emotions towards the problem rather than addressing the problem.”*), and two assessed problem-focused strategy use, (*“When I tried to resolve the problem I focused on the details and information of the problem while trying to*

solve it.” and “When I tried to resolve the problem I tried to focus on the underlying cause while taking action to solve it.”). For each participant, ratings on the two emotion-focused items were averaged across all 24 EPSI problems to produce an overall emotion-focused strategy-use score. Ratings on the two problem-focused items were similarly averaged across all 24 problems to produce an overall problem-focused strategy-use score. The two scores were calculated separately and represented the participant’s reported use of each strategy type. Higher scores indicated more frequent use of the respective strategy, whereas lower scores indicated less frequent use.

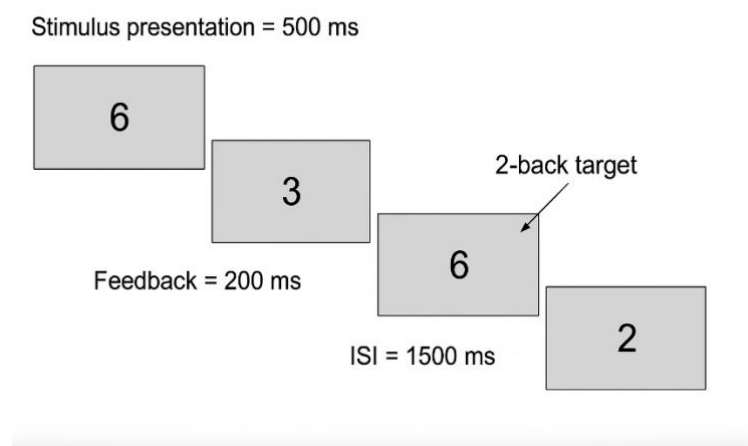
Previous studies have shown good psychometric properties of both the original EPSI ($\alpha=.73$; Marsiske & Willis, 1995) and Greek version ($\alpha=.913$) (see Appendix A).

Positive and Negative Affect Schedule (PANAS). The Greek version of PANAS was used to assess trait affect. The Greek version, as the original one, comprises 20 adjective items and assesses two independent dimensions of trait affect: positive affect and negative affect (Watson et al. 1988; Daskalou & Syggolitu 2012). Each subscale contains 10 items rated on a 5-point Likert scale ranging from (1: *very slightly/not at all*, 5: *extremely*). Separate positive-affect and negative-affect scores were calculated by summing the 10 items within each subscale. Higher scores indicated higher levels of the respective affect dimension. Previous studies have shown good psychometric properties of both the original PANAS (positive affect $\alpha=.89$, negative affect $\alpha=.85$; Crawford & Henry, 2004) and Greek version (positive affect $\alpha=.71$, negative affect $\alpha=.79$; Milis, 2015) (see Appendix I).

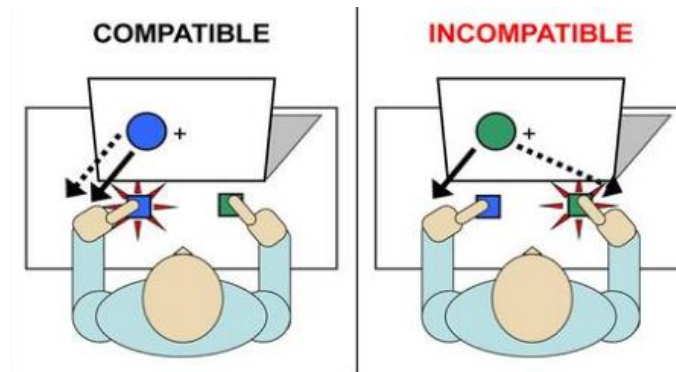
General Self-Efficacy Scale (GSES). The Greek version of GSES was used to assess self-efficacy. The Greek version, as the original one, comprises of 10 questions assessing general self-efficacy (Schwarzer & Jerusalem. 1995; Glynou et al., 1992). An example item is *“I can always manage to solve difficult problems if I try hard enough.”*. All items are

answered using a 5-point Likert scale (1: *not at all true* to 5: *exactly true*). The scale contains no reverse-scored items. A total score was calculated by summing responses across the 10 items, with higher scores indicating greater general self-efficacy. Previous studies have shown good psychometric properties of both the original GSES ($\alpha=.86$; Scholz et al., 2002) and Greek version ($\alpha=.93$; Mystikidou et al., 2008) (see Appendix J).

2-Back Task. The 2-back task (Kirchner, 1958) was used to assess working memory updating and was built and presented using E-Prime Software Tools (Schneider, et al., 2002). The task comprised of 20 practice trials and 60 experimental trials and the presented stimuli were numbers. The experimental trials were pseudo-randomized, out of which 33% were targets. Before the beginning of the task all participants were informed that a number will be presented on the screen and they needed to respond, by pressing the respective keys on the keyboard, whether they have seen the specific number 2 trials before. In every trial, a number was presented at the centre of the screen for 500ms. Right after the stimulus presentation and answer of the participant, a 200ms feedback screen was presented informing participant on whether they answer correctly or incorrectly, followed by 1500ms inter-stimulus interval (see Figure below). The outcome measures were target accuracy and mean reaction time for correct target responses.



Simon Task. The Simon task (Simon, 1969) was used to assess interference control as an index of inhibitory control, and it was built and presented using E-Prime Software Tools (Schneider, et al., 2002). The task comprised of 4 practice trials and 48 experimental trials. Before the beginning of the task all participants were informed that they will be presented with either a brown or a blue circle, on the left or right part of the screen and were instructed to press the left button when presented with a blue circle and the right button when presented with a brown circle. From all the experimental trials, 50% were congruent (position in the screen matched button to be pressed, blue circle on the left or brown circle on the right) and 50% incongruent (position in the screen did not match button to be pressed, blue circle on the right or brown circle on the left). In each trial, either a blue or a brown circle, was presented on either the left (y-axis=0, x-axis=-250) or right (y-axis=0, x-axis= 250) side of the screen until response was provided. Right before the stimulus, a 300ms fixation cross was presented at the centre of the screen (y-axis=0, x-axis=0). After response was provided, a 200ms feedback screen was presented informing the participant on whether they answered correctly or incorrectly, followed by 500ms inter-stimulus interval (see Figure below). Mean reaction times for correct responses were recorded separately for congruent and incongruent trials. Additionally, the congruency effect was also calculated by subtracting mean correct reaction time on congruent trials from mean correct reaction time on incongruent trials. Smaller congruency effects indicated better interference control.



Procedure

The current study was approved by the Research Ethics Committee of the University of Sheffield (application reference number: 020868) (see Appendix D). Once participants provided informed consent to participate in the study, they were asked to complete demographic information that included sex, age, socioeconomic status and educational level (see Appendix K and L).

After completion of the demographic information, all participants completed the MoCA test. After the screening procedure was completed, participants completed the 2-back and Simon tasks, followed by the EPT and EPSI. The PANAS and GSES were then administered, followed by debriefing. The approximate duration of the study was 35 minutes for younger adults and 45 minutes for older adults.

Results

Preliminary Analyses & Assumptions

The MoCA test was administered to the complete sample, 115 younger adults, with age range 18 to 35 years ($M=26.42$, $SD= 5.37$) and 105 older adults, with age range 56 to 81 ($M= 70.23$, $SD= 7.10$).

The average MoCA score for the group of younger adults was 28.00 ($SD=1.21$) ranging from a maximum of 30 points to a minimum of 26 points.

The average MoCA score for the group of older adults was 27.02 ($SD=1.16$) ranging from a maximum of 29 points to a minimum of 25 points. No participants were excluded based on Greek normative cut-off scores.

Outliers were examined using boxplots for accuracy and response times on the 2-back task and for accuracy and response times on congruent and incongruent Simon-task trials, separately for younger and older adults. No extreme outliers were identified. Normality was assessed using the Kolmogorov–Smirnov test for all study variables separately within each age group, and no statistically significant deviations from normality were identified.

For the independent-samples t -tests, homogeneity of variance was assessed using Levene's test. Where this assumption was violated, Welch's t -test was reported. For the mixed ANOVAs, homogeneity of variance was assessed using Levene's test. Sphericity was assessed for analyses containing more than two levels of the within-participants factor, and corrected degrees of freedom were reported where this assumption was violated. For Pearson correlations, scatterplots were examined to confirm approximately linear relationships and the absence of influential bivariate outliers.

The data were also assessed against the assumptions underlying hierarchical multiple regression. Normality of residuals was evaluated using the Shapiro–Wilk test, which indicated that the standardised residuals did not significantly deviate from normality, $p > .05$. Independence of errors was assessed using the Durbin–Watson statistic, with values falling between 1.5 and 2.5. Linearity and homoscedasticity were examined using plots of standardised residuals against standardised predicted values (ZRESID vs. ZPRED), which showed no systematic patterns or curvature. Multicollinearity was assessed using tolerance and variance inflation factor values; all VIF values were below 5 and all tolerance values

exceeded .20. Potentially influential observations were assessed using Cook's distance, and no cases exceeded the conventional threshold of 1 in either regression model.

Reliability Analyses

For all measures used in study, reliability analyses were conducted with the use of Cronbach's alpha coefficient, both for the overall sample, and for each age group separately. Specifically, for the EPSI, interscorer reliability (Kappa coefficient) was also used to address subjectivity in the scoring, by examining agreement in between two independent scorers.

EPSI – Cronbach's Alpha

Reliability of EPSI was assessed using Cronbach's alpha coefficient. For the current study the alpha coefficient for EPSI on the overall sample was $\alpha=.911$. To further analyse internal consistency of the instrument, alpha coefficients were calculated separately for younger and older adults yielding similar results, younger adults $\alpha=.889$ and older adults $\alpha=.899$.

Further, alpha values were also calculated for each of the 3 main categories of problems, instrumental, mixed and interpersonal, both for the overall sample and differently for each age group. Regarding the overall sample, alpha values for instrumental, mixed and interpersonal problems were satisfactory, $\alpha=.933$, $\alpha=.902$ and $\alpha=.774$ respectively.

Results for internal consistency of the individual categories were also confirmed by the alpha coefficients obtained separately for younger and older adults, where in younger adults $\alpha=.933$, $\alpha=.900$ and $\alpha=.873$ were obtained for instrumental, mixed and interpersonal problems respectively. Finally, for older adults $\alpha=.837$, $\alpha=.784$ and $\alpha=.603$ were obtained for the same categories respectively.

EPSI – Kappa Coefficient

Interscorer reliability of EPSI was assessed using Kappa coefficient. For the current study the kappa coefficient for EPSI instrumental problems on the overall sample was $\kappa=.800$. To further analyse agreement in between scorers, kappa coefficients were calculated separately for younger and older adults yielding similar results, younger adults $\kappa=.860$ and older adults $\kappa=.740$.

For EPSI mixed problems on the overall sample was $\kappa=.760$, and for younger adults $\kappa=.820$ and older adults $\kappa=.700$. For EPSI interpersonal problems on the overall sample was $\kappa=.840$, and younger adults $\kappa=.880$ and older adults $\kappa=.800$.

GSES

Similarly, reliability, using Cronbach's alpha coefficient, was assessed for the GSES, both for the overall sample, yielding $\alpha=.933$, and separately for each group, younger adults $\alpha=.852$, and older adults $\alpha=.957$.

PANAS

Finally, reliability using the Cronbach's alpha coefficient was assessed for PANAS, separately for the positive and negative subscales, both for the overall sample and separately for each age group.

Concerning the positive affect subscale, all alpha coefficients were very good. More specifically, for the overall sample the alpha was $\alpha=.874$. Similar results were obtained, when reliability was assessed differently in each age group, younger adults $\alpha=.835$ and older adults $\alpha=.779$.

Concerning the negative affect subscale, all alpha coefficients were very good. More specifically, for the overall sample the alpha was $\alpha=.892$. Similar results were obtained, when

reliability was assessed differently in each age group, younger adults $\alpha=.896$ and older adults $\alpha=.850$.

Age Differences in Executive Functions

Descriptive statistics for the executive function measures, specifically 2-Back task and Simon task are presented in Table 6.

2-Back Task

Independent samples t-tests were employed to test for age differences on correct RT and accuracy in the 2-back task between younger and older adults. Findings revealed a significant difference in correct reaction times between the two age groups, Welch's $t(171) = -34.30, p < .001$, 95% CI for the mean difference $[-374.80, -334.10]$, $d = -4.68$, indicating that younger adults responded faster than older adults. There was also a significant difference in accuracy, Welch's $t(201) = 16.60, p < .001$, 95% CI for the mean difference $[10.60, 13.40]$, $d = 2.25$, showing that younger adults identified more correct targets than older adults.

Simon Task

Mean correct RTs from the Simon task were submitted to a 2x2 mixed ANOVA with age group as the between subject factor and trial type (congruent and incongruent) as the within subject factor. Results showed significant main effects of age group and trial type, $F(1, 218) = 675.75, p < .001, \eta_p^2 = .76$ and $F(1, 218) = 190.44, p < .001, \eta_p^2 = .47$, respectively. That is, RTs were faster for congruent than incongruent trials, and for the younger adult group relative to the older adult group. There was also a significant two-way interaction between type of trial and age group, $F(1, 218) = 20.19, p < .001, \eta_p^2 = .08$ (see Figure 1). Specifically, younger adults responded faster than older adults on congruent trials, Welch's $t(168) = -13.70, p < .001$, 95% CI for the mean difference $[-149, -111]$, $d = -1.83$.

The same pattern was observed on incongruent trials, $t(218) = -23.70, p < .001$, 95% CI for the mean difference $[-203, -172]$, $d = -3.20$.

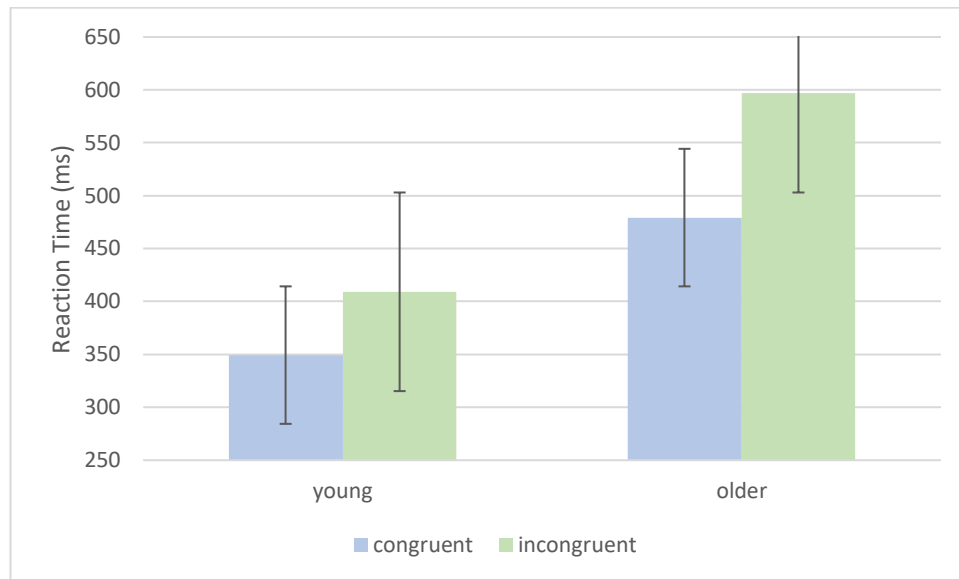


Figure 1: Interaction effect between type of trial in Simon task and age group on RT.

The results from the accuracy data of the Simon task showed significant main effects of age group, $F(1, 218) = 638.12, p < .001, \eta_p^2 = .74$, and trial type, $F(1, 218) = 471.63, p < .001, \eta_p^2 = .68$. That is, accuracy was higher for the congruent condition relative to the incongruent, and for younger adults than older adults. There was also a significant two-way interaction between type of trial and age group, $F(1, 218) = 227.02, p < .001, \eta_p^2 = .51$ (see Figure 2). Specifically, younger adults identified more correct targets than older adults on congruent trials, Welch's $t(145) = 7.94, p < .001$, 95% CI for the mean difference $[1.44, 2.39]$, $d = 1.09$. The same pattern was observed on incongruent trials, $t(218) = 29.41, p < .001$, 95% CI for the mean difference $[6.16, 7.05]$, $d = 3.97$.

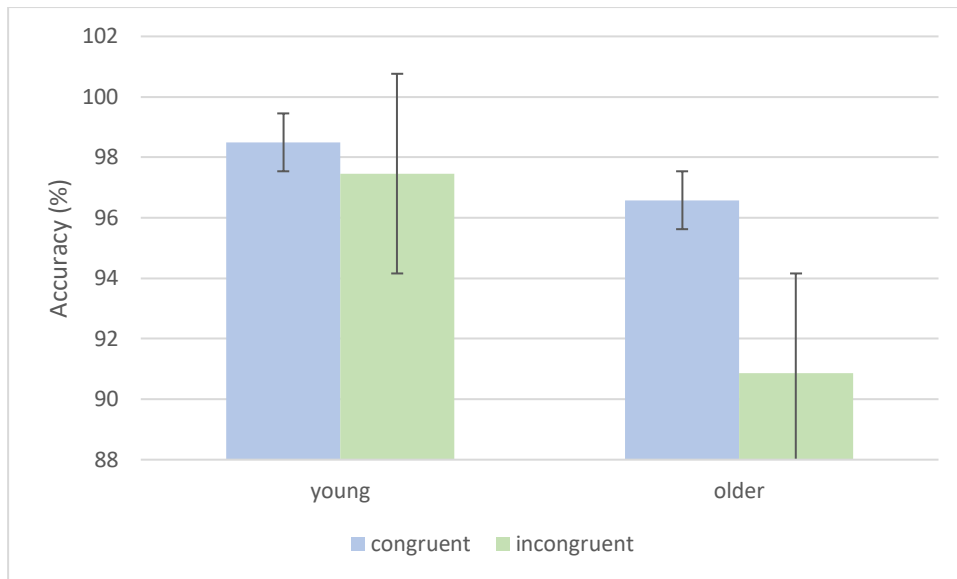


Figure 2: Interaction effect between type of trial in Simon task and age group on accuracy.

Table 6

Descriptive Statistics for Executive Function Measures by Age Group

Variable	Younger Adults (n=115)		Older Adults (n=105)	
	M ($\pm$ SD)	Min–Max	M ($\pm$ SD)	Min–Max
2-Back	87.55 ($\pm$ 4.76)	80–96	75.54 ($\pm$ 5.84)	65–85
Accuracy (%)				
2-Back Correct	500.58 ($\pm$ 56.39)	405–600	855.04 ($\pm$ 90.99)	701–1000
RT (ms)				
Simon	98.50 ($\pm$ 1.06)	97–100	96.58 ($\pm$ 2.25)	93–100
Congruent				
Accuracy (%)				
Simon	97.46 ($\pm$ 1.68)	95–100	90.86 ($\pm$ 1.65)	88–93
Incongruent				
Accuracy (%)				
Simon	349.35 ($\pm$ 90.58)	201–500	479.30 ($\pm$ 43.72)	400–549
Congruent RT				
(ms)				
Simon	409.17 ($\pm$ 55.14)	300–500	596.90 ($\pm$ 62.15)	500–698
Incongruent				
RT (ms)				

Note. M = mean; SD = standard deviation; RT = reaction time.

Age Differences in Performance Across Well-defined and Ill-defined Everyday

Problems

Descriptive statistics for the everyday problem-solving measures, specifically EPT and EPSI are presented in Table 7.

Average number of solutions provided (z-scores) were submitted to a 2x2 mixed ANOVA with age group as the between subject factor and type of everyday problem (well-defined and ill-defined) as the within subject factor. Result showed a significant main effect of age group $F(1, 218) = 353.82, p < .001, \eta_p^2 = .62$, but not for type of everyday problem $F(1, 218) = 0.062, p = .804$. Specifically, younger adults solved more problems than older adults. There was also a significant two-way interaction between type of everyday problem and age group, $F(1, 218) = 29.87, p < .001, \eta_p^2 = .120$ (see Figure 3 & 4). Specifically, younger adults performed better than older adults on well-defined problems, Welch's $t(186) = 23.14, p < .001$, 95% CI for the mean difference [11.76, 13.95], $d = 3.15$. The same pattern was observed for overall ill-defined problems, although the difference was smaller, Welch's $t(210) = 7.75, p < .001$, 95% CI for the mean difference [0.67, 1.13], $d = 1.04$.

Table 7
Descriptive Statistics for Everyday Problem-Solving Measures and Strategies by Age Group

Variable	Younger Adults ($n=115$)		Older Adults ($n=105$)	
	$M (\pm SD)$	Min–Max	$M (\pm SD)$	Min–Max
EPT Accuracy (%)	90.31 (± 3.35)	85–95	77.46 (± 4.71)	70–85
EPSI Total	3.94 (± 0.98)	1.77–5.79	3.04 (± 0.73)	1.68–3.98
EPSI Instrumental	4.28 (± 1.76)	1.00–6.60	2.93 (± 0.79)	1.50–4.20
EPSI Mixed	4.18 (± 1.61)	1.43–6.14	2.86 (± 0.83)	1.43–4.29
EPSI Interpersonal	3.36 (± 1.06)	1.29–6.43	3.34 (± 0.82)	1.57–5.29
Problem-Focused Strategies	4.18 (± 0.55)		2.43 (± 0.83)	
Emotion-Focused Strategies	2.07 (± 0.68)		3.55 (± 0.80)	

Note. M = mean; SD = standard deviation; EPT = Everyday Problems Test; EPSI = Everyday Problem Solving Inventory.

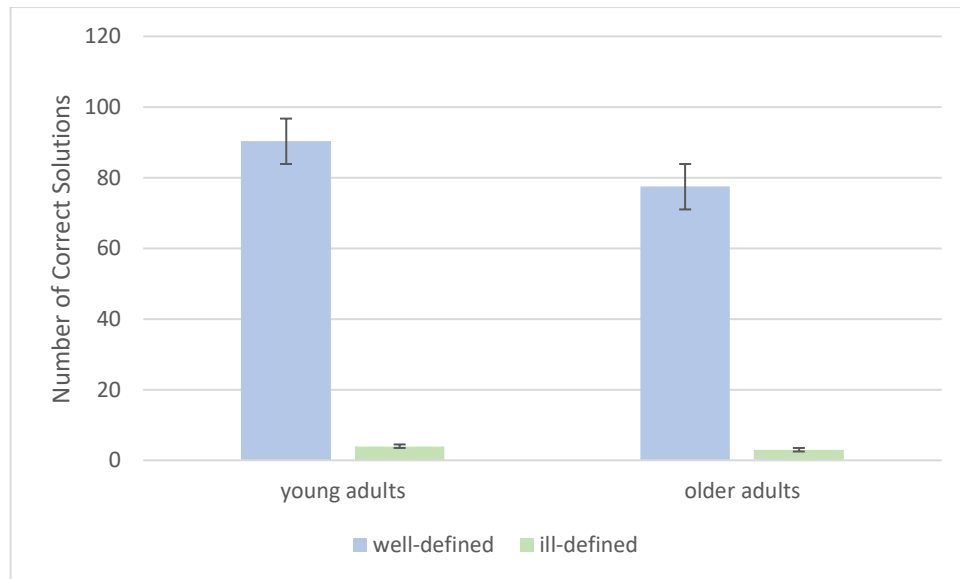


Figure 3: Interaction effect between type of everyday problem and age group on accuracy of solution (raw scores).

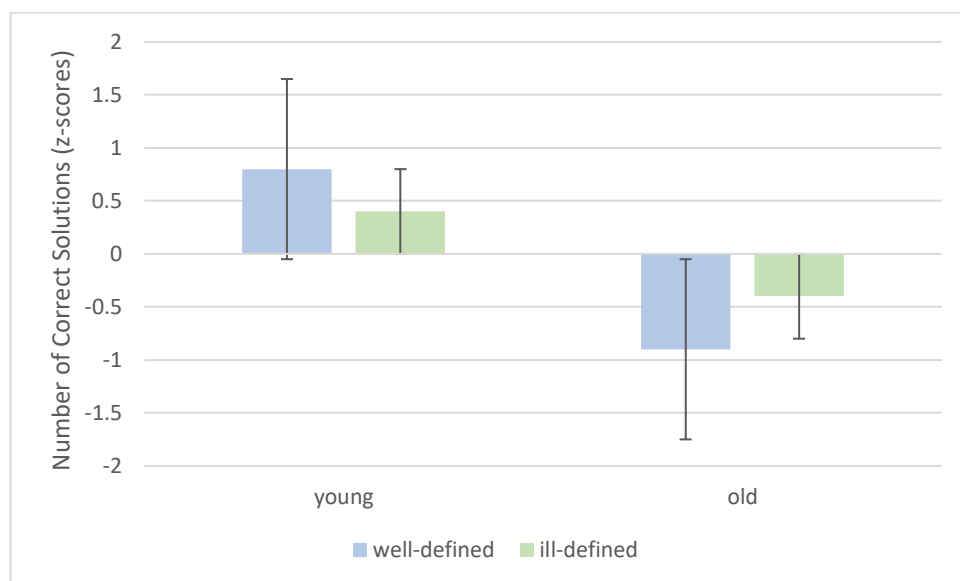


Figure 4: Interaction effect between type of everyday problem and age group on accuracy of solution (z-scores).

Age Differences in Performance Across Types of Ill-defined Everyday Problems

Average number of safe and effective solutions provided in EPSI (z-scores) were submitted to a 2x3 mixed ANOVA with age group as the between subject factor and type of

ill-defined everyday problem (instrumental, mixed, interpersonal) as the within subject factor. Result showed a significant main effect of age group $F(1, 218) = 45.282, p < .001, \eta_p^2 = .17$, but the main effect of type of ill-defined everyday problem did not reach statistical significance $F(1.91, 417.99) = 0.044, p = .957$. Specifically, younger adults solved more problems than older adults. There was also a significant two-way interaction between type of ill-defined everyday problem and age group, $F(2, 436) = 21.322, p < .001, \eta_p^2 = .09$ (see Figure 5). Specifically, younger adults generated more safe and effective solutions than older adults on instrumental problems, Welch's $t(161) = 7.48, p < .001$, 95% CI for the mean difference [1.00, 1.71], $d = 0.99$, and mixed problems, Welch's $t(173) = 7.70, p < .001$, 95% CI for the mean difference [0.98, 1.65], $d = 1.03$. However, performance did not differ significantly between younger and older adults on interpersonal problems, Welch's $t(213) = 0.21, p = .838$, 95% CI for the mean difference [-0.23, 0.28], $d = 0.03$.

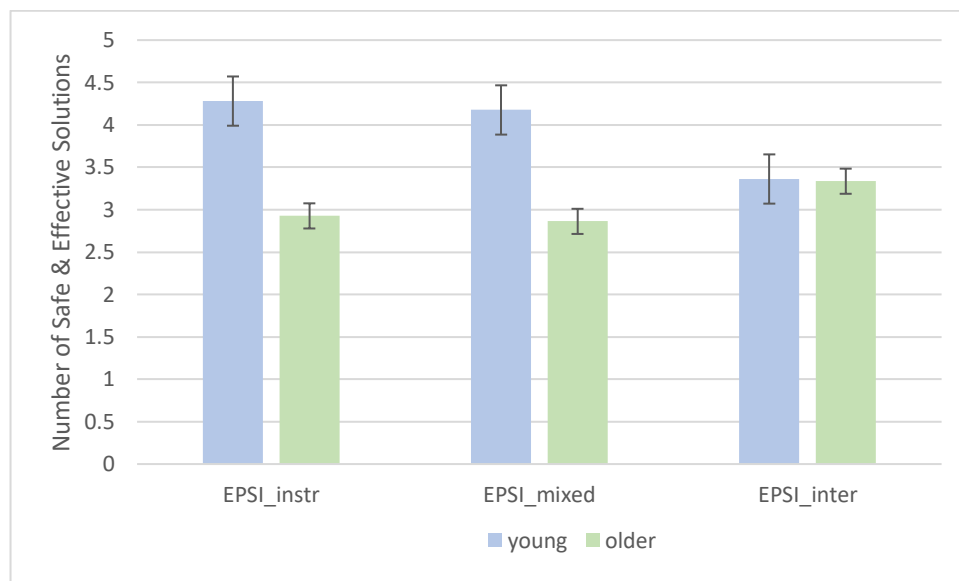


Figure 5: Interaction effect between type of ill-defined everyday problem and age group on number of safe and effective solutions.

Age Differences in Emotion-Focused and Problem-Focused Strategy Use in Ill-defined Everyday Problems

Mean ratings of emotion-focused and problem-focused strategy use were analysed using a 2×2 mixed ANOVA, with age group as the between-participants factor and strategy type as the within-participants factor. Result showed a significant main effect of strategy type $F(1, 218) = 51.440, p < .001, \eta_p^2 = .19$, but the main effect of age group did not reach statistical significance, $F(1, 218) = 3.858, p = .051, \eta_p^2 = .02$. Specifically, problem-focused strategies were employed more frequently than emotion-focused strategies. There was also a significant two-way interaction between type of strategy employed and age group, $F(1, 218) = 557.55, p < .001, \eta_p^2 = .719$ (see Figure 6). Specifically, younger adults reported more frequent use of problem-focused strategies than older adults, Welch's $t(178) = 18.20, p < .001$, 95% CI for the mean difference [1.56, 1.94], $d = 2.48$. The opposite pattern was observed for emotion-focused strategies, with younger adults reporting less frequent use than older adults, Welch's $t(205) = -14.70, p < .001$, 95% CI for the mean difference [-1.68, -1.28], $d = -1.99$.

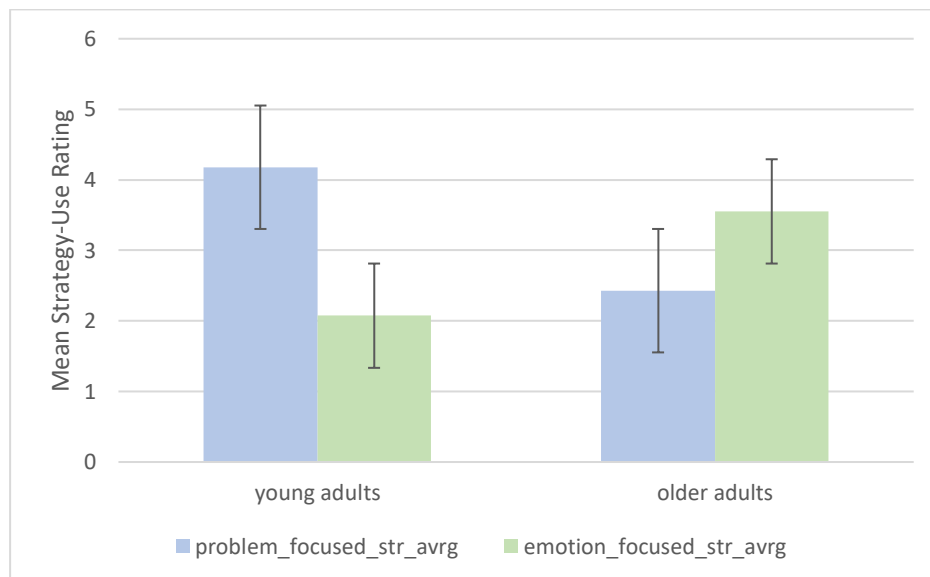


Figure 6: Interaction between strategy type and age group in reported strategy use during ill-defined everyday problem solving.

Age Differences in Trait Affect and Self-Efficacy

Descriptive statistics for the PANAS and Self-Efficacy are presented in Table 8.

Trait Affect

Positive- and negative-affect scores from the PANAS were analysed using a 2×2 mixed ANOVA, with age group as the between-participants factor and affect dimension as the within-participants factor. Result showed significant main effects of age group and affect dimension, $F(1, 218) = 15.265, p < .001, \eta_p^2 = .07$ and $F(1, 218) = 257.814, p < .001, \eta_p^2 = .54$, respectively. There was also a significant two-way interaction between affect dimension and age group, $F(1, 218) = 80.357, p < .001, \eta_p^2 = .27$ (see Figure 7). Specifically, younger adults reported lower positive affect than older adults, $t(218) = -10.37, p < .001$, 95% CI for the mean difference $[-9.93, -6.76]$, $d = -1.40$. The opposite pattern was observed for negative affect, with younger adults reporting higher levels than older adults, Welch's $t(207) = 4.74, p < .001$, 95% CI for the mean difference $[2.56, 6.20]$, $d = 0.64$.

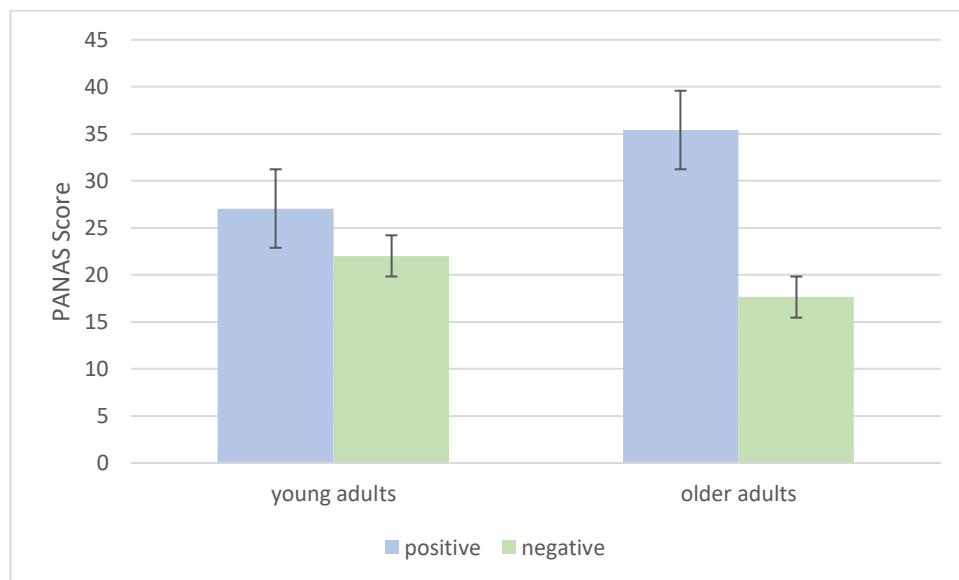


Figure 7: Interaction between affect dimension and age group for PANAS scores.

Self-Efficacy

An independent-samples *t*-test showed a significant difference in self-efficacy between the two age groups, Welch's $t(169) = 5.86, p < .001$, 95% CI for the mean difference [3.13, 6.30], $d = 0.80$, with younger adults reporting higher self-efficacy than older adults.

Table 8
Descriptive Statistics for PANAS and Self-Efficacy by Age Group

Variable	Younger Adults ($n = 115$)	Older Adults ($n = 105$)
	$M (\pm SD)$	$M (\pm SD)$
Positive Affect	27.06 (± 6.43)	35.41 (± 5.40)
Negative Affect	22.03 (± 7.90)	17.65 (± 5.70)
Self-Efficacy	33.90 (± 4.36)	29.18 (± 7.11)

Note. M = mean; SD = standard deviation; PANAS = Positive and Negative Affect Schedule.

Associations Between Executive-Function Performance, Trait Affect, Self-Efficacy, and Everyday Problem-Solving Performance

Well-Defined Problems

Bivariate Pearson correlations were conducted to assess the relationship of EPT performance with executive function measures, as well as positive affect, negative affect and self-efficacy and are presented in Table 9. Overall, well-defined problems were significantly correlated with better 2-back and Simon-task performance, higher negative affect and self-efficacy and lower positive affect.

Table 9
Pearson Correlation Coefficients Between EPT Performance, Executive Function Measures, PANAS and Self-Efficacy

Variable	EPT Accuracy	EPT Time
2-Back Accuracy	.66	-.67
2-Back Correct RT	-.77	.79
Simon Incongruent Accuracy	.75	-.78
Simon Incongruent RT	-.74	.73
Positive Affect	-.49	.49
Negative Affect	.27	-.28
Self-Efficacy	.33	-.39

Note. RT = reaction time. EPT = Everyday Problems Test. PANAS = Positive and Negative Affect Schedule. All correlations were significant at $p < .001$.

Ill-Defined Problems

Bivariate Pearson correlations were conducted to assess the relationship of EPSI performance with executive function measures, as well as positive affect, negative affect and self-efficacy and are presented in Table 10.

Overall, better performance in total, instrumental, and mixed ill-defined everyday problems was associated with better 2-back and Simon-task performance, higher levels of negative affect and self-efficacy, and lower levels of positive affect. In contrast, performance in interpersonal ill-defined problems was not significantly associated with executive function measures, affect, or self-efficacy.

Table 10

Pearson Correlation Coefficients Between EPSI Scores, Executive Function Measures, PANAS and Self-Efficacy

Variable	EPSI Total	Instrumental	Mixed	Interpersonal
2-Back	.35***	.32***	.35***	.03
Accuracy				
2-Back Correct	-.41***	-.41***	-.39***	-.01
RT				
Simon	.40***	.41***	.37***	.03
Incongruent				
Accuracy				
Simon	-.36***	-.32***	-.37***	-.02
Incongruent				
RT				
Positive Affect	-.25**	-.24***	-.23**	-.05
Negative	.21**	.16*	.19**	.10
Affect				
Self-Efficacy	.21**	.19**	.18**	.06

Note. RT = reaction time; EPSI = Everyday Problem Solving Inventory. PANAS = Positive and Negative Affect Schedule. * $p < .05$, ** $p < .01$, *** $p < .001$.

The Contribution of Age, Executive Functions, and Person-Related Factors to Well-Defined and Ill-Defined Everyday Problem-Solving Performance

Well-Defined Problems

Hierarchical multiple regression was used to examine whether positive affect, negative affect, and self-efficacy predicted performance on well-defined everyday problems after accounting for age and executive-function performance (see Table 11). Age entered at Step 1 explained 64.7% of the variance, $R^2 = .65$, $F(1, 218) = 399.88$, $p < .001$. Executive-function measures entered at Step 2 explained an additional 4.9% of the variance, $\Delta R^2 = .05$, $\Delta F(6, 212) = 5.63$, $p < .001$. The addition of positive affect, negative affect, and self-efficacy at Step 3 did not explain significant additional variance, $\Delta R^2 = .003$, $\Delta F(3, 209) = 0.63$, $p = .595$. In the final model, age, 2-back accuracy, and reaction times on congruent and incongruent Simon-task trials were significant predictors.

Table 11
Hierarchical Regression for Performance on the EPT

Variable	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2
Step 1				.65***	.65***
Constant	96.87	0.70			
Age	-.268***	.013	-.80***		
Step 2				.70***	.05***
Constant	77.36	22.77			
Age	-.09***	.04	-.28***		
2-Back Correct RT	-.06	.004	-.15		
2-Back Accuracy	.12***	.05	.13***		
Simon Congruent RT	-.01***	.004	-.10***		
Simon Incongruent RT	-.01***	.01	-.19***		
Simon Congruent Accuracy	-.10	.17	-.03		
Simon Incongruent Accuracy	.25	.17	.12		
Step 3				.70***	.003
Constant	77.32	23.28			
Age	-.08***	.04	-.25***		
2-Back Correct RT	-.01	.004	-.12		
2-Back Accuracy	.13***	.05	.14***		
Simon Congruent RT	-.01***	.004	-.10***		
Simon Incongruent RT	-.01***	.01	-.19***		
Simon Congruent Accuracy	-.08	.17	-.02		

Simon Incongruent Accuracy	.21	.17	.10
Self-Efficacy	.04	.05	.03
Positive Affect	-.04	.05	-.04
Negative Affect	.03	.04	.03

Note. RT = reaction time; EPT = Everyday Problems Test; PANAS = Positive and Negative Affect Schedule. * $p < .05$, ** $p < .01$, *** $p < .001$.

Ill-Defined Problems

Hierarchical multiple regression was used to examine whether problem-focused and emotion-focused strategy use predicted total ill-defined everyday problem-solving performance after accounting for age, executive-function performance, positive affect, negative affect, and self-efficacy (see Table 12). Age entered at Step 1 explained 19.8% of the variance, $R^2 = .20$, $F(1, 218) = 53.66$, $p < .001$. Executive-function measures entered at Step 2 did not explain significant additional variance, $\Delta R^2 = .006$, $\Delta F(6, 212) = 0.26$, $p = .96$. Positive affect, negative affect, and self-efficacy entered at Step 3 also produced no significant improvement, $\Delta R^2 = .01$, $\Delta F(3, 209) = 0.87$, $p = .460$. Finally, problem-focused and emotion-focused strategy use entered at Step 4 did not explain significant additional variance, $\Delta R^2 = .004$, $\Delta F(2, 207) = 0.59$, $p = .554$. No predictor was statistically significant in the final model.

Table 12
Hierarchical Regression for EPSI Total

Variable	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2
Step 1				.20***	.20***
Constant	4.41	.141			
Age	-.02***	.003	-.44***		
Step 2				.20***	.006
Constant	2.97	4.74			
Age	-.02	.008	-.33		
2-Back Correct RT	.00	.001	-.05		
2-Back Accuracy	.009	.01	.08		
Simon Congruent RT	.00004	.001	.004		
Simon Incongruent RT	.00	.001	.05		

Variable	<i>B</i>	<i>SE B</i>	β	<i>R</i> ²	ΔR^2
Simon Congruent Accuracy	-.008	.04	-.02		
Simon Incongruent Accuracy	.01	.04	.04		
Step 3				.21***	.01
Constant	2.62	4.84			
Age	-.15	.01	-.33		
2-Back Correct RT	.00	.001	-.03		
2-Back Accuracy	.01	.01	.09		
Simon Congruent RT	.00002	.001	.002		
Simon Incongruent RT	.00	.001	.05		
Simon Congruent Accuracy	-.003	.04	-.01		
Simon Incongruent Accuracy	.005	.04	.02		
Self-Efficacy	.008	.01	.05		
Positive Affect	.004	.01	.03		
Negative Affect	.013	.01	.10		
Step 4				.22***	.004
Constant	3.07	4.87			
Age	-.013	.01	-.30		
2 Back Correct RT	-.0001	.001	-.02		
2 Back Accuracy	.01	.011	.10		
Simon Congruent RT	.00004	.001	.004		
Simon Incongruent RT	.00	.001	.05		
Simon Congruent Accuracy	-.003	.04	-.01		
Simon Incongruent Accuracy	.003	.04	.01		
Self-Efficacy	.01	.01	.05		
Positive Affect	.002	.01	.02		
Negative Affect	.01	.01	.10		
Problem-Focused Strategy	-.02	.08	-.02		
Emotion-Focused Strategy	-.09	.08	-.09		

Note. RT = reaction time; EPSI = Everyday Problem Solving Inventory. * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

The aim of the current study was to examine age-related differences in everyday problem-solving performance and the contributions of executive-function performance, trait

affect, and self-efficacy to well-defined and ill-defined everyday problems in younger and older adults.

In summary, the findings showed age-group differences in executive-function task performance, with younger adults demonstrating higher accuracy and faster reaction times on the 2-back and Simon tasks. Similarly, there were significant age-related differences in the ability to resolve everyday problems; that is, younger adults performed better than older adults in both well-defined and ill-defined everyday problems. As predicted, the interaction between age group and problem-solving performance differed according to the type of ill-defined problem. Younger adults generated more safe and effective solutions for instrumental and mixed problems, whereas the groups did not differ significantly for interpersonal problems.

For well-defined problem-solving performance, age and selected executive-function measures made significant independent contributions, whereas positive affect, negative affect, and self-efficacy did not explain additional variance.

For overall ill-defined problem-solving performance, several bivariate associations were observed for total, instrumental, and mixed scores, but none of the cognitive or person-related variables made a significant independent contribution in the final regression model.

Age-related differences in EFs

In line with the hypotheses, the current study showed reduced accuracy and increased reaction times in the 2-back task in older adults relative to younger adults. This pattern is consistent with previous evidence of age-related differences in working-memory updating performance (Salthouse, 2005, 2009; Basak & Verhaeghen, 2011). Similar results are also supported by neuroimaging studies that further confirm age-related reductions in working-memory performance due to reduced activity in the dorsolateral prefrontal cortex (Collette &

Van der Linden, 2002; Hedden & Gabrieli, 2004). The worse performance of older adults in updating could also be explained by the *Processing Speed Theory* of ageing that supports that slower information processing speed in older adults could result in longer times to update working memory contents (Salthouse, 1996).

The poorer Simon-task performance of older adults is consistent with accounts proposing age-related difficulties in interference control, including the *Inhibitory Deficit Hypothesis* of ageing and a cognitive decline with increasing age in the ability to suppress irrelevant information (Hasher & Zacks, 1988).

Age-related differences in Everyday Problem-Solving Ability

In line with our hypotheses, older adults showed worse performance than younger adults on well-defined problems, which require the application of fixed rules and have a single correct solution. This replicates previous findings (e.g., Shokri et al., 2016) showing age-related declines in tasks that place high demands on processing speed, working memory, and inhibition. Older adults also performed worse on instrumental and mixed ill-defined everyday problems, but they did not differ significantly from younger adults on interpersonal ill-defined problems. This key finding is consistent with Mienaltowski (2011), who reported that older adults perform comparably to younger adults when solving socially and emotionally meaningful interpersonal dilemmas, often generating solutions of equal or greater effectiveness. According to Mienaltowski and others, such contexts may allow older adults to draw more heavily on emotion-regulation strategies, accumulated interpersonal knowledge, and lifelong social experience, which may partly offset disadvantages in fluid cognitive performance.

Strategy analyses showed clear age-group differences: older adults reported greater use of emotion-focused strategies, whereas younger adults reported greater use of problem-

focused strategies, consistent with previous findings (Blanchard-Fields, 2007; Mienaltowski, 2011). However, strategy-use ratings did not make a significant independent contribution to ill-defined problem-solving performance and therefore did not explain the comparable interpersonal performance of the two age groups. More broadly, although these age-related strategy differences are consistent with theoretical accounts emphasising socioemotional experience and accumulated interpersonal knowledge in later life, neither strategy use, trait affect, nor self-efficacy emerged as a significant predictor of overall ill-defined problem-solving performance.

Person-Related Factors in Everyday Problem-Solving Performance

The finding that older adults reported higher positive affect and lower negative affect than younger adults aligns with the broader literature on emotional ageing (Carstensen et al., 2000; Isaacowitz & Smith, 2003). According to socioemotional selectivity theory, older adults prioritize emotional well-being and focus more on positive, emotionally meaningful experiences, which may shape how they approach everyday problem-solving tasks. Positive and negative affect showed several bivariate associations with problem-solving performance, but neither dimension explained additional variance in the hierarchical regression models after age and executive-function measures were considered.

With regard to self-efficacy, older adults reported lower levels of self-efficacy than younger adults, a pattern consistent with previous literature indicating age-related declines in perceived competence in cognitively demanding or unfamiliar domains (Lachman & Weaver, 1998; Czaja et al., 2006). Previous studies have identified self-efficacy as a significant correlate or predictor of everyday problem-solving outcomes: older adults with higher self-efficacy tend to engage more persistently with complex tasks, select more adaptive strategies, and report better functional outcomes (Artistico et al., 2003; Singh et al., 2010; Diehl & Willis, 2003). However, self-efficacy did not explain additional variance in well-defined or

overall ill-defined problem-solving performance after the other variables in the models were considered.

Interpersonal Ill-defined Everyday Problems

One of the most notable findings of the present study was that older adults performed comparably to younger adults on interpersonal ill-defined problems, despite showing poorer performance on well-defined problems, instrumental ill-defined problems, mixed ill-defined problems, and executive function tasks. This pattern suggests that interpersonal ill-defined problem solving may draw on abilities or resources that are less sensitive to age-related cognitive decline.

Previous research has proposed that interpersonal problem solving depends less heavily on rapid working-memory updating and interference control and more on accumulated interpersonal knowledge, semantic memory, and social reasoning (Artistic et al., 2010; Blanchard-Fields, 2007; Mienaltowski, 2011). These accounts are consistent with the present results in that 2-back and Simon-task performance were not significantly associated with interpersonal problem-solving performance. With respect to person-related factors, the present study did not find significant associations between interpersonal problem-solving ability and positive affect, negative affect, or self-efficacy scores. Although older adults reported higher positive affect, lower negative affect, and lower general self-efficacy, these variables were not significantly correlated with interpersonal problem-solving ability. Nonetheless, previous research has suggested that older adults' emotional goals, emotion-regulation strategies, and perceived social competence may play a role in how they approach social dilemmas (Carstensen et al., 2000; Blanchard-Fields, 2007).

Finally, older adults' greater reliance on emotion-focused problem solving strategies may characterize how they approach interpersonal problems, even though these strategies did

not statistically predict performance in the present analyses. Emotion-focused strategies may be adaptive in some interpersonal contexts, particularly when maintaining relational harmony is an important goal (Blanchard-Fields, 2007; Mienaltowski, 2011). Although strategy use did not emerge as a significant predictor in the present study, it remains possible that qualitative differences in how older adults approach interpersonal problems contribute to their comparable performance, even if these differences are not captured by quantitative associations in the current dataset.

Taken together, the findings suggest that interpersonal ill-defined problem solving may depend on factors other than EF ability, affect, or general self-efficacy as measured in this study. Future research investigating other person-related factors may increase our understanding of individual differences in interpersonal problem-solving ability, particularly in older adults.

Although the regression analyses retained chronological age as a continuous variable and therefore examined associations across the full observed age distribution, they did not test whether the relationships between the individual predictors and problem-solving performance differed between younger and older adults. Possible age-group differences in these associations should therefore be examined directly in future research.

Conclusions

Given that neither executive functions nor the person-related factors measured in this study accounted for interpersonal ill-defined problem-solving performance, it is likely that other socioemotional or experiential factors, not captured by the current measures, contribute to preserved performance in this domain. Prior work suggests that interpersonal problems rely on understanding emotions, managing social dynamics, and generating flexible responses rather than on purely cognitive resources (Blanchard-Fields, 2007; Mienaltowski, 2011). For

this reason, Study 3 examined factors more directly linked to socioemotional and interpersonal functioning: psychological inflexibility and experiential avoidance, affective ToM, creativity, and self-perceptions of ageing. Psychological inflexibility and experiential avoidance may be relevant to navigating interpersonal conflicts because rigid or avoidant responses to difficult internal experiences may constrain adaptive engagement with emotionally demanding situations. Affective theory of mind (affective ToM), referring to the ability to infer others' emotional states, may support the interpretation of intentions and the generation of socially appropriate responses. Creativity, particularly divergent thinking, may support the generation of multiple adaptive solutions to open-ended interpersonal problems. Finally, self-perceptions of ageing may influence how older adults approach and evaluate social situations, given evidence that perceptions of one's own ageing are associated with coping, engagement, and well-being.

Together, these variables were therefore examined as potential contributors to individual differences in interpersonal everyday problem-solving performance in older adults.

Chapter 4 – Study 3

Introduction

Previous research has explored older adults' performance on both well- and ill-defined everyday problems, suggesting different patterns of age-related strengths and weaknesses (Allaire & Marsiske, 2002). Consistent with this, Study 2 showed that younger adults performed better than older adults on the 2-back and Simon tasks and on well-defined, instrumental, and mixed ill-defined problems. However, the two age groups performed comparably on interpersonal ill-defined problems, despite older adults' poorer executive-function task performance. This was accompanied by the finding that older adults relied more frequently on emotion-focused problem-solving strategies, whereas younger adults made greater use of problem-focused problem-solving strategies.

This pattern aligns with prior work showing that age-related differences in strategy use can influence the effectiveness of solutions to different types of ill-defined problems. Emotion-focused strategies—such as de-escalation, perspective-taking, or managing emotional tone—are particularly adaptive in interpersonal problems, which involve navigating relationships, social expectations, and emotional consequences (Blanchard-Fields, 2007; Mienaltowski, 2011). Because these problems rarely have a single correct solution and often benefit from maintaining social harmony, it is theoretically plausible that greater use of emotion-focused approaches may be advantageous in such contexts. However, Study 2 did not demonstrate that strategy use independently predicted interpersonal performance, suggesting that other socioemotional processes may be involved.

Previous research has also suggested that older adults may flexibly combine problem-focused and emotion-focused strategies in instrumental ill-defined problems (Artistico et al., 2003; Diehl et al., 2005; Meegan & Berg, 2002). Although Study 2 observed age differences in strategy preference, strategy use did not independently predict performance. Therefore,

strategy differences alone cannot account for the preserved interpersonal performance observed in older adults.

Furthermore, Study 2 showed that none of the cognitive or person-related factors measured (EFs, affect, general self-efficacy) were significantly associated with interpersonal problem-solving performance. This is consistent with previous research suggesting that interpersonal problems constitute a distinct category of everyday problems, relying less on traditional cognitive abilities and more on socioemotional processes (Blanchard-Fields et al., 2004).

Study 3 therefore examined additional socio-cognitive, psychological, and person-related factors theoretically relevant to interpersonal problem solving: affective theory of mind, psychological inflexibility and experiential avoidance, creativity, and self-perceptions of ageing. The next sections introduce these constructs, followed by the study's methodology, results, and discussion.

Affective Theory of Mind

Theory of mind (ToM) refers to the capacity to infer others' beliefs, intentions, desires, and emotions and is fundamental to navigating complex social environments (Premack & Woodruff, 1978). Affective ToM refers specifically to the inference or identification of others' emotional states. Beyond its role in social cognition, ToM has also been linked to performance in everyday problem solving, especially in interpersonal contexts where understanding another person's perspective is essential (Baron-Cohen et al., 2001; Otsuka et al., 2021). Interpersonal everyday problems are ill-defined and require individuals to interpret emotions, anticipate social consequences, and integrate relational expectations when generating solutions (Blanchard-Fields, 2007; Diehl et al., 2020).

EFs—particularly inhibition, cognitive flexibility, and working memory—have been associated with ToM performance. Inhibition is needed to suppress the immediate egocentric perspective in order to adopt someone else’s mental or emotional viewpoint (Carlson & Moses, 2001). This is especially relevant for affective ToM, which involves understanding others’ emotional states. Research shows that inhibitory control is related to affective ToM performance across adulthood, with somewhat stronger associations in older adults due to age-related variability in EFs (Henry et al., 2013; Otsuka et al., 2021).

Importantly, however, reliance on EFs does not mean that older adults will necessarily show poorer ToM performance. Although age-related declines in EFs are well documented, many studies show that older adults perform as well as or better than younger adults on affective ToM tasks (Cavallini et al., 2013; Wang & Su, 2013). This is likely because affective ToM draws on additional resources that do not decline with age—and in some cases improve—such as emotional experience, emotion regulation capacities, and socioemotional knowledge (Cho & Cohen, 2019; Urry & Gross, 2010). Thus, even when EF capacity decreases, older adults may compensate by relying more on accumulated interpersonal experience and refined emotional understanding.

Socioemotional selectivity theory (Carstensen et al., 1999) further supports this perspective by proposing that older adults increasingly prioritize emotionally meaningful interactions and goals. As emotional well-being improves with age and emotional responses become more balanced and regulated, older adults may be especially motivated and well-equipped to interpret emotional cues in others. These socioemotional advantages can offset EF declines, allowing older adults to maintain strong performance on affective ToM tasks and in emotionally relevant interpersonal problem-solving situations.

Task-based differences in ToM assessment also reveal age-related patterns. Older adults often perform comparably or better than younger adults on tasks measuring affective ToM (Rosi et al., 2016; Otsuka et al., 2021), mirroring patterns found in interpersonal everyday problem solving (Blanchard-Fields et al., 2007; Thornton & Dumke, 2005). Both domains require integration of emotional sensitivity, perspective taking, and strategic decision-making. Research indicates that interpersonal problem-solving performance is closely tied to emotion regulation, empathy, and accumulated social experience, all reflecting competencies strongly linked with affective ToM. More specifically, the study of Blanchard-Fields (2007) indicates that even if cognitive skills of people deteriorate, as they grow older, they tend to solve interpersonal problems more effectively than younger ones, keeping their emotions salient and regulated. In fact, older people tend to focus more on the context of the problem they have to deal with, while at the same time combining instrumental and emotion-regulation strategies, also utilizing their longer experience in social issues, compared with their younger counterparts.

In sum, research indicates that affective ToM may be relatively preserved in later adulthood, suggesting that it could contribute to interpersonal competence among older adults. While executive functions support cognitive control and planning, affective ToM enables effective interpretation of socially and emotionally complex situations. Although affective ToM has been associated with social functioning, little research has directly examined its relationship with performance on ill-defined interpersonal everyday problems.

Psychological Inflexibility and Experiential Avoidance

Emotion regulation is theoretically relevant to the management of ill-defined interpersonal everyday problems because such situations often involve emotional ambiguity, competing goals, and the need to preserve relational harmony (Blanchard-Fields, 2007;

Mienaltowski, 2011). Previous research suggests that older adults may approach interpersonal dilemmas in ways that prioritise emotional balance and relationship maintenance (Blanchard-Fields et al., 2004; Blanchard-Fields, 2007). However, there is limited direct evidence examining whether regulatory functioning predicts performance on interpersonal problem-solving tasks.

In the present study, potentially maladaptive aspects of regulatory functioning were examined through psychological inflexibility and experiential avoidance. Psychological inflexibility refers to difficulty adapting behaviour to situational demands and personally meaningful goals when distressing thoughts or emotions are present. Experiential avoidance refers to attempts to avoid, suppress, or control unwanted internal experiences, even when doing so interferes with adaptive action. These related processes may constrain the generation of constructive and socially appropriate responses to emotionally complex interpersonal problems. Accordingly, they were treated as indicators of potentially maladaptive regulatory functioning rather than as comprehensive measures of emotion regulation.

Ill-defined interpersonal problems are inherently ambiguous, lack a clear solution path, and are embedded within emotionally meaningful social interactions (Blanchard-Fields, 2007; Mienaltowski, 2011). Because such situations may involve heightened emotions, conflicting goals, or the need to maintain relational harmony, the capacity to manage emotional reactions may influence how effectively individuals navigate them.

Older adults often demonstrate greater emotional stability and more effective emotion regulation than younger adults (Carstensen et al., 2011; Urry & Gross, 2010). These age-related strengths may help them remain composed, reduce emotional reactivity, and generate more socially sensitive responses during interpersonal challenges. Emotion regulation and self-control may both be relevant in such contexts, although they are distinct processes:

emotion regulation involves modifying the intensity or duration of emotional responses, whereas self-control refers more specifically to the effortful inhibition of dominant impulses (Gross, 1998; Baumeister et al., 2007).

One emotion-regulation strategy frequently discussed in relation to ageing is cognitive reappraisal, which involves reinterpreting a situation to alter its emotional impact (Opitz et al., 2012). Older adults may use reappraisal more frequently and effectively than suppression, potentially supporting calmer assessments of others' intentions, reduced impulsivity, and improved communication in interpersonal situations (Urry & Gross, 2010; Shiota & Levenson, 2012; Paterson et al., 2015; Blanchard-Fields et al., 2007).

These patterns are consistent with socioemotional selectivity theory, which proposes that increasing awareness of limited future time leads older adults to prioritise emotionally meaningful goals and relationships (Carstensen et al., 1999; Nowlan et al., 2015). Through reappraisal, older adults may reinterpret interpersonal tensions in ways that preserve relationship quality and reduce emotional escalation.

Despite age-related declines in executive functioning, older adults may compensate by relying on well-practised regulatory strategies (Urry & Gross, 2010). Although they may show reduced flexibility in adapting strategies to novel situations, they may also draw on adaptive and prosocial behavioural tendencies that are effective in real-world interpersonal contexts (Orth et al., 2010). Suppression, although generally considered less adaptive, may also be used selectively without substantially compromising emotional well-being (Shiota & Levenson, 2012).

Emotion-regulation strategies, particularly reappraisal, have been associated with better psychological well-being, social functioning, and adjustment in emotionally demanding contexts (Gross & John, 2003; John & Gross, 2004). However, the present study

did not assess reappraisal, suppression, or other specific emotion-regulation strategies directly. Instead, it examined whether psychological inflexibility and experiential avoidance were associated with interpersonal problem-solving performance.

Self-Perceptions of Ageing

Self-perceptions of ageing, specifically the beliefs and attitudes individuals hold about their own ageing process, have emerged as a significant psychological construct with broad implications for well-being, health, and longevity (Diehl et al., 2014; Diehl & Wahl, 2010; Levy et al., 2002a, 2002b; Steverink et al., 2001; Westerhof et al., 2012). A growing body of research has shown that older adults who hold positive self-perceptions of ageing tend to experience better health outcomes, increased life satisfaction, and even longer lifespans compared to those with more negative views (Levy et al., 2002a, 2002b; Westerhof et al., 2012). Notably, perceived control may be one mechanism through which positive self-perceptions of ageing are associated with cognitive and health outcomes. (Demakakos et al., 2006; Levy et al., 2016).

In addition to physical health outcomes, self-perceptions of ageing are also strongly linked to psychological health. Older adults who view ageing as a time of continued growth and potential are significantly less likely to report depressive symptoms or experience persistent negative emotions (Wurm & Benyamini, 2014). These individuals are more likely to engage in proactive coping, use adaptive emotion regulation strategies, and sustain motivation in the face of daily challenges, factors that are all critical for effective functioning in later life (Wurm & Tomasik, 2008).

Given these broad and impactful connections, it is relevant to explore how self-perceptions of ageing may influence ill-defined everyday problem solving, particularly in interpersonal or emotionally loaded contexts. Everyday problem solving in older adulthood,

as mentioned previously, often involves managing social interactions, regulating emotional responses, and drawing upon life experience to resolve complex, ambiguous challenges (Allaire & Marsiske, 2002). Positive self-perceptions may bolster confidence and agency, which can promote greater engagement and persistence in tackling such problems. Conversely, negative views of ageing may lead to self-limiting beliefs, reduced initiative, and avoidance, thereby undermining problem-solving performance (Artistico, Cervone & Pezzuti, 2003).

The link between self-perceptions of ageing and emotion regulation provides an important conceptual foundation for examining interpersonal problem solving in later life. Research shows that individuals with more positive views of their own ageing tend to use more adaptive regulation strategies, such as cognitive reappraisal, and experience greater emotional stability and sustained positive affect in challenging situations (Diehl et al., 2014; Westerhof et al., 2012). These findings suggest that the way people interpret and evaluate their ageing process may shape how they manage emotionally charged interpersonal situations.

Although age-related patterns in emotion regulation are well documented more broadly (e.g., Urry & Gross, 2010), the present study focuses specifically on self-perceptions of ageing because emerging evidence indicates that self-perceptions of ageing can influence how older adults approach daily experiences, including social challenges. Older adults with more positive self-perceptions of ageing tend to interpret problems less negatively, feel more efficacious when evaluating interpersonal difficulties, and are more likely to engage in constructive emotional coping (Diehl et al., 2014; Wurm & Tomasik, 2008). Conversely, negative self-perceptions of ageing have been associated with reduced motivation, heightened emotional reactivity, and less adaptive responses to everyday difficulties (Westerhof et al., 2012).

As the concept of the “ageing self” gains attention in gerontology research, its implications for problem-solving processes are increasingly recognized. Initial evidence suggests that positive self-perceptions of ageing may serve as a motivational and interpretive lens, encouraging older adults to approach interpersonal challenges with greater confidence, emotional openness, and a more constructive mindset (Diehl et al., 2014). Thus, in the present study, the construct of self-perceptions of ageing was examined not because it has been firmly established as a predictor of interpersonal problem solving, but because it represents a promising and theoretically grounded factor.

Creativity

Creativity is another factor that may contribute to successful everyday problem solving, particularly in ill-defined or open-ended situations where solutions are not immediately apparent and multiple approaches may be viable (Marsiske & Willis, 1998). In such contexts, creativity can support the cognitive flexibility, idea generation, and perspective shifting needed to navigate ambiguous interpersonal challenges (Runco & Jaeger, 2012). These capacities may be especially relevant for interpersonal problems, which often require individuals to integrate emotional cues, consider competing viewpoints, and generate socially sensitive solutions. In the present study, creativity was operationalised through divergent-thinking performance, including fluency, flexibility, originality, and elaboration.

Much of the existing evidence comes from studies using divergent thinking tasks, where participants are asked to generate as many ideas or solutions as possible under time constraints (Kim et al., 2007). For example, tasks such as alternate uses, brainstorming, or mind-mapping have been used to assess creativity in problem contexts similar to everyday challenges (Kim et al., 2007). Divergent thinking performance—especially fluency (the number of ideas generated) and flexibility (the number of conceptual categories

represented)—has been positively associated with problem-solving outcomes in open-ended and novel tasks, such as social dilemmas, hypothetical interpersonal conflicts, and real-life decision-making scenarios (e.g., Grohman et al., 2017; Zabelina & Robinson, 2010). These studies suggest that creativity contributes not only to the generation of multiple potential solutions but also to the ability to reframe problems, consider alternative interpretations, and adapt solutions to interpersonal contexts.

However, despite these links, little research has directly examined creativity in the context of ill-defined interpersonal everyday problems in older adulthood. Most work has focused on either younger adults or non-social problem-solving scenarios (Zabelina & Robinson, 2010; Grohman et al., 2017). The present study therefore addresses an important research gap by investigating whether creativity—including divergent thinking—contributes to interpersonal everyday problem solving among older adults, for whom flexible thinking may provide an additional resource when addressing complex interpersonal problems.

While cognitive ageing is generally associated with declines in EFs, a growing body of work suggests that older adults may retain or even show relative strengths in creative thinking, particularly in everyday or socially meaningful contexts (Palmiero et al., 2014). Creativity may support ill-defined problem solving by enabling flexible reinterpretation and the generation of multiple potential solutions.

One of the foundational studies linking creativity to everyday problem solving is that of Marsiske and Willis (1998), who examined adult participants across a wide age range using an ecologically valid everyday problem-solving battery that included ill-defined interpersonal and instrumental scenarios. Creativity was operationalized through indices of solution fluency, originality, and flexibility. Although their study did not focus exclusively on older adults and used different measures than the present study, it provides important

evidence that creative thinking contributes to everyday problem solving in ecologically relevant contexts. Importantly, creativity contributed uniquely and significantly to everyday problem-solving performance, accounting for additional variance beyond traditional fluid cognitive abilities. This suggests that creative thinking may support everyday problem solving independently of traditional fluid cognitive mechanisms.

Although some studies report age-related declines in laboratory measures of creativity (Palmiero et al., 2014), such findings often reflect reduced processing speed or inhibition rather than diminished real-world adaptive capacity (Salthouse, 2005; Amer et al., 2016). Creativity in later adulthood appears to be shaped by individual differences and life context rather than showing a uniform decline. In particular, older adults may continue to draw on experience and contextual knowledge when dealing with complex, ill-defined, and social problems.

In particular, fluency and flexibility components of creativity may play a role in solving ill-defined problems. Fluency refers to the ability to generate many ideas, while flexibility refers to developing ideas across a variety of categories (Kim et al., 2007). Originality, the capacity to produce novel and unique ideas, may also support ill-defined everyday problem solving (Zabelina & Robinson, 2010). Older adults have been found to produce more original responses compared to younger adults in open-ended problem contexts, potentially due to accumulated life experiences and a richer base of knowledge (Marsiske & Willis, 1993). In a related study, González-Restrepo et al. (2019) found that although creativity manifests differently across the lifespan, it does not necessarily diminish with age, underscoring the need for assessment tools that account for age-related changes.

Similarly, Madore et al. (2016) showed that an episodic specificity induction—a brief intervention prompting detailed recall of past experiences—enhanced divergent thinking in

both younger and older adults. After the induction, participants performed better on divergent thinking tasks such as the Alternate Uses and Consequences Tasks. Crucially, the improvement observed in older adults suggests that when they draw on rich, specific episodic memories, their capacity for flexible and original ideation can be strengthened.

These findings challenge the stereotype that creativity necessarily declines with age and instead highlight how experience, contextual knowledge, and life wisdom can support originality in real-world situations (Hickson & Housley, 1997). In the context of the present study, this suggests that older adults' creative contributions to ill-defined interpersonal problems may be supported by their ability to draw on detailed past experiences and rework them into novel, adaptive solutions, rather than relying solely on fluid cognitive resources.

One paradoxical explanation for age-related gains in originality relates to declines in inhibitory control, which are associated with ageing (Amer et al., 2016). Reduced inhibition can increase distractibility; however, distraction has also been shown to foster greater creative output by allowing access to a broader range of ideas, including unconventional or tangential associations (Carpenter et al., 2020). Thus, what might typically be considered a cognitive decline may, paradoxically, support creative ideation and enhance performance in ambiguous problem-solving scenarios.

Overall, creativity—particularly its components of fluency, flexibility, and originality—may represent an important cognitive resource for navigating ill-defined everyday problems. Rather than reflecting a uniform decline, creative performance in later life appears to depend on contextual engagement, accumulated knowledge, and motivational factors. These characteristics may be particularly relevant in interpersonal problem solving, where generating multiple, socially appropriate responses can facilitate adaptive functioning.

Current Study

The present study examined four theoretically relevant factors in relation to interpersonal ill-defined problem-solving performance in older adults: affective theory of mind (affective ToM), psychological inflexibility and experiential avoidance, divergent-thinking performance, and self-perceptions of ageing. Affective ToM was examined as a socio-cognitive capacity relevant to recognising and interpreting others' emotional states in complex interpersonal situations (Otsuka et al., 2021). Psychological inflexibility and experiential avoidance were examined as indicators of maladaptive regulatory functioning that may constrain adaptive responses to emotionally demanding situations (Gross, 1998; Blanchard-Fields, 2007). Divergent-thinking performance was examined as a cognitive resource supporting the generation of multiple and flexible solutions to ill-defined problems (Marsiske & Willis, 1998), whereas self-perceptions of ageing were examined as a self-related factor that may shape motivation, confidence, and engagement in later life (Diehl et al., 2014; Westerhof et al., 2012). Drawing on lifespan and developmental perspectives, these factors were considered within an integrated framework in which socio-cognitive, regulatory, cognitive, and self-related processes may jointly contribute to adaptive interpersonal functioning in older adulthood (Carstensen et al., 1999; Diehl et al., 2014).

RQ: Do affective ToM, psychological inflexibility and experiential avoidance, divergent-thinking performance, and self-perceptions of ageing predict performance on interpersonal ill-defined everyday problems in older adults?

1. Higher affective ToM capacity will be associated with better performance in interpersonal ill-defined everyday problems.
2. Lower psychological inflexibility and experiential avoidance will be associated with better performance on interpersonal ill-defined everyday problems.
3. More positive self-perceptions of ageing will be associated with better performance in interpersonal ill-defined everyday problems.

4. Higher divergent-thinking performance will be associated with better performance on interpersonal ill-defined everyday problems.

In addition, theoretically informed exploratory mediation analyses examined whether creativity and self-perceptions of ageing represented potential indirect pathways in the associations of affective ToM and psychological inflexibility and experiential avoidance with interpersonal problem-solving performance. Affective ToM may support the interpretation of others' emotional states in complex interpersonal situations, while divergent thinking facilitates the generation of multiple, flexible, and context-sensitive solutions to ill-defined problems (Otsuka et al., 2021; Marsiske & Willis, 1998; Runco & Jaeger, 2012). Creativity was therefore examined as a potential indirect pathway between affective ToM and interpersonal problem-solving performance. Similarly, psychological inflexibility and experiential avoidance may constrain adaptive engagement with emotionally demanding situations, whereas more positive self-perceptions of ageing have been associated with greater confidence, adaptive coping, and engagement in everyday challenges (Diehl et al., 2014; Wurm & Tomasik, 2008; Westerhof et al., 2012). Self-perceptions of ageing were therefore examined as a potential indirect pathway between psychological inflexibility and experiential avoidance and interpersonal problem-solving performance. Although the specific pathways examined in the present study have not been directly tested, conceptually comparable models have linked theory of mind with creativity and examined creativity as a pathway to functional outcomes (Sampedro et al., 2020, 2021). Similarly, attitudes toward ageing have been examined as potential mediators between older adults' health or contextual experiences and adaptive outcomes, including quality of life and life satisfaction (Low et al., 2013; Che et al., 2024).

Method

Participants

A sample of 88 participants ($N=88$) was recruited from the older-adult sample that participated in Study 2. From the 88 people who agreed to participate in this study, 64.8% were females and 35.2% were males with their age ranging from 57 to 81 years ($M=71.18$, $SD=7.31$; $Mdn=73$ years). Although the lower age limit of the sample was 57 years, 73.9% of participants were aged 65 years or older, and 54.5% were older than 70 years. Concerning education of the sample, 29.5% had completed high school, 46.6% had obtained Bachelor's degree and finally 23.9% had obtained a Master's degree. Therefore, despite the relatively low minimum age, the sample predominantly consisted of participants in older adulthood and retained a similar age profile to the older participants who took part in Study 2 (see Table 13).

Participants were drawn from the sample of Study 2. At the end of Study 2, participants were given the option to voluntarily provide contact information if they wished to be invited to future related research. Contact details were stored separately from research data and were not linked to participants' responses. Individuals who had consented to be re-contacted were subsequently invited to take part in the present study. Upon agreeing to participate, they were provided with a new information sheet and consent form, and informed that participation was voluntary and confidential. Participants' contact information was used solely for the purpose of invitation and was deleted following completion of the study.

Table 13
Participant Demographic Characteristics in Study 3

Characteristic	Study 3 Sample ($N = 88$)
Age, $M (\pm SD)$	71.18 (± 7.31)
Median age	73
Age range	57–81
Female, $n (\%)$	57 (64.8%)
Male, $n (\%)$	31 (35.2%)
High school, $n (\%)$	26 (29.5%)
Bachelor's degree, $n (\%)$	41 (46.6%)

Characteristic	Study 3 Sample (<i>N</i> = 88)
Master's degree, <i>n</i> (%)	21 (23.9%)

Note. In the sample, 73.9% of participants were aged 65 years or older and 54.5% were older than 70 years.

Materials

Montreal Cognitive Assessment (MoCA). The Greek version of the Montreal Cognitive Assessment (MoCA) was used as a cognitive screening measure to identify participants whose scores fell below the cut-off associated with possible mild cognitive impairment (Nasreddine et al., 2005; Konstantopoulos et al., 2016). The MoCA assesses six cognitive domains; executive functioning, visuospatial abilities, short-term memory, working memory, language and temporal/spatial orientation. The number of correct responses is recorded. Scores range from 0 to 30, with higher scores indicating better global cognitive performance. The cut-off score based on Greek normative data is 25 out of 30 (Konstantopoulos & Vogazianos, 2019). Previous studies have confirmed good psychometric properties of the original version, $\alpha=.903$ (Freitas et al., 2013) as well as the Greek version, $\alpha=.710$ (Konstantopoulos & Vogazianos, 2019) (see Appendix G).

Everyday Problem-Solving Inventory (EPSI). The Greek version of EPSI was employed to assess performance on ill-defined everyday problems. The Greek version of EPSI comprises of 24 everyday ill-defined problems, covering all six categories (including each 4 problems) identified in the original version; home (“*There have been a number of burglaries near your home in recent months. What do you do?*”), consumer (“*You would like to buy a birthday gift for a friend but cannot afford it at the time. What do you do?*”), information (“*You are completing your income tax but find it difficult to interpret some of the instructions. What do you do?*”), health (“*Your doctor tells you to only eat foods low in fat.*”),

What do you do to determine if a particular food at the super market is low in fat?”), family (*“You have an argument with someone from your immediate family (child, sibling or other) about an issue that is important to you. What do you do?”*) and friends (*“You lost or broke an expensive item that you borrowed from someone. What do you do?”*). The 24 problems were further classified as instrumental, (*“A complicated form that you completed was returned because you misinterpreted the instructions on how to fill it out. What would you do?”*), interpersonal, (*“You have done something that offended one of your friends. What would you do?”*), or mixed, (*“You would like to buy a birthday gift for a friend but cannot afford it at the time. What would you do?”*). Ten problems were classified as instrumental, seven as interpersonal, and seven as mixed.

In comparison to the original version of EPSI that provided the participants possible solutions to choose from, in the Greek version of EPSI participants were required to generate instead as many safe and effective solutions they can think of, as proposed by Allaire and Marsiske (1999) for a similar instrument, the Open-Ended Everyday Problem-Solving Test (OEEPT). Responses were scored using solution fluency, defined as the number of safe and effective solutions generated for each problem. Two independent scorers coded participants' responses according to the criteria described by Denney and colleagues (Denney & Pearce, 1989; Denney et al., 1992). Higher scores indicated greater solution fluency and therefore better performance on ill-defined everyday problems. Participants also rated the extent to which they used emotion-focused and problem-focused strategies when attempting to solve each problem. Four items were rated on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very much*). Two items assessed emotion-focused strategy use, (*“When I tried to resolve the problem I focused on how I feel in order to come up with a solution.”* and *“When I tried to resolve the problem I focused on regulating my emotions towards the problem rather than addressing the problem.”*), and two assessed problem-focused strategy use, (*“When I tried to*

resolve the problem I focused on the details and information of the problem while trying to solve it.” and “When I tried to resolve the problem I tried to focus on the underlying cause while taking action to solve it.”). For each participant, the mean of the two emotion-focused items and the mean of the two problem-focused items were calculated across the EPSI problems. Higher scores indicated more frequent use of the respective strategy type.

Previous studies have shown good psychometric properties of both the original EPSI ($\alpha=.73$; Marsiske & Willis, 1995) and Greek version ($\alpha=.913$) (see Appendix A).

Personal Experience of Ageing Scale (PEAS). The original PEAS comprises of 12 questions assessing personal experience on ageing through three different factors, physical decline, social loss and continuous growth (Steverink et al., 2001). Each factor is measured through 4 questions, items 1 to 4 assess self-perceptions on physical decline, items 5 to 8 assess self-perceptions on social loss and items 9 to 12 assess self-perceptions on continuous growth. All questions are answered using a 4-point Likert scale (1: *completely true*, 4: *completely not true*). A score for each factor can be calculated by adding up answers to all items, which higher scores indicating more negative self-perceptions on ageing for the physical decline and social loss factors, and more positive self-perceptions on ageing for the continuous growth factor. A total score representing the overall self-perceptions on ageing can be calculated by the reversing items 1 to 8 (physical decline and social loss factors) and adding up with the remaining items. Higher total scores suggest more positive self-perceptions towards one's ageing. Previous studies have shown good psychometric properties of both the original PEAS ($\alpha=.77-79$; Steverink et al., 2001) and Greek version ($\alpha=.921$) (see Appendix C).

Acceptance and Action Questionnaire-II (AAQ-II). The Greek version of the Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011; Karekla & Michaelides,

2017) was used to assess psychological inflexibility and experiential avoidance. The scale comprises seven items rated on a 7-point Likert scale ranging from 1 (*never true*) to 7 (*always true*). No items are reverse-scored. A total score was calculated by summing responses across the seven items, with higher scores indicating greater psychological inflexibility and experiential avoidance. Previous research has reported good internal consistency for both the original version, $\alpha = .84$ (Bond et al., 2011), and the Greek version, $\alpha = .92$ (Karekla & Michaelides, 2017) (see Appendix M).

Alternative Uses Task (AUT). Divergent-thinking performance was assessed using the Alternative Uses Task (AUT; Guilford, 1967). Participants were asked to generate as many possible uses for a newspaper as they could within five minutes. Instructions were administered in Greek.

Scores were derived for fluency, flexibility, elaboration, and originality, as well as an overall creativity score computed by summing these indices. Fluency was calculated as the total number of alternative uses generated. Flexibility was assessed as the number of conceptually distinct categories represented in participants' responses, as determined independently by two trained raters. Elaboration was evaluated based on the level of detail provided for each response, with 0 points assigned for non-elaborated answers, 1 point for moderately elaborated answers, and 2 points for highly elaborated answers, as judged independently by two trained raters. Originality was determined based on the frequency of responses within the sample, with rarer responses receiving higher scores. Specifically, responses produced by 5% or fewer of participants received 1 point, and responses produced by 1% or fewer received 2 points; all other responses received 0 points. An overall divergent-thinking score was computed by summing these indices.

The Revised Eyes Test (RET). The Greek version of the Revised Eyes Test (RET) was used to assess affective theory of mind, specifically the ability to infer complex emotional and mental states from the eye region of faces. The task comprised of 36 trials, as in the original one (Baron-Cohen et al., 1997; Baron-Cohen et al., 2001; Panteraki, 2005). On each trial, participants viewed the eye region of a face and selected the mental or emotional state that best described the expression from four response alternatives. One point was awarded for each correct response, producing a total score ranging from 0 to 36. Higher scores indicated better affective-ToM performance. (see Appendix N).

Procedure

The study was approved by the Research Ethics Committee of the University of Sheffield (application reference number: 049789) (see Appendix O). All participants provided written informed consent and completed demographic questions assessing sex, age, socioeconomic status, and educational level (see Appendix P and Q).

Participants first completed the MoCA as a cognitive screening measure. They then completed the seven interpersonal EPSI problems, followed by the AUT, RET, AAQ-II, and PEAS. Participants were subsequently debriefed. The approximate duration of the study was 25 minutes.

Results

Preliminary Analyses & Assumptions

MoCA

The average MoCA score for the group of older adults was 27.49 ($SD=1.02$) ranging from a maximum of 29 points to a minimum of 25 points. No participants were excluded based on the Greek normative cut-off score.

To assess for differences between participants' MoCA score between Study 2 and Study 3 a paired samples *t*-test was conducted. The results showed a significant difference, $t(87)=-3.427, p=.001, d=0.37$, Study 2 ($M=26.94, SD=1.13$) and Study 3 ($M=27.49, SD=1.02$).

Normality was assessed using the Kolmogorov–Smirnov test for all study variables, and no statistically significant deviations from normality were identified, $p > .05$. For the paired-samples *t*-tests, the distributions of the difference scores were examined and showed no substantial deviations from normality or influential outliers. For the Pearson correlations, scatterplots were inspected to assess linearity and identify potentially influential bivariate outliers; the relationships were approximately linear, and no influential bivariate outliers were identified.

The data were also assessed against the assumptions underlying multiple regression. Normality of residuals was evaluated using the Shapiro–Wilk test, which indicated that the standardised residuals did not significantly deviate from normality, $p > .05$. Independence of errors was assessed using the Durbin–Watson statistic, with values falling between 1.5 and 2.5. Linearity and homoscedasticity were examined using plots of standardised residuals against standardised predicted values (ZRESID vs. ZPRED), which showed no systematic patterns or curvature. Multicollinearity was assessed using tolerance and variance inflation factor values; all VIF values were below 5 and all tolerance values exceeded .20. Potentially influential observations were assessed using Cook's distance, and no cases exceeded the conventional threshold of 1. These assumptions were also considered applicable to the regression paths estimated within the exploratory indirect-effect models.

Reliability Analyses

Cronbach's alpha was used to assess the internal consistency of the multi-item measures. Inter-rater reliability was additionally assessed for EPSI scoring and for the AUT flexibility and elaboration indices to address subjectivity in scoring.

EPSI – Cronbach's Alpha

Reliability of EPSI was assessed using Cronbach's alpha coefficient. For the current study the alpha coefficient for EPSI interpersonal problems was $\alpha=.631$, similar to Study 2.

EPSI – Kappa Coefficient

Interrater reliability of EPSI was assessed using Kappa coefficient. For the current study the kappa coefficient for EPSI interpersonal problems was $\kappa=.841$.

AUT – Kappa Coefficient

Interrater reliability of AUT flexibility and elaboration was assessed using Kappa coefficient. For the dimension of flexibility, the coefficient of agreement between the two independent scorers was $\kappa=.818$. For the dimension of elaboration, the coefficient of agreement between the two independent scorers was $\kappa=.773$.

AAQ-II

Similarly, reliability, using Cronbach's alpha coefficient, was assessed for the AAQ-II, yielding an $\alpha=.953$.

PEAS

Finally, reliability using the Cronbach's alpha coefficient was assessed for PEAS, both for the overall scale, $\alpha=.918$, and separately for the three subscales, Physical Decline ($\alpha=.943$), Social Loss ($\alpha=.870$) and Continuous Growth ($\alpha=.966$).

Descriptive Statistics

Descriptive statistics for the principal performance measures are presented in Table 14.

EPSI – Differences Between Study 2 & Study 3

To assess for the differences between participants' score in interpersonal problems between Study 2 and Study 3 a paired samples t-test was conducted, and there was a significant difference, $t(87)=7.202$, $p<.001$, $d=0.77$, that is participants were better in Study 3 ($M=3.42$, $SD=0.80$), as compared to Study 2 ($M=3.32$, $SD=0.82$).

Table 14
Descriptive Statistics for the Study Variables

Variable	$M (\pm SD)$	Min–Max
EPSI Interpersonal	3.41 (± 0.80)	1.71–5.43
Overall AUT	9.13 (± 3.19)	3–16
Fluency	4.60 (± 1.78)	2–7
Flexibility	2.65 (± 1.23)	1–6
Elaboration	1.20 (± 0.79)	0–2
Originality	0.67 (± 0.67)	0–2
RET	20.99 (± 5.18)	10–31

Note. M = mean; SD = standard deviation; EPSI = Everyday Problem Solving Inventory; AUT = Alternative Uses Task; RET = Revised Eyes Test

Associations of Affective ToM, Psychological Inflexibility and Experiential Avoidance, Divergent-Thinking Performance, and Self-Perceptions of Ageing with Interpersonal Problem-Solving Performance

Bivariate Pearson correlations were conducted to assess the relationship of EPSI interpersonal performance with all variables assessed in the current study and results are presented in Table 15. Overall, better interpersonal problem-solving performance was associated with lower psychological inflexibility and experiential avoidance, higher divergent-thinking performance, more positive self-perceptions of ageing, and better affective-ToM performance.

Table 15

Pearson Correlation Coefficients Between EPSI Interpersonal Performance and Study Variables

Variable	<i>r</i>
Psychological Inflexibility and Experiential Avoidance	-.78***
Overall AUT	.57***
Fluency	.43***
Flexibility	.47***
Originality	.30**
Elaboration	.33**
PEAS Total	.75***
Physical Decline	.44***
Continuous Growth	.91***
Social Loss	.33**
Affective ToM	.73***

Note. AUT = Alternative Uses Task; PEAS = Perceptions of Ageing Scale; ToM = Theory of Mind. ** $p < .01$, *** $p < .001$.

Prediction of Interpersonal Problem-Solving Performance

A multiple regression analysis examined whether psychological inflexibility and experiential avoidance, overall AUT performance, affective ToM, and self-perceptions of ageing predicted interpersonal EPSI performance. The overall model explained 79.1% of the variance in interpersonal EPSI performance, $R^2 = .79$, $F(4, 83) = 78.40$, $p < .001$. All four predictors made significant independent contributions. Psychological inflexibility and experiential avoidance showed the largest standardised association with EPSI interpersonal scores ($\beta = -.37$, $p < .001$), followed by self-perceptions of ageing ($\beta = .28$, $p < .001$), affective ToM ($\beta = .27$, $p < .001$), and overall AUT performance ($\beta = .17$, $p = .004$).

Exploratory Mediation Analyses

Two theoretically informed exploratory models were examined. The first tested creativity as a potential indirect pathway in the association between affective ToM and

interpersonal problem-solving performance. The second tested self-perceptions of ageing as a potential indirect pathway in the association between psychological inflexibility and experiential avoidance and interpersonal problem-solving performance.

Given the exploratory nature of the mediation analyses, the following results are interpreted as indicative of potential indirect pathways rather than as conclusive evidence of mediation. As only two theoretically specified exploratory models were examined, no formal adjustment for multiple testing was applied; the findings were therefore interpreted cautiously and require replication.

Indirect effects were evaluated using bias-corrected and accelerated bootstrap confidence intervals based on 5,000 resamples.

The first exploratory model examined creativity as a potential indirect pathway in the association between affective ToM and interpersonal problem-solving performance (Figure 8). The bootstrap analysis indicated an indirect effect of affective theory of mind on interpersonal everyday problem solving through creativity (Estimate = 0.0209, 95% BCa CI [0.0080, 0.0386], $p = .002$). The direct effect of affective theory of mind remained significant after accounting for creativity (Estimate = 0.0911, $p < .001$). This pattern indicated an indirect association alongside a remaining direct association, although the cross-sectional design does not establish causal mediation.

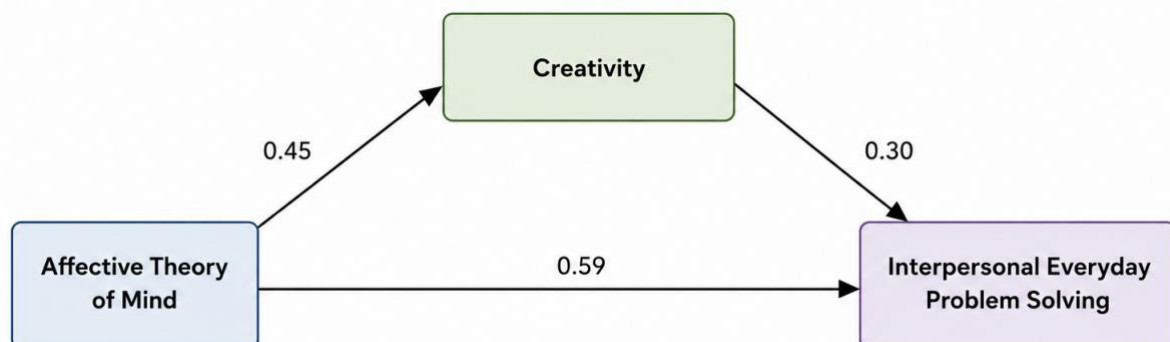


Figure 8: Exploratory indirect-effect model examining creativity as a potential pathway in the association between affective ToM and interpersonal everyday problem-solving performance.

The second exploratory model examined self-perceptions of ageing as a potential indirect pathway in the association between psychological inflexibility and experiential avoidance and interpersonal problem-solving performance (Figure 9). The bootstrap analysis indicated an indirect effect of psychological inflexibility and experiential avoidance on interpersonal everyday problem solving through self-perceptions of ageing (Estimate = -0.0213 , 95% BCa CI [-0.0336 , -0.0118], $p < .001$). The direct effect of psychological inflexibility and experiential avoidance remained significant after accounting for self-perceptions of ageing (Estimate = -0.0389 , $p < .001$). This pattern indicated an indirect association alongside a remaining direct association, but should not be interpreted as evidence of causal mediation.



Figure 9: Exploratory indirect-effect model examining self-perceptions of ageing as a potential pathway in the association between psychological inflexibility and experiential avoidance and interpersonal everyday problem-solving performance.

Across the two exploratory models, both proposed indirect pathways were supported by bootstrap confidence intervals that did not include zero, while the corresponding direct effects remained significant, indicating similar patterns of indirect association alongside

remaining direct associations despite involving different predictors and potential pathway variables.

Discussion

The present study examined whether psychological inflexibility and experiential avoidance, affective theory of mind (affective ToM), divergent-thinking performance, and self-perceptions of ageing were associated with interpersonal ill-defined everyday problem-solving performance in older adults. Together, the four variables explained a substantial proportion of variance in interpersonal EPSI performance, and each made a significant independent contribution. Lower psychological inflexibility and experiential avoidance showed the largest standardised association with performance, while higher self-perceptions of ageing, better affective-ToM performance, and higher divergent-thinking performance were also associated with better interpersonal problem-solving performance.

Exploratory indirect-effect analyses further indicated that creativity may represent a potential pathway in the association between affective ToM and interpersonal problem-solving performance, while self-perceptions of ageing may represent a potential pathway in the association between psychological inflexibility and experiential avoidance and interpersonal problem-solving performance. These cross-sectional findings are consistent with potential indirect pathways but do not establish causal mediation.

Although the findings are discussed separately for clarity, the regression analysis examined an integrated model in which psychological inflexibility and experiential avoidance, affective ToM, divergent-thinking performance, and self-perceptions of ageing jointly contributed to interpersonal problem-solving performance. These variables may therefore be understood as related socio-cognitive, regulatory, cognitive, and self-related factors rather than as entirely independent processes.

Psychological Inflexibility and Experiential Avoidance

Psychological inflexibility and experiential avoidance showed the largest standardised association with interpersonal problem-solving performance. Higher AAQ-II scores were associated with poorer performance, indicating that older adults reporting greater difficulty remaining open to unwanted internal experiences and acting flexibly in their presence generated fewer safe and effective solutions to interpersonal problems. This result is consistent with socioemotional selectivity theory (Carstensen, 1992), which posits that older adults prioritize emotionally meaningful goals and interactions. With advancing age, individuals typically exhibit improved emotion regulation abilities, which may reflect both motivational shifts and accumulated emotional expertise (Carstensen et al., 2003; Grossmann et al., 2025). The finding is consistent with the broader proposition that regulatory functioning is relevant to interpersonal problem solving. However, because the AAQ-II assesses psychological inflexibility and experiential avoidance rather than emotion regulation comprehensively, the results should not be interpreted as demonstrating the contribution of all forms of emotion regulation.

Lower psychological inflexibility and experiential avoidance may facilitate interpersonal problem solving by allowing individuals to remain engaged with emotionally uncomfortable situations rather than responding through avoidance or rigid behavioural patterns. Greater openness to difficult internal experiences may support perspective-taking, reduce reactive responding, and permit consideration of a wider range of constructive solutions. However, these mechanisms were not measured directly and remain possible explanations for the observed association. (Blanchard-Fields, 2007; Carstensen, 1992).

Overall, the findings identify psychological inflexibility and experiential avoidance as potentially important correlates of individual differences in interpersonal problem-solving

performance among older adults. Longitudinal and experimental research is needed to determine the direction of this relationship and the regulatory processes through which it may operate (Urry & Gross, 2010; Hopp, et al., 2011). These results add to a growing body of literature underscoring the adaptive role of emotional processes in ageing (Carstensen, Fung, & Charles, 2003; Blanchard-Fields, 2007).

Affective Theory of Mind

Affective ToM also made a significant independent contribution to interpersonal problem-solving performance. This finding extends research on the role of affective ToM in social functioning by showing that the ability to infer complex emotional and mental states was associated with the generation of safe and effective solutions to interpersonal everyday problems (Urry & Gross, 2010; Blanchard-Fields, 2007). Previous research suggests that affective ToM may be relatively less affected by ageing than cognitive ToM, although findings across tasks are mixed (Henry et al., 2013; Bottiroli et al., 2016). The present study did not examine age differences in affective ToM; rather, it demonstrated that individual differences in affective-ToM performance were associated with interpersonal problem-solving performance within an older-adult sample. Evidence from previous research suggesting relative preservation of affective ToM in later adulthood has been linked to age-related shifts in motivational and emotional priorities, as described by socioemotional selectivity theory, which proposes that older adults increasingly value emotionally meaningful interactions and become more attuned to others' affective states (Carstensen et al., 2003). Additionally, affective ToM may be supported by accumulated social experience and crystallized emotional knowledge, which remain stable or even improve with age, unlike the fluid cognitive abilities underpinning cognitive ToM (Henry et al., 2013; Rakoczy et al., 2012).

Affective Theory of Mind is also theoretically relevant for interpersonal problem solving because it supports the interpretation of others' emotional and mental states, which is essential when navigating ill-defined social situations. Individuals with stronger affective-ToM performance may be better able to recognise emotional cues, anticipate interpersonal consequences, and generate socially appropriate responses in ambiguous situations (Niven et al., 2009; Reeck et al., 2016; Henry et al., 2013). These processes may be especially relevant to ill-defined interpersonal problems, in which understanding another person's perspective is central to evaluating possible solutions. These capacities are particularly relevant in later adulthood, when socioemotional goals and interpersonal harmony are prioritized (Carstensen et al., 2003). Accordingly, the present finding of a strong association between affective ToM and interpersonal problem-solving performance is consistent with theoretical accounts emphasizing the role of emotional understanding in adaptive social functioning.

Self-Perceptions of Ageing

Self-perceptions of ageing reflect individuals' beliefs and attitudes about their own ageing process and have increasingly been recognised as an important factor influencing motivation, coping, and behavioural outcomes in later life (Wurm et al., 2007; Levy & Myers, 2004). Older adults who hold more positive self-perceptions are often more confident in their abilities, more willing to engage in complex social interactions, and more resilient when facing interpersonal challenges (Diehl et al., 2014). The present study extends this literature by showing that more positive self-perceptions of ageing were independently associated with better performance on ill-defined interpersonal problems in older adults. Moreover, the exploratory analysis further indicated that self-perceptions of ageing may represent a potential indirect pathway in the association between psychological inflexibility and experiential avoidance and interpersonal problem-solving performance. This pattern

should be interpreted cautiously because the cross-sectional design does not establish temporal ordering or causal mediation.

One possible explanation for this relationship is that positive self-perceptions of ageing may shape how older adults interpret and approach interpersonal situations. Individuals who view their ageing process positively may enter social encounters with greater emotional openness, reduced threat sensitivity, and a stronger belief in their capacity to navigate relational difficulties—factors that can facilitate adaptive decision making in ambiguous social contexts (Kotter-Grühn, 2015). Notably, the present findings are based on the overall PEAS score rather than its individual subcomponents. This suggests that general attitudes toward ageing may play a meaningful role in interpersonal problem solving, although it remains possible that specific components—such as beliefs about ongoing personal growth or perceived control—may differentially contribute to performance. Future research should examine these subcomponents in more detail.

Taken together, these findings highlight a potentially relevant psychological pathway through which older adults maintain strong interpersonal functioning despite cognitive ageing. They also point to the value of examining which aspects of ageing self-perceptions matter most, offering a clear direction for future research on interpersonal problem-solving processes in later life.

Creativity

In the present study, overall AUT performance made a significant independent contribution to interpersonal problem-solving performance. Higher divergent-thinking scores were associated with the generation of more safe and effective solutions, suggesting that fluency, flexibility, originality, and elaboration may be relevant to navigating open-ended interpersonal situations. Divergent thinking may support interpersonal problem solving by

facilitating consideration of alternative perspectives and the generation of multiple context-sensitive responses (Runco & Jaeger, 2012). However, conceptual overlap between the AUT and EPSI solution-fluency scoring should also be considered, because both tasks reward the generation of multiple responses. Research has shown that creativity remains a vital strength in later life, facilitating generativity and self-expression, particularly in complex or emotionally charged social contexts (Palmiero et al., 2014; Kaufman & Sternberg, 2010).

Notably, the exploratory analyses indicated two distinct potential indirect pathways: creativity in the association between affective ToM and interpersonal problem-solving performance, and self-perceptions of ageing in the association between psychological inflexibility and experiential avoidance and interpersonal problem-solving performance. In both models, the direct effects remained significant after the proposed indirect variable was included. These patterns are consistent with indirect associations alongside remaining direct associations but do not establish causal mediation (Blanchard-Fields, 2007; Urry & Gross, 2010; Henry et al., 2013; Livingstone & Isaacowitz, 2015).

Taken together, the findings support an integrated view in which socio-cognitive understanding, regulatory functioning, divergent thinking, and self-perceptions of ageing are jointly associated with interpersonal problem-solving performance. This is consistent with lifespan perspectives emphasising the coordination of cognitive, emotional, and self-related resources in adaptation during later adulthood (Baltes & Baltes, 1990; Carstensen et al., 2003; Freund & Baltes, 2002). Our findings extend this work by highlighting how psychological attitudes (e.g., self-perceptions of ageing) and cognitive performance (e.g., divergent thinking) may account for the influence of social-emotional capacities on real-world social problem-solving.

Several limitations should be considered. First, the cross-sectional design prevents conclusions about temporal ordering or causal mediation. The indirect-effect findings should therefore be regarded as exploratory indications of possible pathways requiring longitudinal or experimental replication. Second, the relatively small convenience sample of older adults limits generalisability, particularly to older populations with different educational, cultural, or cognitive profiles. Third, the AAQ-II assesses psychological inflexibility and experiential avoidance rather than emotion regulation comprehensively, and the RET provides a task-based measure of affective ToM rather than a complete assessment of social cognition. Fourth, both the AUT and EPSI involve generating multiple responses, creating potential overlap in task demands and scoring. Finally, the high proportion of variance explained by the regression model should be interpreted cautiously and replicated in an independent sample, particularly given the strong correlations among some predictors, including the PEAS continuous-growth subscale and interpersonal EPSI performance.

Conclusions

Overall, the findings highlight the multifactorial nature of interpersonal ill-defined everyday problem solving in older adulthood. Lower psychological inflexibility and experiential avoidance showed the largest standardised association with interpersonal EPSI performance, while affective ToM, divergent-thinking performance, and self-perceptions of ageing also made significant independent contributions. The exploratory analyses further identified creativity and self-perceptions of ageing as potential indirect pathways in two distinct models. However, because the data were cross-sectional, these findings should not be interpreted as evidence of causal mediation. Together, the results suggest that interpersonal everyday problem solving is associated with an interplay of regulatory, socio-cognitive, cognitive, and self-related factors, providing a basis for future longitudinal and experimental research.

Chapter 5 – General Discussion

The present thesis examined age-related differences and individual differences among older adults in everyday problem-solving performance, with a particular focus on the cognitive, emotional, and socioemotional factors associated with performance in well-defined and ill-defined problem contexts. Across the two empirical studies, the findings demonstrated a distinction between problem types in the factors associated with performance: well-defined everyday problem-solving performance was primarily associated with age and selected executive-function measures, whereas interpersonal ill-defined problem-solving performance was associated with socio-cognitive, regulatory, cognitive, and self-related factors. Importantly, the results indicate that preserved interpersonal problem-solving performance in older adulthood cannot be fully explained by general cognitive abilities alone, highlighting the need to consider broader socioemotional mechanisms.

Study 2 provided evidence that, despite substantial age-group differences in executive-function task performance and well-defined everyday problem solving, older adults did not show poorer performance on interpersonal ill-defined problems. However, this preserved performance could not be explained by executive-function task performance, positive and negative affect, general self-efficacy, or reported problem-solving strategy use, as none of these factors uniquely predicted interpersonal problem-solving outcomes. Study 3 therefore examined more targeted socio-cognitive, regulatory, cognitive, and self-related factors as potential contributors to interpersonal problem-solving performance among older adults.

Age-Group Differences in Well-Defined and Ill-Defined Everyday Problem-Solving Performance

A key finding of the present thesis was that younger and older adults did not differ significantly in their performance on interpersonal ill-defined everyday problems (Study 2).

This pattern is consistent with the possibility that interpersonal problem-solving performance is relatively preserved in later adulthood, although the cross-sectional design does not demonstrate preservation over time (Mienaltowski, 2011).

At the same time, the absence of age differences observed in the present study contrasts with findings from previous research reporting superior performance of older adults in certain types of ill-defined everyday problems (e.g., instrumental problems; Allaire & Marsiske, 2002; Artistic et al., 2010; Mienaltowski, 2011; Cutler et al., 2021; Chen et al., 2017). Differences across studies may reflect variations in task characteristics, problem content, or contextual demands, highlighting the sensitivity of everyday problem-solving performance to methodological factors.

Importantly, although older adults in Study 2 reported greater use of emotion-focused strategies, higher positive affect, and lower negative affect, these variables did not independently predict interpersonal problem-solving performance. Study 2 therefore did not identify a specific cognitive or person-related factor that accounted for the comparable interpersonal performance of the two age groups. This finding motivated the more targeted examination of socio-cognitive, regulatory, cognitive, and self-related factors in Study 3.

Cognitive, Socio-Cognitive, Regulatory, and Self-Related Factors Associated with Everyday Problem-Solving Performance

Cognitive factors and the limits of executive-function explanations

The findings of the present thesis indicate that executive functions play a central role in everyday problem solving, particularly in well-defined problem contexts. In Study 2, younger adults demonstrated better performance than older adults on the 2-back and Simon tasks, which assessed working-memory updating and interference control, respectively. Age and selected executive-function measures also made significant independent contributions to well-defined everyday problem-solving performance. This pattern is consistent with a

substantial body of research reporting age-related reductions in executive functioning across a range of tasks, including those tapping inhibition, updating, and cognitive flexibility (e.g., Adólfssdóttir et al., 2016; Fisk & Sharp, 2004; Hull et al., 2008; Shokri et al., 2016; Vaughan, 2008).

At the same time, the broader literature presents a more nuanced picture of age-related change in EFs. Some studies and meta-analyses have reported little or no evidence for age-related deficits in specific executive components, particularly inhibition, once processing speed is taken into account (Rey-Mermet & Gade, 2017; Salthouse, 2005). Similarly, findings regarding age-related differences in updating are mixed, with evidence suggesting that performance may vary depending on task characteristics and contextual relevance (Basak & Verhaeghen, 2011; Miyake et al., 2000; Radvansky et al., 2003). In particular, tasks that resemble everyday contexts or involve meaningful material may reduce age-related performance differences relative to more abstract experimental paradigms.

Importantly, despite the clear contribution of EFs to well-defined problem solving, the present findings demonstrate that cognitive processes alone cannot account for performance in interpersonal ill-defined everyday problems. In Study 2, 2-back and Simon-task performance was not significantly associated with interpersonal problem-solving performance, indicating that additional factors beyond core cognitive abilities are required to explain adaptive functioning in socially complex situations. This limitation of executive-function-based explanations highlights the need to consider socioemotional and self-referential processes, which are addressed in the following section.

Socioemotional and self-referential factors in interpersonal ill-defined problem solving

Study 3 demonstrated that psychological inflexibility and experiential avoidance, affective theory of mind (affective ToM), divergent-thinking performance, and self-

perceptions of ageing were independently associated with interpersonal ill-defined problem-solving performance among older adults. Psychological inflexibility and experiential avoidance showed the largest standardised association, with lower AAQ-II scores associated with better performance. This finding is consistent with the broader proposition that regulatory functioning is relevant to interpersonal problem solving. However, because the AAQ-II assesses psychological inflexibility and experiential avoidance rather than emotion regulation comprehensively, it should not be interpreted as demonstrating the contribution of emotion regulation as a whole (Carstensen, Fung, & Charles, 2003; Blanchard-Fields, 2007).

Affective Theory of Mind further contributed to interpersonal problem-solving performance, highlighting the importance of inferring and interpreting others' complex emotional and mental states when navigating ill-defined social situations. Affective ToM and psychological inflexibility and experiential avoidance were each independently associated with interpersonal problem-solving performance, indicating that emotional understanding and regulatory functioning may both be relevant to individual differences in socially complex problem solving (Henry et al., 2013; Niven et al., 2009). These findings align with socioemotional selectivity theory, which posits that emotional goals and interpersonal harmony become increasingly prioritized in later adulthood (Carstensen et al., 2003).

With respect to self-efficacy, older adults reported lower general self-efficacy in Study 2; however, this did not seem to influence their interpersonal problem-solving performance. This suggests that general self-efficacy may be less relevant for interpersonal ill-defined problem solving than domain-specific socioemotional capacities. Previous research has similarly indicated that confidence in social functioning may be relatively preserved in older adulthood, even when confidence in instrumental problem-solving declines (Artistico et al., 2003; Artistico et al., 2010). In the present study, general self-efficacy did

not make a significant independent contribution to interpersonal problem-solving performance. Domain-specific social or interpersonal self-efficacy may nevertheless show different associations.

Creativity and self-perceptions of ageing also emerged as significant predictors of interpersonal ill-defined problem-solving performance in Study 3. Higher overall AUT performance was associated with better interpersonal problem-solving performance, consistent with evidence that creative thinking supports cognitive flexibility, openness to alternative perspectives, and the generation of context-sensitive solutions in complex situations (Runco & Jaeger, 2012; Marsiske & Willis, 1998; Kim et al., 2007). Similarly, more positive self-perceptions of ageing were associated with better interpersonal problem-solving performance, underscoring the role of self-referential beliefs in adaptive functioning.

Importantly, the exploratory analyses identified two distinct potential indirect pathways: divergent-thinking performance in the association between affective ToM and interpersonal problem-solving performance, and self-perceptions of ageing in the association between psychological inflexibility and experiential avoidance and interpersonal problem-solving performance. These cross-sectional patterns were consistent with indirect associations alongside remaining direct associations but did not establish temporal ordering or causal mediation. This pattern is consistent with theoretical accounts highlighting the relevance of emotional understanding and regulatory functioning to adaptive interpersonal problem solving, while also suggesting that these processes may operate alongside divergent-thinking performance and self-related beliefs in later life (Blanchard-Fields, 2007; Urry & Gross, 2010; Henry et al., 2013).

Taken together, Study 3 supports an integrated account in which socio-cognitive, regulatory, cognitive, and self-related factors are jointly associated with interpersonal ill-

defined problem-solving performance. Rather than being explained primarily by executive-function task performance or general self-efficacy, individual differences in interpersonal problem solving were associated with psychological inflexibility and experiential avoidance, affective ToM, divergent-thinking performance, and self-perceptions of ageing.

Limitations and recommendations for future research

Several limitations of the present thesis should be acknowledged. First, the cross-sectional and correlational nature of the studies limits causal interpretation. Although significant associations were observed between interpersonal ill-defined problem-solving performance and socioemotional variables such as psychological inflexibility and experiential avoidance, affective ToM, divergent-thinking performance, and self-perceptions of ageing, the direction and temporal ordering of these associations cannot be established. Future research employing longitudinal or experimental designs would be valuable in clarifying causal pathways and examining how these processes interact over time.

A further limitation concerns the measurement of self-efficacy in Study 2. General self-efficacy was assessed rather than self-efficacy specific to the everyday problems participants were asked to solve. Although this measure has been used in previous related research (Hernandez, 2021; Wu et al., 2023), domain-specific assessments may better capture the role of perceived competence in interpersonal ill-defined problem solving. Future studies should therefore consider including problem-specific or social self-efficacy measures.

In addition, the present thesis focused primarily on EFs when examining cognitive contributions to everyday problem solving. Although age and selected executive-function measures were associated with well-defined problem-solving performance, other cognitive processes such as attention, perception, and learning were not directly assessed (Kiely, 2014).

Future research could examine the contribution of a broader range of cognitive functions, particularly in relation to ill-defined everyday problems.

With respect to socioemotional processes, Study 3 assessed affective ToM using the RET and examined regulatory functioning through psychological inflexibility and experiential avoidance as measured by the AAQ-II. Given the complexity of both constructs (Haroush & Williams, 2015; Aldao et al., 2014), future research could assess additional components of ToM and a broader range of emotion-regulation processes and strategies, including reappraisal, suppression, rumination, and catastrophising (Zsido et al., 2021).

Another limitation relates to the assessment of problem-solving performance. The studies evaluated overall effectiveness based on the generation of safe and effective solutions, rather than examining performance across distinct stages of the problem-solving process (Thornton et al., 2013). Although this approach reflects the complexity and variability of everyday problem solving (Thornton & Dumke, 2005), future research could investigate age-related differences at specific stages, such as problem understanding and reflective evaluation, where metacognitive processes may play a critical role (Guner & Erbay, 2021; Pennequin et al., 2010).

The AUT and interpersonal EPSI also shared a generative response format, and both rewarded the production of multiple responses. Their association may therefore partly reflect overlapping fluency demands. In addition, the high proportion of variance explained in Study 3 and the strong association between the PEAS continuous-growth subscale and interpersonal EPSI performance require replication in an independent sample.

Finally, future research should examine whether these factors may inform interventions aimed at supporting interpersonal functioning and well-being in later life.

Future research should also consider contextual factors, including problem type and time constraints. Previous work suggests that age-group differences in problem-solving strategies may vary depending on whether problems require immediate or long-term solutions (Blanchard-Fields et al., 2007; Yeung et al., 2012). Examining how temporal demands influence strategy use and effectiveness across problem types may provide additional insight into adaptive problem solving in later life.

Conclusions

The present thesis examined everyday problem solving in older adulthood, a capacity that is central to independent living and quality of life. By distinguishing between well-defined and ill-defined everyday problems, the findings demonstrated that everyday problem solving is not a unitary construct, but instead reflects different underlying processes depending on problem type. Across two empirical studies, performance on well-defined everyday problems was closely associated with executive functioning, whereas interpersonal ill-defined problem solving was less dependent on cognitive resources typically shown to decline with age.

Importantly, the findings showed that older adults did not perform worse than younger adults in interpersonal ill-defined problem solving. In Study 2, preserved performance in interpersonal problems could not be explained by executive-function task performance, positive and negative affect, general self-efficacy, or reported problem-solving strategy use, highlighting the limitations of traditional cognitive and trait-based explanatory models. Study 3 addressed these limitations by identifying socio-cognitive, regulatory, cognitive, and self-related factors associated with interpersonal problem-solving performance in later life.

Specifically, psychological inflexibility and experiential avoidance, affective ToM, divergent-thinking performance, and self-perceptions of ageing each made significant

independent contributions to interpersonal problem-solving performance. The exploratory analyses were also consistent with two potential indirect associations involving divergent-thinking performance and self-perceptions of ageing. However, these cross-sectional findings should not be interpreted as evidence of causal mediation. Together, these results highlight the combined associations of regulatory, socio-cognitive, cognitive, and self-related factors with interpersonal functioning in older adulthood.

Overall, the findings suggest that interpersonal problem-solving performance may be less closely associated with executive-function task performance than instrumental and well-defined problem solving. Instead, individual differences among older adults were associated with regulatory functioning, affective ToM, divergent thinking, and self-perceptions of ageing. By moving beyond a purely cognitive perspective, the thesis contributes to a more differentiated understanding of everyday problem solving in later life and identifies directions for longitudinal, experimental, and applied research.

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Appendix A

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Appendix B

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Appendix C

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Appendix D



Downloaded: 23/03/2020
Approved: 26/03/2019

Ioanna Sofia Spentza
Registration number: 170244495
Psychology
Programme: PhD in Psychology

Dear Ioanna Sofia

PROJECT TITLE: Validation of EPSI, OEEPT & PEAS Instruments and Exploration of the Link between Executive Functioning, Well- and Ill-Defined Everyday Problems and Person-Related Factors

APPLICATION: Reference Number 020868

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 26/03/2019 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 020868 (form submission date: 20/03/2019); (expected project end date: 30/07/2019).
- Participant information sheet 1057015 version 2 (28/02/2019).
- Participant information sheet 1057014 version 2 (28/02/2019).
- Participant consent form 1057017 version 2 (28/02/2019).
- Participant consent form 1057016 version 2 (28/02/2019).

If during the course of the project you need to [deviate significantly from the above-approved documentation](#) please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Jilly Gibson-Miller
Ethics Administrator
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy:
<https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure>
- The project must abide by the University's Good Research & Innovation Practices Policy:
https://www.sheffield.ac.uk/polopoly_fs/1.6710661/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix E

Validation of EPSI, OEEPT & PEAS Instruments Consent Form

<i>Please tick the appropriate boxes</i>	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet dated DD/MM/YYYY or the project has been fully explained to me. (If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree to take part in the project. I understand that taking part in the project will include completion of four different instruments/questionnaires, Every Day Problem Solving Inventory, the Open-Ended Everyday Problem Test and the Personal Experience of Aging.	☐	☐
I understand that my taking part is voluntary and that I can withdraw from the study at any time do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw.	☐	☐
How my information will be used during and after the project		
I understand my personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	☐	☐
I understand and agree that my words may be quoted in publications, reports, web pages, and other research outputs. I understand that I will not be named in these outputs.	☐	☐
I understand and agree that other authorised researchers will have access to this data, however anonymity will be preserved throughout and no direct link will be made between my data and I.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, however anonymity will be preserved throughout and no direct link will be made between my data and I.	☐	☐
I give permission for the [specify the data] that I provide to be deposited in [name of data repository] so it can be used for future research and learning	☐	☐
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐

Name of participant [printed]

Signature

Date

Name of Researcher **Ioanna Sofia Spentza**

Signature

Date

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International Faculty of Sheffield

South East European Research Centre
(SEERC), Thessaloniki

Appendix F

Participant Information Sheet

1. Research Project Title:

Validation Study for Everyday Problem Solving Inventory, Open-Ended Problem Test and Personal Experience of Aging Questionnaire.

2. Invitation paragraph

You are being invited to take part in a research project. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

3. What is the project's purpose?

The aim of the study is to validate and culturally adopt three instruments in the Greek language and culture. In simpler terms, the current study will assess whether the above mentioned instruments/questionnaires assess the same theoretical concepts in a consistent way as the already existing English versions.

4. Why have I been chosen?

The sample of the current study targets individuals of two different groups, young adults with an age range from 18 to 30 years old and older adults that are 60 years old and above. You are randomly selected if you belong to one of the two age groups.

5. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time without any negative consequences. You do not have to give a reason. If you wish to withdraw from the research, please inform the researcher at any point.

6. What will happen to me if I take part? What do I have to do?

If you decide to take part, you will be asked to complete the three aforementioned questionnaire in your own pace with no time limit. Please keep in mind that the total number of questions you will need to answer is 42.

7. What are the possible disadvantages and risks of taking part?

There are no risks, disadvantages and/or potential harm in participating in the current study.

8. What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will expand the knowledge in the field of everyday problem solving and especially in the Greek population.

9. Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be strictly anonymous and will only be accessible to members of the research team. You will not be able to be identified in any reports or publication. You will only be assigned with a code number in order for all your answers to be matched.

10. What is the legal basis for processing my personal data?

According to data protection legislation, we are required to inform you that the legal basis we are applying in order to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Further information can be found in the University's Privacy Notice <https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

11. What will happen to the data collected, and the results of the research project?

In the current study data will only be accessible from the principle investigator and supervisors of the project (research team). Due to the nature of the study data may be published, however no link would be made to individual participants. All data will be safely stored and kept for 5 years.

12. Who is organising and funding the research?

The current study is conducted in support of Sheffield University, the International Faculty of Sheffield University and the South East European Research Centre. The current study is not funded.

13. Who is the Data Controller?

The University of Sheffield and the South East European Research Centre will act as the Data Controller for this study. This means that University of Sheffield and the South East European Research Centre is responsible for looking after your information and using it properly.

14. Who has ethically reviewed the project?

This project has been ethically approved via the University of Sheffield's Ethics Review Procedure, as administered by the Psychology Department.

15. What if something goes wrong and I wish to complain about the research?

In case you wish to complain about the current research you can contact Dr Ana Vivas (a.vivas@sheffield.ac.uk) or Dr Tom Stafford (t.stafford@shef.ac.uk).

16. Contact for further information

Principle Investigator

Ioanna Sofia Spentza (ISSpentza1@sheffield.ac.uk / ispentza@seerc.org)

Supervisors

Dr Ana Vivas (a.vivas@sheffield.ac.uk)

Dr Tom Stafford (t.stafford@shef.ac.uk)

Finally, please be informed that you will be given this copy of the information sheet, as well as a copy of the signed consent form, if you decide to participate. Thank you in advance for taking part in this study.

Appendix G

This material has been removed from the publicly available version of the thesis for copyright reasons.

Appendix H

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Appendix I

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Appendix J

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Appendix K

Exploration of the Link between Executive Functioning, Well- and Ill-Defined Everyday Problems and Affect Consent Form

<i>Please tick the appropriate boxes</i>	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet (If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)	☐	☐
I agree to take part in the project. I understand that taking part in the project will include completion of demographic information (age, gender, educational background etc.), the Montreal Cognitive Assessment, two tasks that assess cognitive processes (Simon task & N-Back task), the Everyday Problems Test, the Everyday Problem Solving Inventory, the PANAS and the General self-efficacy Scale.	☐	☐
I understand that my taking part is voluntary and that I can withdraw from the study at any time do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw.	☐	☐
How my information will be used during and after the project		
I understand that no personal details such as name, phone number, address and email address, IP address etc. will be collected for the project.	☐	☐
I understand and agree that my words may be quoted in publications, reports, web pages, and other research outputs. I understand that I will not be named in these outputs.	☐	☐
I understand and agree that other authorised researchers will have access to this data, however anonymity will be preserved throughout and no direct link will be made between my data and I.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, however anonymity will be preserved throughout and no direct link will be made between my data and I.	☐	☐
I give permission for the data that I provide to be deposited in the PsychchStudio personal data so it can be used for future research and learning	☐	☐
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐

Name of participant [printed]

Signature

Date

Name of Researcher **Ioanna Sofia Spentza**

Signature

Date

Project contact details for further information:

Principle Investigator

Ioanna Sofia Spentza (ISSpentza1@sheffield.ac.uk / ispentza@seerc.org)

Supervisors

University

Dr Ana Vivas (a.vivas@sheffield.ac.uk)

Dr Tom Stafford (t.stafford@shef.ac.uk)

University

Sheffield University, UK

International Faculty of Sheffield

South East European Research Centre
(SEERC), Thessaloniki

Appendix L

Participant Information Sheet

17. Research Project Title:

Exploration of the Link Between Executive Functioning, Person-Related Factors and Well- and Ill-Defined Everyday Problem Solving.

18. Invitation paragraph

You are being invited to take part in a research project. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

19. What is the project's purpose?

The aim of the study is to explore how different cognitive process influence different types of everyday problem solving skills. Additionally, the role of your overall emotional state and self-efficacy levels, your belief that you can deal with a problem, will be also be examined.

In simpler terms, the current study will assess how specific brain activities can relate and predict your skills in solving everyday problems. Further, your trait affect (tendency towards positive or negative emotions) and your self-efficacy (belief in yourself that you can cope) will also be explored in order to assess whether it alters in any way the link between the previously mentioned brain activities and everyday problem solving skills.

20. Why have I been chosen?

The sample of the current study targets individuals of two different groups, young adults with an age range from 18 to 30 years old and older adults that are 60 years old and above. You are randomly selected if you belong to one of the two age groups.

21. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time without any negative consequences. You do not have to give a reason. If you wish to withdraw from the research, please inform the researcher at any point.

22. What will happen to me if I take part? What do I have to do?

If you decide to take part, you will be asked to complete four different questionnaires. The first is assessing executive functioning, the next two tests assess your everyday problem solving skills, one for well-defined problems and one for ill-defined problems, and finally the last assesses emotional state. You can complete all questionnaires in your own pace with no time limit.

23. What are the possible disadvantages and risks of taking part?

There are no risks, disadvantages and/or potential harm in participating in the current study.

24. What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will expand the knowledge in the field of everyday problem solving and especially in the Greek population.

25. Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be strictly anonymous and will only be accessible to members of the research team. You will not be able to be identified in any reports or publication. You will only be assigned with a code number in order for all your answers to be matched.

26. What is the legal basis for processing my personal data?

According to data protection legislation, we are required to inform you that the legal basis we are applying in order to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Further information can be found in the University's Privacy Notice <https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

27. What will happen to the data collected, and the results of the research project?

In the current study data will only be accessible from the principle investigator and supervisors of the project (research team). Due to the nature of the study data may be published, however no link would be made to individual participants. All data will be safely stored and kept for 5 years.

28. Who is organising and funding the research?

The current study is conducted in support of Sheffield University, the International Faculty of Sheffield University and the South East European Research Centre. The current study is not funded.

29. Who is the Data Controller?

The University of Sheffield and the South East European Research Centre will act as the Data Controller for this study. This means that University of Sheffield and the South East European Research Centre is responsible for looking after your information and using it properly.

30. Who has ethically reviewed the project?

This project has been ethically approved via the University of Sheffield's Ethics Review Procedure, as administered by the Psychology Department.

31. What if something goes wrong and I wish to complain about the research?

In case you wish to complain and/or report any incidents/concerns about the current research you can contact Dr Ana Vivas (a.vivas@sheffield.ac.uk) or Dr Tom Stafford (t.stafford@shef.ac.uk).

32. Contact for further information

Principle Investigator

Ioanna Sofia Spentza (ISSpentza1@sheffield.ac.uk / ispentza@seerc.org)

Supervisors

Dr Ana Vivas (a.vivas@sheffield.ac.uk)

Dr Tom Stafford (t.stafford@shef.ac.uk)

Finally, please be informed that you will be given this copy of the information sheet, as well as a copy of the signed consent form, if you decide to participate. Thank you in advance for taking part in this study.

Appendix M

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Appendix N

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Appendix O



Downloaded: 30/03/2026
Approved: 21/02/2023

Ioanna Sofia Spentza
Registration number: 170244495
Psychology
Programme: PhD in Psychology

Dear Ioanna Sofia

PROJECT TITLE: The Comparison of Cognitive and Non-Cognitive Factors of Ill-Defined Everyday Problem Solving.
APPLICATION: Reference Number 049789

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 21/02/2023 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 049789 (form submission date: 20/02/2023); (expected project end date: 30/04/2023).
- Participant information sheet 1112046 version 3 (20/02/2023).
- Participant consent form 1115219 version 1 (09/12/2022).

If during the course of the project you need to [deviate significantly from the above-approved documentation](#) please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Department Of Psychology Research Ethics Committee
Ethics Admin
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: <https://www.sheffield.ac.uk/research-services/ethics-integrity/policy>
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.6710661/file/GRIPPpolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Admin (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix P

The Comparison of Cognitive and Non-Cognitive Factors of Ill-Defined Everyday Problem Solving.

<i>Please tick the appropriate boxes</i>	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet dated DD/MM/YYYY or the project has been fully explained to me. (If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree to take part in the project. I understand that taking part in the project will include completion of the Acceptance and Action Questionnaire, the Perception of Ageing Scale, the Guilford Creativity Task and the Revised Mind through the Eyes Test. Additionally, I will complete the MOCA test and the Everyday Problem Solving Inventory (interpersonal problems only).	☐	☐
I understand that my taking part is voluntary and that I can withdraw from the study at any time do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw.	☐	☐
How my information will be used during and after the project		
I understand that no personal details such as name, phone number, address and email address etc. will be collected for the project.	☐	☐
I understand and agree that my words may be quoted in publications, reports, web pages, and other research outputs. I understand that I will not be named in these outputs.	☐	☐
I understand and agree that other authorised researchers will have access to this data, however anonymity will be preserved throughout and no direct link will be made between my data and I.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, however anonymity will be preserved throughout and no direct link will be made between my data and I.	☐	☐
I give permission for the [specify the data] that I provide to be deposited in [name of data repository] so it can be used for future research and learning	☐	☐
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐

Name of participant [printed]

Signature

Date

Name of Researcher **Ioanna Sofia Spentza**

Signature

Date

Project contact details for further information:

Principle Investigator

Ioanna Sofia Spentza (ISSpentza1@sheffield.ac.uk / ispentza@seerc.org)

Supervisors

University

Dr Ana Vivas (a.vivas@sheffield.ac.uk)

Dr Tom Stafford (t.stafford@shef.ac.uk)

University

Sheffield University, UK

International Faculty of Sheffield

South East European Research Centre
(SEERC), Thessaloniki

Appendix Q

Participant Information Sheet

33. Research Project Title:

The Comparison of Cognitive and Non-Cognitive Factors of Ill-Defined Everyday Problem Solving.

34. Invitation paragraph

You are being invited to take part in a research project. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

35. What is the project's purpose?

The aim of the study is to explore how different cognitive process influence different types of everyday problem solving skills. Additionally, the role of how you regulate your emotion, how you perceive your ageing process, your levels of creativity and the how well you understand the emotional state of another individual will be also be examined.

36. Why have I been chosen?

The sample of the current study targets older adults that are 60 years old and above. You have been selected based on participation from previous study conducted that assessed how executive functions, trait affect and self-efficacy influence both well- and ill-defined everyday problem solving.

37. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time without any negative consequences. You do not have to give a reason. If you wish to withdraw from the research, please inform the researcher at any point.

38. What will happen to me if I take part? What do I have to do?

If you decide to take part, you will be asked to complete four different questionnaires. The first is assessing executive functioning, the next two tests assess your everyday problem solving skills, one for well-defined problems and one for ill-defined problems, and finally the last assesses emotional state. You can complete all questionnaires in your own pace with no time limit.

39. What are the possible disadvantages and risks of taking part?

There are no risks, disadvantages and/or potential harm in participating in the current study.

40. What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will expand the knowledge in the field of everyday problem solving and especially in the Greek population.

41. Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be strictly anonymous and will only be accessible to members of the research team. You will not be able to be identified in any reports or publication. You will only be assigned with a code number in order for all your answers to be matched.

42. What is the legal basis for processing my personal data?

According to data protection legislation, we are required to inform you that the legal basis we are applying in order to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Further information can be found in the University's Privacy Notice <https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

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The current study is supported by Sheffield University, the International Faculty of Sheffield University and the South East European Research Centre. The current study is not funded.

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46. Who has ethically reviewed the project?

This project has been ethically approved via the University of Sheffield's Ethics Review Procedure, as administered by the Psychology Department.

47. What if something goes wrong and I wish to complain about the research?

In case you wish to complain about the current research you can contact Dr Ana Vivas (a.vivas@sheffield.ac.uk) or Dr Tom Stafford (t.stafford@shef.ac.uk).

48. Contact for further information

Principle Investigator

Ioanna Sofia Spentza (ISSpentza1@sheffield.ac.uk / ispentza@seerc.org)

Supervisors

Dr Ana Vivas (a.vivas@sheffield.ac.uk)

Dr Tom Stafford (t.stafford@shef.ac.uk)

Finally, please be informed that you will be given this copy of the information sheet, as well as a copy of the signed consent form, if you decide to participate. Thank you in advance for taking part in this study.