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Are older individuals predisposed to habitual control more resilient?

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Abstract
Based on evidence for age-related impairments in flexible, goal-directed control, the formation of habits has been recognized as an opportune route for behavioural adjustment that promotes resilience among older adults. The present study set out to examine how individual differences in quality of life (QoL) and mental well-being (MWB) in older adults ($N = 1116$, 55 – 92 years old) relate to the inclination to engage in strategic planning and lifestyle regularity. Importantly, the beneficial effects of these two habit predisposing factors on MWB and QoL were found to be mediated by conscientiousness, a personality trait characterized by a tendency to be goal-oriented, organized, responsible and disciplined, and to plan for the future. These results emphasize the benefits of conscientiousness for resilience in later life and suggest that both habit-predisposing factors may offer promising and concrete target points to elicit more conscientious behaviour, and thereby support QoL and MWB. Longitudinal and experimental research may help to establish the flow of causality in the intriguing dynamics between these variables.

Keywords Quality of life · Mental well-being · Lifestyle regularity · Conscientiousness · If–then planning · Prospective memory

Introduction

As individuals age, they face various challenges that necessitate adapting their behaviour to prevent a major decline in functional ability, well-being and quality of life (Brinkhof et al., 2021; Hayman et al., 2017; Hildon et al., 2010; Stephens et al., 2015). For instance, a decline in physical or cognitive functioning may be countered by frequently engaging in (physical) activities; to adapt to retirement or

widowhood one may need to redefine day-to-day routines. Accordingly, the ability to adjust one's behaviour (in addition to psychological adaptability) is a vital element of successful aging and resilience in later life (also see: Brinkhof et al., 2022). Age-related changes in neural integrity and connectivity of prefrontal brain areas can, however, compromise cognitive functions that are crucial for flexible, goal-directed adjustment of behaviour (Anderson et al., 2010; de Wit et al., 2014; Eppinger et al., 2013; Gross & Grossman, 2010; Kirova et al., 2015; Ridderinkhof & Krugers, 2022; Salthouse, 2014) and thereby reduce autonomy (e.g., Burkard et al., 2014). In contrast, habitual control processes have been shown to remain relatively intact (de Wit et al., 2014; Eppinger et al., 2013). Therefore, the gradual formation of new, adaptive habits may offer an alternative, opportune route for behavioural adjustment in favour of resilience among older adults (e.g., Brinkhof et al., 2022; Neal et al., 2013). Previous studies have shown large individual differences in the propensity to rely on habitual versus goal-directed processes (Linnebank et al., 2018; van de Vijver et al., 2023), also at an older age (Brinkhof et al., 2022; de Wit et al., 2014). We propose that older individuals who rely more on the *habitual route* may be better off than those

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who tend to focus on (declining) goal-directed processes to regulate their daily behaviours. Departing from this perspective, the present study examined how individual differences in quality of life (QoL) and mental well-being (MWB) in older adults relate to two habit-predisposing factors, namely the inclination to engage in strategic planning and lifestyle regularity, and their interplay with the personality trait of conscientiousness. Furthermore, we investigated the potential mediating role of prospective memory ability.

The inclination to engage in strategic planning

The first factor that can predispose individuals to habitual control is a strong inclination to engage in strategic planning. Engaging in strategic planning involves the formation of so-called implementation intentions: if–then plans that specify a behaviour to be performed in response to an anticipated cue (*'If situation Y arises, then I will initiate behaviour X'*; Gollwitzer, 1993, 1999). Forming if–then plans increases the likelihood of frequent repetition in *consistent* contexts (Gollwitzer & Sheeran, 2006). This can facilitate routine formation (Gardner et al., 2012; Lally et al., 2010; also see Orbell and Verplanken (2010) for direct evidence of stronger automatization of behaviours through if–then planning) and eventually reduces the need for deliberate goal-directed resources in action control (Martiny-Huenger et al., 2016; Wood & Rünger, 2016). This renders strategic if–then planning particularly helpful for older individuals. Prompting people to form if–then plans for specific, pre-determined goals can have beneficial impacts on health outcomes that benefit from consistent and maintained performance of desired behaviours, including physical activity, diet quality, smoking behaviour, bed time routines, depressive symptomatology and social anxiety (e.g., Adriaanse et al., 2009; Armitage, 2016; Fritsch et al., 2007; Hall et al., 2012; Shah et al., 2014; Valshtein et al., 2019; Warner et al., 2022; also see meta-analysis of Gollwitzer and Sheeran (2006) for overview of studies before 2005), all contributing to better MWB and QoL in the long-run. However, despite these beneficial effects reported for specific goals introduced in study contexts, it is still unknown whether individual differences in the *inclination* to independently or spontaneously engage in strategic if–then planning in daily life (Bieleke & Keller, 2021) can also predict MWB and QoL among older adults.

Lifestyle regularity

Another factor that may incline individuals to more strongly rely on habit formation, rather than goal-directed action control, is a strong lifestyle regularity. Individuals who adopt a regular lifestyle show high consistency in the timing with which various social, work, feeding and rest related activities occur (e.g., waking up, having breakfast,

going out (for work); Monk et al., 2002). This may provide a framework that facilitates regular and consistent engagement in other activities and behaviours, which allows one to attach or 'piggyback' a new behaviour onto an existing routine (Judah et al., 2013). This favours the formation stimulus-driven habits (e.g., it will be easier to anticipate future events and remember to perform planned actions). As per the health benefits, it has been suggested that consistent social and behavioural rhythms are conducive to continued good (mental) health and well-being in later life (Margraf et al., 2016; Monk et al., 1997; Prigerson et al., 1995), at least partially because it can promote a necessary sense of control and stability, especially when confronted with physical or psychological frailty (Bergua et al., 2006). In support of this, evidence suggests that individuals tend to adopt a more regular lifestyle as they grow older (Monk et al., 1992, 1997, 2006), although great individual differences still exist. Monk et al. (2006) showed that the rate of change throughout the lifespan was greater among those who were strongly challenged by external circumstances (e.g., spousal bereavement), potentially serving as adaptive coping strategy to deal with these changes.

The personality trait of conscientiousness

Next to these concrete habit-predisposing factors, the relatively broad and multi-faceted personality trait of conscientiousness has also been linked to the ability to automatize adaptive behaviours. Highly conscientious people are purposeful and disciplined, work hard towards their goals in an organized, orderly manner, and consequently they are reliable and productive (e.g., McCrae & Löckenhoff, 2010; Roberts et al., 2005). Conscientious individuals have, therefore, typically been characterized as strongly goal-directed, meaning that their choices and behaviour are driven by conscious deliberation on the outcomes of their actions. Recently, however, this traditional view of effortful self-control has been challenged by the opposing view that conscientious individuals actually rely relatively strongly on habitual control. Indeed, their structured, consistent goal striving may allow conscientious individuals to automatize their behaviour and thereby rely on efficient adaptive habits (Galla & Duckworth, 2015; Judah, 2015; Wood, 2017). A recent study provided direct support for this idea and found that conscientiousness positively predicted the automatization of a novel routine (van de Vijver et al., 2023). This may explain why conscientious individuals tends to be healthier, show better psychological well-being and QoL, and live longer (Brett et al., 2012; Chapman et al., 2007; Goodwin & Friedman, 2006; Hill et al., 2011; McCloskey & Johnson, 2021; McCrae & Costa, 1991; Pocnet et al., 2016).

The interplay between the inclination to engage in strategic planning, lifestyle regularity and conscientiousness

The present study aims to shed light on the interplay between the inclination to engage in strategic planning and lifestyle regularity, as well as conscientiousness. Those with a higher regularity in daily re-occurring activities may be more inclined to independently engage in strategic if–then planning, as it could provide an optimal framework for the use of if–then plans (i.e., many consistent, potential cues). However, regular engagement in strategic planning may also contribute to a higher consistency of social and behavioural rhythms. As a preference for future planning (i.e., 'planfulness') is a key indicator of conscientious people (Ludwig et al., 2019), people high in conscientiousness may also be more inclined to engage in strategic if–then planning. Indeed, previous research has shown a small-to-medium association between conscientiousness and the inclination to (independently) engage in strategic if–then planning (Bieleke & Keller, 2021), but not yet among older adults. This association may also be explained in the opposite direction, where a stronger inclination to engage in strategic planning promotes specific indicators of conscientiousness, such as self-discipline or determination. This aligns with the idea that interventions promoting strategic planning of desired daily life behaviours can prove useful in increasing conscientiousness and specifically the facets of industriousness (i.e., tendency to both begin tasks and carry them through to completion) and self-control (Javaras et al., 2019). A similar two-sided perspective holds for lifestyle regularity: it can be expected that conscientious people have a more regular lifestyle (e.g., due to a morning preference; Monk et al., 1994; Walker et al., 2014), but a more regular lifestyle may also provide structure and routine to one's life and thereby facilitate an organized and diligent approach.

The role of prospective memory ability

Next to investigating the interplay between these variables, we aim to shed light on the pathways through which these characteristics affect MWB and QoL. Here, we will also examine potential indirect pathways via prospective memory ability. Previous research has already provided evidence for a positive association between prospective memory ability and (independent) functioning, autonomy, QoL/MWB (Hering et al., 2018; Woods et al., 2015; Zuber & Kliegel, 2020). Furthermore, we would expect that habit formation partially exerts its beneficial effects by supporting the ability to remember to perform planned actions (Zhang et al., 2022) Indeed, strategic planning facilitates prospective memory performance (Burkard et al., 2014; Chasteen et al., 2001; Chen et al., 2015; Liu & Park,

2004; McFarland & Glisky, 2011) and has even been suggested as means to compensate for age-related prospective memory declines (Zimmermann & Meier, 2009). The inclination to engage in if–then planning would therefore be expected to support prospective memory functioning as well. Lifestyle regularity may also prevent prospective memory lapses by promoting a stable framework with reliable triggers of everyday routine behaviours. Finally, some tendencies that characterize conscientiousness are known to positively predict prospective memory functioning (Cuttler & Graf, 2007; McCabe et al., 2018), and conscientiousness has also been suggested to buffer cognitive (prospective memory) function by decelerating cognitive decline (Chapman et al., 2012; Wilson et al., 2007, 2015). However, whether PMA function acts as (partial) mediator of the effects of conscientiousness and lifestyle regularity on QoL/MWB has not been tested before.

Hypotheses

To summarize, we tested three parallel hypotheses:

a. that the inclination to engage in strategic (if–then) planning contributes to better MWB and QoL, at least partially through its favourable effects on conscientiousness, lifestyle regularity and/or prospective memory functioning, and
b. that lifestyle regularity contributes to better MWB and QoL, at least partially through its favourable effects on the inclination to engage in strategic (if–then planning), conscientiousness, and/or prospective memory functioning, and
c. that conscientiousness contributes to better MWB and QoL, at least partially through its favourable effects on the inclination to engage in strategic (if–then planning), lifestyle regularity and/or prospective memory functioning.

Life phase

In addition, we explored the role of age—or more specifically *life phase*—and determined whether this factor moderated the interplay between variables. We were interested as to whether newly retired individuals, who need to redefine their day-to-day life, may benefit more strongly from higher levels of conscientiousness, lifestyle regularity or a higher inclination to engage in if–then planning than those well before or well after this transition phase. Given the limited availability of literature on the role of life phase on our mechanisms of interest, no a priori hypotheses were derived.

Table 1 Descriptive statistics

	Samples							
	All (n = 1116)			1 (n = 252)	2 (n = 514)	3 (n = 350)	
	56–93 years			Pre-retirement	Newly retired	Retired	
Age:[a] M (SD)	69.5 (6.74)			61.5 (2.89)	68.1 (3.19)	77.2 (3.99)	
Gender: % female	68%			79%	68%	60%	
Education: % high[b]	86%			90%	86%	84%	
	M (SD)	range	r	M (SD)	M (SD)	M (SD)	Contrasts
Prospective Memory	34.8 (3.83)	20–40	–.07*	35.1 (3.73)	34.8 (3.76)	34.2 (4.24)	1 > 3
Strategic Planning	39.9 (6.75)	14–56	.03	38.7 (7.43)	39.8 (6.77)	39.8 (6.80)	–
Lifestyle regularity	11.6 (1.68)	5.5–14	.18*	11.0 (1.68)	11.7 (1.68)	11.9 (1.64)	1 < 2 & 3
Conscientiousness	46.8 (5.46)	30–60	–.12*	47.6 (5.37)	46.8 (5.52)	46.0 (5.61)	1 > 3
Mental Well-being	56.2 (6.12)	32–70	.04	55.9 (5.74)	56.2 (6.01)	56.7 (6.42)	–
Quality of Life	95.4 (8.87)	60–120	–.14*	97.3 (8.79)	95.5 (8.93)	94.0 (8.63)	1 > 2 > 3

Each variable of interest was correlated with age (r). Only significant (p < .05) contrasts are depicted

[a] Participants had indicated their age (e.g., 69 years old) upon signing up for the overall study, while the follow-up package was conducted 40.0 weeks later on average (SD = 6.29, range 12.47 to 60.23 weeks). We therefore adjusted the age of our participants by assuming our participants were on average halfway through their year (69.5) and adding the number of years since enrolling in the overall study (number of weeks/ number of weeks per year – 52.18; e.g., 69.5 + (44.7/52.18) = 70.4 = 70)

[b] According to the Dutch Verhage (1964) scale, categories 6 and 7 reflect a high education level

Relevance

Insights into these dynamics can improve our understanding of *how* different characteristics can help to outsource the habitual action control processes, and the relative contribution of each of these characteristics in particular. This can help to pinpoint what characteristics may be opportune target points for interventions and which individuals would benefit from such programs.

Methods

Sample characteristics

Participants were drawn from a larger pool of older individuals of an ongoing online study on successful aging and resilience in the Netherlands [details removed to ensure anonymity], consisting of a battery of questionnaires and tests that cover relevant factors from multiple domains (e.g., physical, psychological, cognitive, social, environmental). Participants were 55 years or older, living in the Netherlands and had no dementia diagnosis. Other exclusion criteria were insufficient command of the Dutch language, impaired vision, and being unable to perform the operations required to successfully use a computer or laptop independently (i.e., mouse clicks, pressing keys on the keyboard). Participants were primarily recruited through online advertisements, and as a token of their participation, they received a brochure filled with evidence-based tips to promote healthy aging. All

participants who successfully[1] completed the main inventory, as well as a follow-up package containing our main variables of interest, were included in this study (N = 1171). Participants were divided into three life-phase groups by separating individuals based on intervals ranging from 55 – 66 (pre-retirement; n = 373), 67 – 71 (newly retired[2]; n = 431), and 72 – 92 (retired; n = 367) years old. During the baseline inventory, however, some participants from the pre-retirement group indicated to have retired early. These individuals (n = 119) were allocated to the newly retired group. Individuals from the newly retired (n = 31) and retired (n = 14) group that indicated to still be active on the labour market were excluded. Upon visual inspection, we identified some *extreme* outliers in the distributions of some variables of interest. To remove these, we used Rosner's (1983) test to remove up to 10 outliers per variable of interest (see Supplement A for details). A total of ten outliers, corresponding to ten different participants were removed through this procedure, which resulted in a total sample size of 1116, with subgroups of n = 252 (1; pre-retirement), n = 514 (2; newly retired), and n = 350 (3; retired). The demographic characteristics of the study sample are shown in Table 1.

[1] Participants that completed the If–Then Planning Scale, but indicated to not have had any behaviour in mind while filling out the scale, were considered to be 'unsuccessful'. A total of 101 participants were removed based on this criteria.

[2] The statutory retirement age for the Netherlands was 66 years in 2018, after which it has risen to 66 years and 9 months in 2022.

Materials

Outcome variables

Quality of life The World Health Organization Quality of Life (WHOQOL)-OLD instrument (Gobbens & van Assen, 2016; Power et al., 2005; $\alpha=0.87$) was used to assess QoL based on six subscales of four items each: (1) sensory abilities, (2) autonomy, (3) satisfaction with past, present, and future activities and achievements in life, (4) social participation, concerns, (5) worries and fears about death and dying, and (6) being able to have personal and intimate relationships. All 24 items were scored on a 5-point Likert Scale, with different wordings, and summed to a total QoL score (24 – 120). Some items were reverse scored prior to summation, such that higher scores were indicative of better quality of life.

Mental well-being The 14-item Warwick Edinburgh Mental Wellbeing Scale (WEMWBS; Ikink et al., 2012; Tennant et al., 2007; $\alpha=0.91$) was used to measure subjective well-being and psychological functioning. The 14 items, all addressing positive aspects of mental health, were scored on a 5-point Likert scale (1 = never, 2 = barely, 3 = sometimes, 4 = often, 5 = always) and summed to a total of 14 to 70. Higher scores indicated better mental well-being.

Predictors

Prospective memory ability The 8-item Prospective Memory Ability scale of the short Metacognitive Prospective Memory Inventory (MPMI-s; Rummel et al., 2019; $\alpha=0.65$) was used to assess prospective memory ability. Half of the items represented prospective remembering (e.g., 'I am able to remind myself of phone calls I need to make, such as calling a friend on his or her birthday.') and the other half represented prospective forgetting (e.g., 'I receive overdue notification because I forget to pay bills on time'). Each item was scored on a 5-point Likert scale ranging from 1 (rarely) to 5 (often) and summed to a total score of 8 to 40. The prospective forgetting items were reverse scored prior to summation, such that high scores were indicative of better prospective memory ability.

Strategic if–then planning The 8-item If–Then Planning Scale (ITPS; Bieleke & Keller, 2021; $\alpha=0.85$) was used to assess the participants' general inclination to engage in if–then planning. The first four items were used to determine individuals' tendencies to identify critical situations and opportunities to act (if-part) and the last four items were used to assess whether individuals specify corresponding goal-directed behaviours (then-part). In both parts, half of the items related to seizing opportunities (e.g., 'I think about chances and possibilities that I could use.') and the other half to overcoming obstacles (e.g., 'I am concerned with what setbacks to expect.'). Participants were directed to have goals in mind that they found worthwhile and rewarding, but which were also challenging while answering the questions. Each item was scored on a 7-point Likert scale ranging from 1 (does not apply at all) to 7 (does fully apply). Total scores were calculated by summing the scores of all items together, ranging from 8 to 56. Higher scores indicate a higher inclination to engage in if–then planning.

Lifestyle regularity An adaptation of the short Social Rhythm Metrix (SRM-5) was used to quantify daily lifestyle regularity (Monk et al., 1990, 1992). The original SRM-5 is a diary-like questionnaire, in which participants are supposed to report on the timing of five specific events (i.e., getting out of bed; first contact with another person; starting work, housework or volunteer activities; having dinner; going to bed) on a daily basis for one week. Based on these data, a habitual time for each event is calculated and the number of occurrences within a 1.5-h window around this habitual time is counted to determine the regularity of that event. The combination of these evens together is supposed to reflect one's lifestyle regularity.

To reduce the burden on participants, we did not ask individuals to fill out the questionnaire on a daily basis, but instead asked them to indicate the timing on which these events usually took place in the previous month (i.e., habitual time). 'Having lunch' was added as the sixth event to the list of events included in the SRM-5. Subsequently, they were instructed to report on approximately how many days in the past two weeks each of the six events occurred within a 1.5 h window (45 min before to 45 min after the habitual time), and outside this window. An overall lifestyle regularity score was constructed by taking the average number of days across the six events, with higher scores reflecting a more regular lifestyle (ranging from 0 to 14).

Conscientiousness The NEO-FFI conscientiousness subscale (12 items) was used to assess individual differences in the personality dimension conscientiousness (Costa & McCrae, 1989; $\alpha=0.84$). Each item (e.g., "I keep things neat and clean') was scored on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The four negatively formulated items were reverse scored, and a total sum score ranging from 12—60 was computed. Higher scores indicate higher levels of conscientiousness.

Analysis

Statistical operations were conducted in R (4.1.2), with alpha set at 0.05. Two serial multiple mediation analyses

Fig. 1 *Serial mediation model.*
Note. The indirect effects of interest are shown. SP: Strategic planning, LR: Lifestyle regularity, PM: Prospective memory ability, CON: Conscientiousness, MWB: Mental well-being, QoL: Quality of Life. Paths *a*, *b* and *c* are only included in model 1 (1), whereas path *k*, *l* and *m* are only included in model 2 (2)
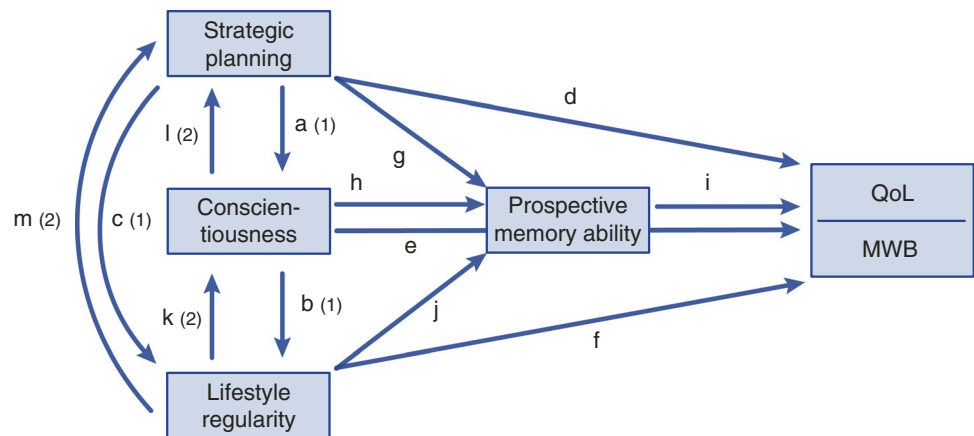
Indirect effects of interest:
» SP - CON - MWB/QoL = *a * e (model 1)*
» CON - LR - MWB/QoL = *b* f (model 1)*
» SP - LR - MWB/QoL = *c * f (model 1)*

» SP - PM - MWB/QoL = *g * i (model 1 & 2)*
» CON - PM - MWB/QoL = *h * i (model 1 & 2)*
» LR - PM - MWB/QoL = *j * i (model 1 & 2)*

» LR - CON - MWB/QoL = *k* e (model 2)*
» CON - SP - MWB/QoL = *l * d (model 2)*
» LR - SP - MWB/QoL = *m* d (model 2)*

were performed using the *Lavaan* package (Rosseel, 2012; version 0.6–11), as path analysis does not allow for bi-directional influences. In each of the models, both mental well-being and quality of life were included as outcome variables, and prospective memory ability as mediator. In model 1, as illustrated in Fig. 1, lifestyle regularity and conscientiousness were also included as mediators, allowing us to test the indirect effect of strategic planning on MWB/QoL via lifestyle regularity (*cf*), conscientiousness (*ae*), and prospective memory (*gi*), as well as the indirect effect of conscientiousness on MWB/QoL via lifestyle regularity (*bf*). The path from lifestyle regularity and conscientiousness to MWB/QoL via prospective memory were also included in this model (*ji* and *hi*, respectively). In model 2, strategic planning and conscientiousness were included as additional mediators, and lifestyle regularity as independent variable, enabling us to examine the indirect effect of lifestyle regularity on MWB/QoL via strategic planning (*md*), and conscientiousness (*ke*). Additionally, the path from conscientiousness to MWB/QoL via strategic planning was included (*ld*; and again path *gi*, *ji* and *hi*). The models were estimated using the *sem* function, with maximum likelihood estimation (i.e., parameter estimates are obtained by maximizing the likelihood that the assumed model results in the observed data), and 5000 bootstraps. As both models are fully identified (i.e., zero degrees of freedom), and the model therefore fits the

data perfectly by definition, fit indices are not reported and evaluated. Moderation effects of life phase were assessed by performing two (again model 1 and 2) multi-group analyses, in which estimates were calculated for each subgroup separately.
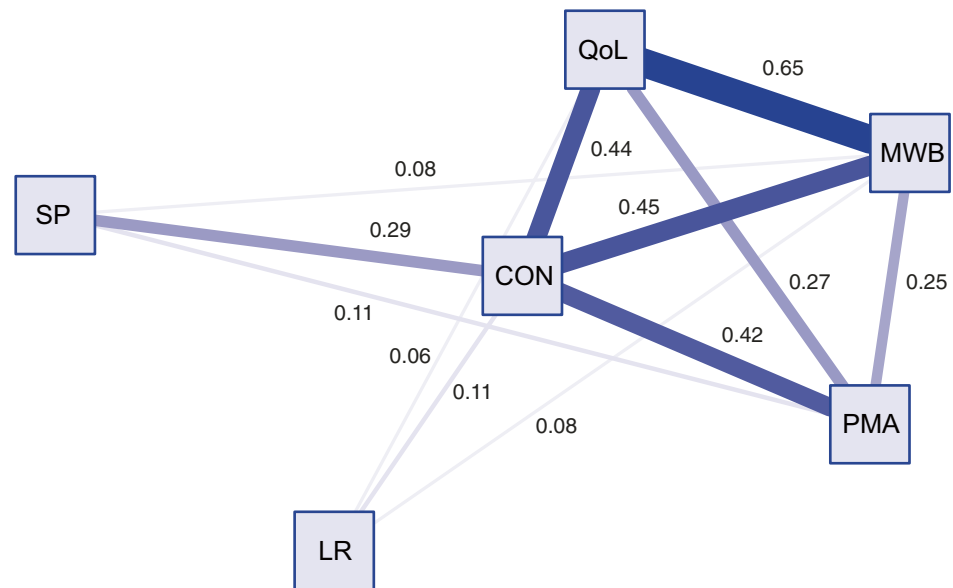
Results

### Serial multiple mediation analysis

As illustrated in Fig. 2A, most of our variables of interest were positively associated to one another when evaluating each pair of variables separately. Strategic planning and lifestyle regularity were not associated, and only weakly, or not at all, with prospective memory ability and QoL/MWB. When considering the direct and indirect pathways (see Fig. 2B), we found that strategic planning and lifestyle regularity were positively associated with prospective memory ability, and subsequently with QoL/MWB, via conscientiousness (with small to medium effect sizes; see Table S2 for all details). Surprisingly, a negative *direct* path from strategic planning to QoL, albeit weaker in terms of its path regression coefficient (with correspondingly small effect size: 0.10), was also observed. This suggests that a

Fig. 2 *Serial mediation models outcomes. Note.* In panel (**A**), associations are visualized with *qgraph* (Epskamp et al., 2012). Only significant (*p* < .05) coefficients are shown. The thickness and saturation of the lines are relative to the strength of the associations. All associations with a correlation coefficient of 0.10 or lower have lines of similar thickness and saturation to improve visibility of the weakest relationships. In panel (**B**), the results of the two mediation models are combined. Reported path coefficients are unstandardized, and can therefore be considered as partial regression coefficients, with *p* < .05, **p* < .01, ***p* < .001. The thickness of the paths are relative to the strength of the path coefficients. By default, arrows are removed to emphasize that causality cannot be inferred from these findings (i.e., cross-sectional data). However, the arrows from/to conscientiousness (CON) are included to emphasize the direction of the pathways tested in model 1 (1) and 2 (2). SP: Strategic planning, LR: Lifestyle regularity, PMA: Prospective memory ability, CON: Conscientiousness, MWB: Mental well-being, QoL: Quality of Life

A. Bivariate correlation coefficients of study variables of interest

B. Results of the serial (multiple) mediation models
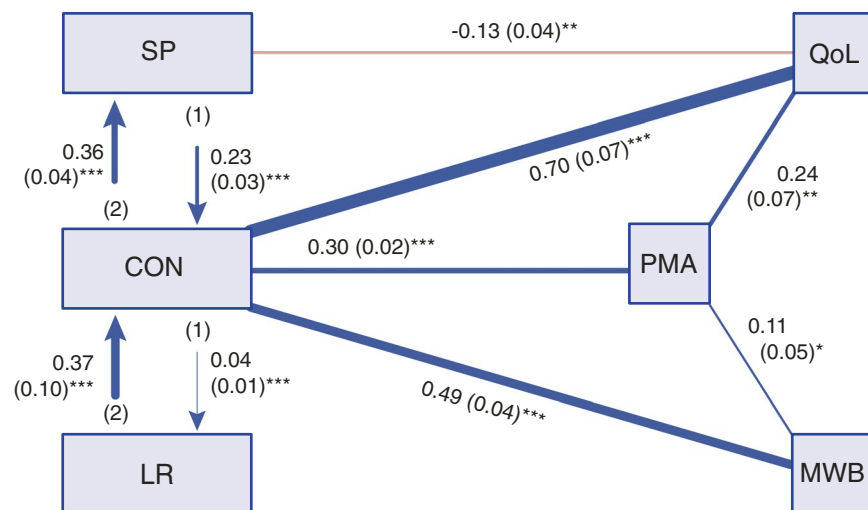
strong inclination to engage in strategic planning may have adverse effects as well.

Post-hoc moderation analysis

To further elaborate on this surprising relation, we performed two post-hoc multiple regression (moderation) analyses (see Supplement A for details on statistical method and simple slope analyses).

The first analysis included QoL as single outcome variable. When subgrouping based on the level of conscientiousness, lifestyle regularity and prospective memory ability (i.e., four-way interaction), we found that for those

with a regular lifestyle *or* higher levels of conscientiousness (*n* = 284, *n* = 77, respectively), strategic planning negatively predicted QoL, *B* = -1.14 (0.30), *p* = 0.001, *B* = -1.96 (0.49), *p* < 0.001 (see Fig. 3A; and Table S3). For those scoring higher on lifestyle regularity *and* conscientiousness (*n* = 503), there seems to be little variation in both the inclination to engage in strategic planning and QoL, and accordingly no significant relation was observed. In contrast, for those with *lower levels* of lifestyle regularity *and* conscientiousness (*disadvantaged, n* = 52), higher inclinations to engage in strategic planning actually were beneficial for QoL, *B* = 1.78 (0.58), *p* = 0.02. These effects were only observed among those with higher prospective memory

Fig. 3 Post hoc *multiple regression analyses. Note.* Panel A shows the estimated marginal trends of the multiple regression models with quality of life (QoL) as dependent variable, strategic planning (SP) as main predictor, and lifestyle regularity (LR), conscientiousness (CON) and prospective memory ability (PMA) as potential moderating variable. Panel B shows the estimated marginal trends of the multiple regression models with SP as dependent variable, QoL as main predictor, and LR, CON and PMA as potential moderating variable. In both panel A and B, only the trends corresponding to high levels of PMA are shown. $^+ p < 0.09$, $*p < .05$, $**p < .01$, $***p < .001$ (Bonferroni corrected). The moderator values selected for the simple slope analyses are listed in parentheses

A. Predicted values of quality of life (QoL)

B. Predicted values of strategic planning (SP)
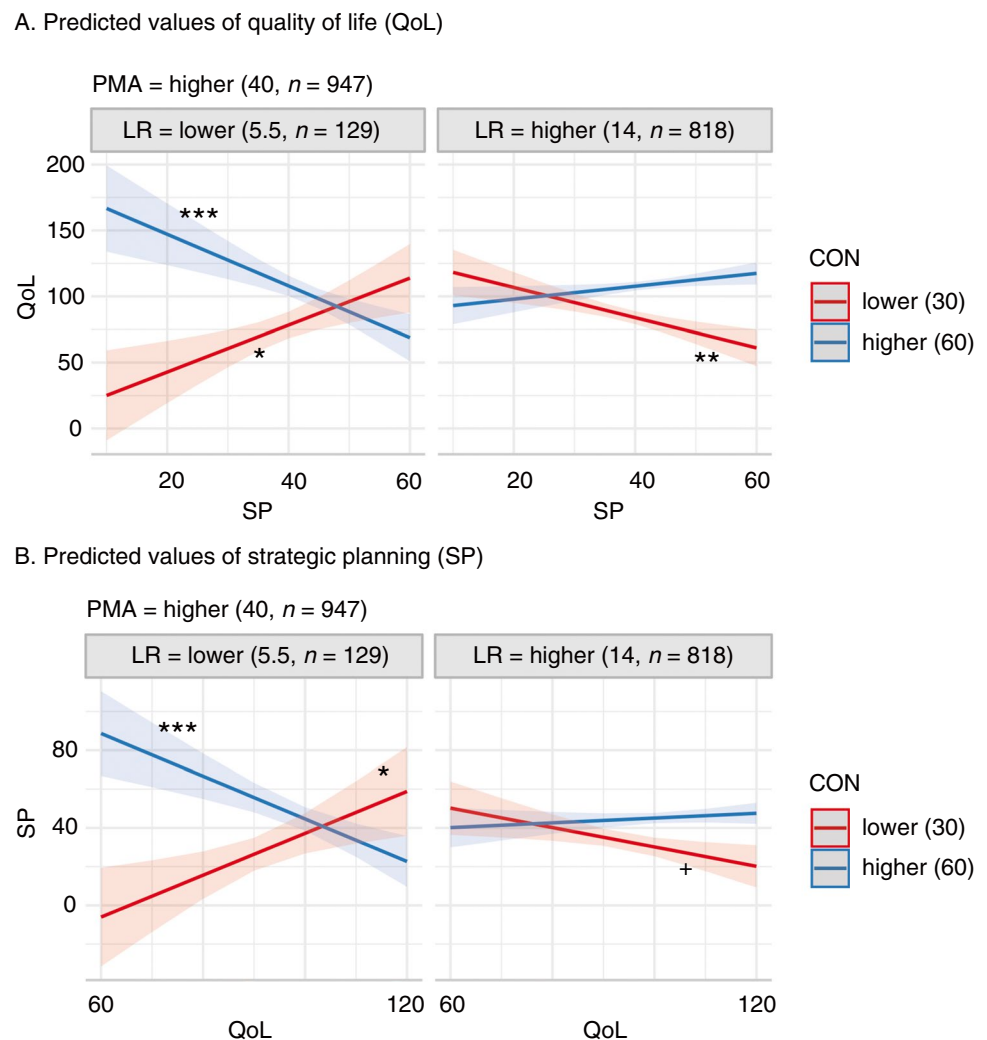
ability ($n = 947$), and no significant trends were found for individuals with relatively lower prospective memory ability ($n = 169$). Altogether, this seems to suggest that strategic if–then planning does not provide any additional benefit, and may even be counterproductive, for those who utilize other (planning) strategies that already help individuals to obtain good outcomes, but may be particularly beneficial for those who lack (other) resources to adjust their behaviour.

Indeed, planning is what people do when they struggle to accomplish (daily) life goals, and are not completely satisfied with their current situation. Hence, the negative association between strategic planning and QoL may also be interpreted reversely, where those reporting higher levels of QoL are less inclined to engage in strategic planning. Our second post-hoc analysis – with strategic planning being included as single *outcome* variable, and QoL as one of the predictors – revealed that this may be particularly true when individuals show higher levels of conscientiousness. We found a significant four-way interaction, which suggest that highly conscientious individuals ($n = 77$) seem to
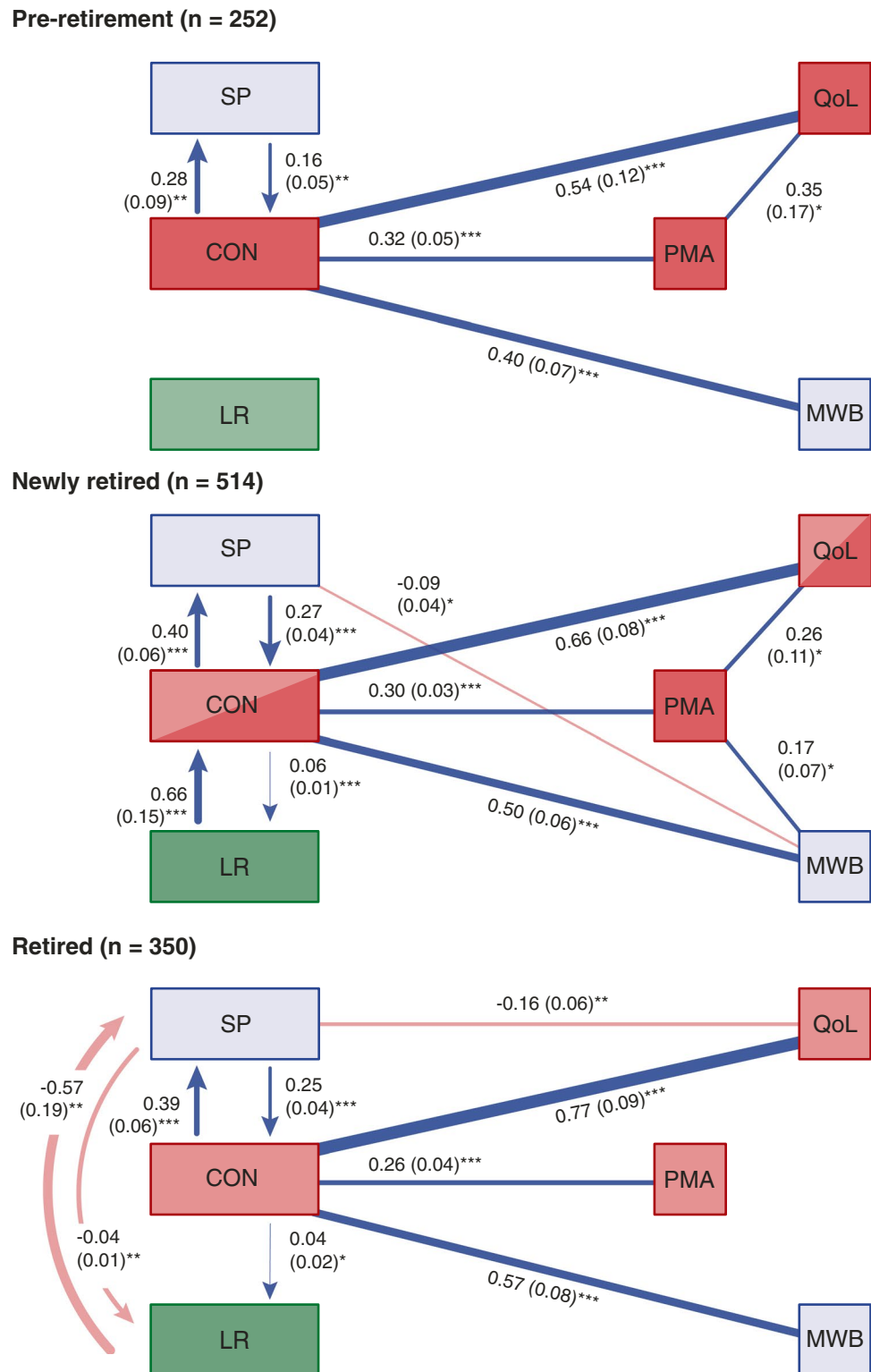
engage more strongly in if–then planning, if they show lower levels of QoL, $B = -1.10$ (0.28), $p < 0.001$, and likely have important goals to accomplish (see Table S4; and Fig. 3B). However, less conscientious individuals do not seem to be more inclined to engage in if–then planning if their QoL is lower, but rather when their QoL is higher, $B = 1.08$ (0.39), $p = 0.004$ ($n = 52$). We should point out that we only found these patterns among those who had a good prospective memory ability and an irregular lifestyle. No significant association between strategic planning and QoL was found for the other subgroups.

The moderating role of life phase

Life phase was significantly associated with QoL, prospective memory ability, lifestyle regularity and conscientiousness (see Table 1). Specific group comparisons revealed that all retired individuals had a more regular lifestyle than those still active on the labour market. The retired individuals had, however, lower prospective memory ability and

Fig. 4 *Serial multiple media-tion analyses, moderated by life phase. Note.* Reported path regression coefficients are unstandardized. *p < .05, **p < .01, ***p < .001. Variables that are positively or negatively associated with age are shown in green or red, respectively. Blue variables are not associated with age. The darkness of the colour is used to depict significant subgroups differences for these variables, with darker colours indicating higher averages

As illustrated in Fig. 4, life phase also seemed to moderate some of the pathways in the serial mediation models (with small to medium effect sizes; see Table S5-7 for all details). For instance, prospective memory ability showed no associations with QoL/MWB among the retired individuals,

lower levels of conscientiousness than pre-retired individuals (with newly retired individuals somewhere in between), and QoL also decreased with advancing life phase. No life phase effects were found for MWB and the inclination to engage in if–then planning.

and lifestyle regularity did not seem to exert any (indirect) influences on MWB/QoL among the pre-retired individuals. Among the retired individuals, lifestyle regularity was negatively associated with the inclination to engage in strategic planning. Despite these observed differences, statistical comparisons with (omnibus) Wald-tests showed no significant contrasts (all p's < 0.05). Given the large standard errors (as compared with those in the main model), particularly for the subgroups with the lowest sample size, this is likely due to insufficient power to detect such differences. As this can increase the incidence of type II errors (i.e., false negatives) and thereby invalidate our interpretations, we will refrain from directly comparing the subgroup models and only use current findings as a means to form specific hypotheses for future work.

Discussion

The ability to adapt behaviour when quality of life (QoL) and mental well-being (MWB) are challenged, is crucial for resilience in later life. Age-related impairments in flexible goal-directed control may render this ability relatively dependent on intact automatic processes. Therefore, the formation of efficient stimulus-driven habits may provide an opportune route for behavioural adjustment in favour of resilience in older adults. In line with this idea, we hypothesized that habit-predisposing factors (i.e., the inclination to engage in strategic planning and lifestyle regularity) and the related personality trait of conscientiousness contribute to QoL and MWB, either directly or through their favourable effects on prospective memory ability. In line with our hypotheses, we found that conscientiousness was indeed associated with better MWB and QoL: both directly and indirectly via prospective memory ability. Moreover, our results suggest that strategic planning and lifestyle regularity also exerted favourable influences on MWB and QoL, but only indirectly through their effect on conscientiousness. This casts new light on the relative contribution of each of these characteristics, as well as the potential mechanisms through which they affect QoL and MWB. Furthermore, we found a surprising negative *direct* relationship between strategic planning and QoL. We will discuss our findings and alternative causal explanations in more detail below, as well as the implications for interventions aiming to promote resilience in older adults.

The role of conscientiousness in effective and habitual regulation of behaviour

Certainly, our findings confirm that high levels of conscientiousness are positively related to both prospective memory (Cuttler & Graf, 2007; McCabe et al., 2018), and

QoL/MWB (see e.g., Brett et al., 2012; Chapman et al., 2007; Pocnet et al., 2017). In addition, we show that prospective memory ability acts as an important mediator of the relationship between conscientiousness and QoL/MWB. This may reflect that highly conscientious people automatize adaptive behaviours, which helps them to remember to carry out intended (repetitive) actions, in support of QoL/MWB.

While conscientious individuals are generally goal-oriented, the structured and consistent manner in which they strive for goals has been thought to facilitate habit formation (e.g., Judah, 2015), and indeed a recent study showed that this trait positively predicts the automatization of a novel routine (van de Vijver et al., 2023). Our results provide further evidence for this idea by confirming that highly conscientious older individuals are generally more inclined to engage in if–then planning, a planning strategy that has been proposed to result in 'strategic automaticity' (in line with Bieleke et al., 2021). Additionally, to the best of our knowledge, this is the first direct confirmation of the idea that conscientious individuals have greater regularity in their social and behavioural rhythms. While strategic planning and lifestyle regularity are not directly linked, they are connected through their associations with conscientiousness.

Both engaging in strategic if–then planning (in controlled research contexts; e.g., Adriaanse et al., 2009; Warner et al., 2022; Gollwitzer & Sheeran, 2006), and exhibiting a regular lifestyle are known to yield various health benefits (Margraf et al., 2016; Monk et al., 1997). Our results suggest that both of these favourable effects may be mediated by conscientiousness. In other words, conscientious individuals may *not only* frequently engage in strategic planning and exhibit a regular lifestyle, but these habit-predisposing factors may also promote certain hallmarks of conscientiousness and thereby exert a positive indirect influence on QoL/MWB. The tendency to frequently engage in if–then planning may facilitate conscientiousness by promoting a sense of organization (i.e., time management, prioritization of tasks) and responsibility, and inducing more thorough considerations of potential obstacles or problems. A strong lifestyle regularity may provide structure and routine to one's life, which can help older adults to maintain a sense of control and facilitate industriousness. In turn, the improvement of these capacities may again strengthen the inclination to engage in if–then planning and promote greater regularity, thereby forming two interconnected and adaptive feedback loops between the personality trait of conscientiousness and these habit-predisposing factors that together reinforce effective and habitual regulation of one's behaviour. Given the existence of these two mediation patterns and adaptive feedback loops, it appears that both the inclination to engage in strategic planning and regularity in daily

rhythms could serve as effective intervention targets to initiate a positive cycle towards conscientiousness and thereby foster resilience among older adults.

Boundary conditions of strategic planning

Our analyses also revealed a potentially adverse effect of a strong inclination to engage in strategic planning, which is important to consider. Specifically, next to the *indirect* positive relation between strategic planning and QoL, we found a negative *direct* relation between these variables. This represents the relative (or *residual*) contribution of the effect of strategic planning on QoL, after taking into account its favourable effects on conscientiousness and the relative contributions of conscientiousness and lifestyle regularity (and prospective memory ability) on QoL. Our post-hoc analyses inspired some plausible ideas on how to interpret this finding. These suggested that only individuals reporting lower levels of regularity and conscientiousness (i.e., 'disadvantaged' individuals) benefit from a higher inclination to engage in strategic planning, whereas individuals who scored higher on lifestyle regularity and/or conscientiousness experienced no additional benefit, or even counterproductive effects. Therefore, engaging in effortful planning strategies may only make sense for those *who are in need* of additional help to adjust their behaviour and achieve new goals, as these individuals lack other resources to do so. These findings converge with previous studies showing that if–then plans are particularly useful for low conscientious individuals (Gollwitzer & Oettingen, 2013; Webb et al., 2007), and add new insights about the conceivably similar role that lifestyle regularity plays. Furthermore, this pattern aligns well with the common finding that implementation intention effects have stronger beneficial effects for difficult than for easy goals (Gollwitzer & Sheeran, 2006). Speculatively, the negative relation between strategic planning and QoL among those high in lifestyle regularity *or* conscientiousness, may be explained by the lack of added benefit of strategic planning when goal striving is already highly successful, leading to disappointment or frustration (Bieleke et al., 2021). This raises the question why we did not observe this negative relation among those who score high on both constructs. Potentially, this is due to the limited diversity among individuals in this particular subgroup, which may have prevented us from accurately capturing the true relationship between strategic planning and QoL. Be that as it may, our findings suggest that, from a certain point onwards, the level of conscientiousness and lifestyle regularity represent important boundary conditions to the effectiveness of self-initiated if–then plans in promoting goal goal-striving (see e.g., Churchill and Jessop (2010) for an analogous reasoning regarding impulsivity).

Inclination to engage in strategic planning: not a fixed trait?

Since we relied on cross-sectional data, and therefore cannot provide direct support for causality, we should also consider the alternative directionality of the aforementioned negative relationship. This could be that people with a relatively high QoL are less inclined to engage in strategic planning because of a lower need for behavioural adjustment. In this view, a high inclination to engage in if–then planning can be an indication that things are not going well. Deploying this strategy may subsequently, in time, lead to better QoL. The inclination to engage in if–then planning is a relatively novel construct, and our findings raise the question to what extent this is a stable trait, or whether it is indeed modulated by current needs for behaviour regulation. Interestingly, our second post-hoc analysis suggests that when *conscientious* individuals report lower levels of QoL and lifestyle regularity (and most likely struggle with accomplishing certain life goals), they will readily act upon this and employ strategic planning to deal with the challenges they face. This pattern corroborates previous evidence showing that conscientious individuals are more willing to form if–then plans and reliably enact them when circumstances ask for it (Ajzen et al., 2009; Webb et al., 2007), and casts new light on conscientious individuals' metacognitive ability to assess their needs and adapt their strategies accordingly. In other words, conscientious individuals know when it is useful to employ this strategic planning and when not. This more nuanced perspective on our previously discussed findings suggests that strategic planning *can* be advantageous for conscientious individuals, but *only* when their situation asks for it (i.e., they face particular challenges that have threatened their QoL). Those who are less conscientious do not necessarily show higher inclinations to engage in if–then planning if their QoL is low, but rather if their QoL is high. This may reflect a lack of insights of when additional efforts are needed, or echo that engagement in strategic planning for low conscientious individuals can contribute to higher QoL. More research is needed to determine to what extent the inclination to engage in strategic planning represents a relatively stable trait or is dependent upon an individuals' need for behaviour regulation. This need may vary among individuals over time, depending on the attainment of their daily life goals. If the majority of goals have already been accomplished, the (perceived) need for planning may be low (Bösch et al., 2023; Palsola et al., 2020), whereas unfulfilled goals would motivate individuals to engage in strategic planning.

Altogether, our post-hoc analyses suggest that especially individuals that have an irregular lifestyle and are low in conscientiousness, and thus seem to struggle with mobilizing appropriate strategies/efforts when this is needed to

accomplish daily life goals in favour of QoL, may benefit from using strategic if–then planning.

Concrete target points for interventions

In the face of age-related challenges and declines in resources, it is essential to optimize goal striving (relatedly see the theory of selective optimization with compensation Baltes & Baltes, 1990; Freund & Baltes, 2002).Our findings suggest that both the inclination to engage in strategic planning and lifestyle regularity may offer promising and concrete target points for interventions aimed to elicit more conscientious behaviour and thereby produce downstream effects on QoL and MWB (see e.g., Bieleke et al., 2021). More specifically, we propose that an intervention to encourage strategic if–then planning as a metacognitive strategy would be most promising for individuals that are low in conscientiousness and lifestyle regularity. It may be helpful to precede such broader interventions with a program that can help to improve the regularity in social and behavioural rhythms. This can be achieved by introducing a regular wake or sleeping time, to stabilize the circadian rhythm (Kar, 2022; Murray et al., 2021), but also by already prompting the use of strategic if–then planning for some basic, daily activities (e.g., to plan to go outside for a walk in the morning after the first coffee, or to cook/eat dinner at regular times). Such a program may provide a sense of control and stability, but may also help to create stable cues and potential opportunities for change that can help to become more focused on obtaining goals, and allow for piggybacking of new activities. Altogether, given the observed effect sizes, such interventions are expected to yield small to medium effects on actual changes in behavior.

Life phase

The present study also explored the effects of life phase. Life phase seemed to moderate some of the observed pathways, but we had insufficient power to compare subgroup models. Nonetheless, our findings may help to formulate specific hypotheses for follow-up work, and we will therefore discuss some of the most striking patterns that specifically concern the newly retired individuals, for whom behavioural adaptability in the face of changing life circumstances may be particularly relevant. At first glance, our findings seem to suggest that newly retired individuals may be the *only group* that directly benefit from a regular lifestyle. This aligns well with earlier studies suggesting that a regular lifestyle may be an adaptive coping style to deal with transitions in life and maintain stability in these changing contexts (Monk et al., 1997, 2006). After retirement individuals lose a variety of daily tasks and positive social interactions, but also gain a substantial amount of free time that can be filled-up

by engaging in new activities. Accordingly, retirement has often been identified as an optimal window of opportunity for behaviour change (Smeaton et al., 2017), and further research should reveal whether this window may indeed be deployed optimally by actively maintaining or improving regularity in social and behavioural rhythms. Newly retired individuals also seem to be the *only group* in which prospective memory ability plays a considerable role in predicting QoL and MWB. Thus, the subgroup of individuals that is most concerned with redefining their daily routines, may benefit most from other factors or characteristics (e.g., higher conscientiousness, lifestyle regularity, etc.) that are conducive to prospective memory ability. For future studies that aim to address (some of) these pertinent ideas, it may be desired to ensure subgroups of similar sizes to ensure reliable comparisons (i.e., the newly retired group was much larger, which may have influenced the presence/absence and strength of certain relationships in other groups).

Future outlook

Our study revealed new potential mechanisms through which conscientiousness exerts its favourable influences on QoL and MWB: through its positive relationship with prospective memory ability, as well as its contribution in two adaptive feedback loops with lifestyle regularity and the inclination to engage in strategic planning. Although the effect sizes observed were modest, which can be expected given the multitude of variables that can influence QoL/MWB, these findings highlight the potential of these habit-predisposing factors as target points for interventions aimed at improving conscientious behaviour and ultimately enhancing QoL/MWB in later life. However, the personality trait of conscientiousness is multi-faceted, and future research may identify other reinforcing factors. For example, a promising target point for interventions could be the ability to monitor and identify aspects of one's life that could benefit from changes. Besides focusing on reinforcing factors, it is also important to account for factors that might impede habit formation. One example is boredom proneness, which refers to the inclination to perceive one's life as boring (Farmer & Sundberg, 1986; Tam et al., 2021), and becomes especially prevalent among older and retired individuals (e.g., Conroy et al., 2010). People high in boredom proneness find it difficult to get started and initiate any kind of behaviour (e.g., Bieleke et al., 2022; Mugon et al., 2018), which likely interferes with the development of new habits.

As mentioned earlier, the fact that we have relied on cross-sectional data hampered us to provide direct support for causality among the variables of interest, and therefore also to precisely gauge the complex dynamics between, for instance, the inclination to engage in strategic planning and QoL. Longitudinal designs are needed to disentangle

these (potentially opposing) patterns, and allow stronger conclusions on for whom, and in which situations, a strong inclination to engage in strategic planning can yield either beneficial or counterproductive effects (i.e.., the level of self-efficacy; Bandura, 1986). Furthermore, such prospective studies may reveal relationships that have not come to light here, because several processes could be intertwined (e.g., individuals with low levels of regularity, may report high inclinations to engage in strategic planning because they would like to build in more structure, whereas others report high levels of regularity *because* they have strong inclinations to engage in strategic planning).

Another aspect of the present study that should be addressed is the lack of diversity within our sample. While there was substantive variation in participants' inclination to engage in strategic if–then planning and lifestyle regularity,[3] less variation and higher averages were observed for the other factors. That is, most individuals were highly educated, and scored relatively high on conscientiousness, QoL and MWB (Egan et al., 2000; Gobbens & van Assen, 2016; Tennant et al., 2007; note that conscientiousness is known to increase with age, Roberts et al., 2006; McCrae & Costa, 2007). In addition, the majority of individuals had a relatively high level of prospective memory ability, indicating an adequate cognitive capacity to remember to enact one's intentions. Importantly, this prevented us from reliably estimating the relationship between strategic planning and QoL for the subgroups reporting lower prospective memory abilities (as revealed by our post-hoc analyses). The absence of relations seems at least partially due to a power issue, and caution when interpreting this finding is therefore warranted. Indeed, previous research has shown that older adults with low prospective memory ability *can* also profit from planning (Wolff et al., 2016). Good prospective memory functioning contributes to goal attainment and may therefore also reduce the need to rely on other factors (such as a regular lifestyle). This may be especially the case for the relatively younger older adults. In the older (post-retirement) groups, who experience further declines in prospective memory ability (Schnitzspahn & Kliegel, 2009), other factors may become more important. Our subgroup findings provide preliminary support for this idea, as the role of prospective memory ability in predicting QoL/MWB appears to be less prominent in the oldest subgroup, while the role of other characteristics becomes more apparent. Hence, future studies should investigate these relationships in a more diverse sample.

Conclusion

In conclusion, our findings align with the view that an opportune route for behavioural adjustment in favour of resilience among older adults, is to rely on preserved habitual, rather than declining goal-directed action control processes (e.g., Brinkhof et al., 2022; de Wit et al., 2014; Neal et al., 2013). The personality trait of conscientiousness seems to play a central role in this capacity for resilience, together with two habit-predisposing factors: forming strategic if–then plans and adopting a regular lifestyle. The latter factors offer concrete target points for interventions aiming to elicit more conscientious behaviour and build new, desired routines in favour of prospective memory and in turn quality of life and mental wellbeing. However, high levels of conscientiousness may also posit a boundary condition for the effectiveness of interventions that promote the metacognitive use of if–then plans in daily life, and such interventions may therefore be especially desirable for individuals that are low in conscientiousness (and lifestyle regularity). Future research is needed to provide more insights about the role of such individual differences, and evaluate the true potential of facilitating strategic if–then planning and/or a regular lifestyle.

Data availability The datasets presented in this article are not readily available because the datasets used and/or analyzed for the current study will only be made publicly available after completion of the over-arching project, and will until that time only be available from the corresponding author on collaboration basis upon reasonable request. Requests to access the datasets should be directed to LB, l.p.brinkhof@uva.nl.

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[3] Scores on the if–then planning scale showed a wide distribution, ranging from 14 to 56 (i.e. lowest possible value is 8, highest possible value is 56). While the average score (39.9, SD 6.75) may be somewhat lower than those reported in previous studies with relatively younger samples (Bieleke & Keller, 2021; when adjusted to mean scores), a large group of individuals from the current study scored high on this measure. Hence, the lower and upper bound can be considered as low and high levels of the inclination to engage in strategic if–then planning.

The lifestyle regularity measure used in the current study is an adaptation of the diary-like Social Rhythm Metric (Monk et al., 1990, 1992). Due to this adaptation, the current study's lifestyle regularity scores cannot be compared to previous ones. Nonetheless, there is substantive variation in the sample, with some individuals scoring low (5.5) and other scoring high (14, which is the maximum value that can be obtained). These numbers represent the number of days in which 6 key behaviors are performed on approximately the same time within a 2-week timeframe. In this perspective, 5.5 days can be considered as 'low' lifestyle regularity.

Declarations

Ethical approval and consent to participate The study is approved by the local ethics committee of the University of Amsterdam (2020-DP-12556; 2021-DP-13798) and is conducted in accord with relevant laws and institutional guidelines. Informed consent was obtained from all subjects involved in the study.

Conflicts of interest The authors declare no conflict of interest.

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Preregistration This study was pre-registered: https://osf.io/8wmp6

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