The relation between personality and the realism in confidence judgements in older adults

Mats Dahl · Carl Martin Allwood ·
Mikael Rennemark · Bo Hagberg

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Abstract This study investigated the relation between personality factors, as measured by the Swedish version of the NEO-FFI questionnaire, and the realism in older adults' (aged 60–93 years, $n = 1,384$) probability confidence judgements of their answers to general knowledge questions. The results showed very small effect sizes for the contribution of the personality variables to the fit between the proportion correct answers and the level of one's confidence judgements. Although personality differed somewhat within the age span studied and between the genders no differences were found in the relation between the dimensions of the NEO-FFI and the degree of realism in the confidence judgements as a function of age or gender. In total, the results show a significant but very small effect of personality on the realism in older adults' confidence judgements of their semantic knowledge.

Keywords Elderly people · Personality · Big-five · Semantic memory · Metamemory · Calibration

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M. Dahl (✉)
Department of Psychology, Lund University, Box 213,
221 00 Lund, Sweden
e-mail: Mats.Dahl@psychology.lu.se

C. M. Allwood
Department of Psychology, University of Gothenburg,
Gothenburg, Sweden

M. Rennemark
Linnaeus University, Växjö, Sweden

B. Hagberg
Blekinge Institute for Research and Development,
Lund University, Lund, Sweden

Introduction

The present study investigated the relation between personality factors and an aspect of metamemory, the realism in older adults' confidence judgements. Metamemory can be seen as the part of metacognition relating specifically to memory. It mainly concerns a person's knowledge of his or her memory and the person's ability to use this knowledge to regulate his or her memory processes (Flavell 1979; Koriat 2006). There are different types of metacognitive judgements, including both judgements made at the acquisition and judgements made at the retrieval of knowledge (Nelson and Narens 1994). Since a well-functioning learning and recall from memory is crucial for living, a normal life metacognition is a fundamental cognitive function.

In spite of this, the amount of research addressing various aspects of metamemory abilities in advancing age is still somewhat limited and the results concerning whether metamemory abilities decrease with increasing age are inconclusive (e.g., Crawford and Stankov 1996; Dahl et al. 2009; Dodson et al. 2007; Hansson et al. 2008; Hertzog 2002; Pansky et al. 2009; Perlmutter 1978; Pliske and Mutter 1996). There are presumably many different reasons for this. One reason is that different metamemory tasks appear to be differently affected by age (for examples see, Dodson et al. 2007; Pansky et al. 2009; see also Keleman et al. 2000).

One important aspect of metamemory ability, both for young and old, is to be able to realistically assess the correctness of one's memory of different facts about the world, that is to produce *confidence judgements* of the correctness of one's memory recall at an appropriate level. The confidence an individual feels in the correctness of his/her recalled memory will influence, for example, whether

the person will be satisfied with the information retrieved or perform additional search, externally (e.g. by asking someone) or internally (by continued memory search) for better supported information. It will also influence what information a person is prepared to report to others (Koriat and Goldsmith 1996). Since the consequences of unidentified mistakes in the recall of information necessary for every day planning (e.g., bus times, times of meetings and number of pills to be taken, etc.) may be even more costly for elderly people than for younger in terms of extra effort spent to correct the mistakes, metamemory skills are especially important for older adults.

Previous research shows that individual difference variables such as personality and cognitive style variables contribute variance to the realism of confidence judgements (Jonsson and Allwood 2003; Kleitman and Stankov 2001, 2007; Körner and Bierman 2007; Pallier et al. 2002; Schaefer et al. 2004). The extent to which this also holds for older adults has not been investigated but given that older adults may show a different personality profile than younger adults it is of interest to study if these findings hold also for older adults. This is done in the present study. More specifically, we analysed the relation between personality as measured by the five factor theory of personality (Costa and McCrae 1988) and metamemory ability in the form of the realism in the confidence judgements of older adults using a broad age range, including very old people, 93 years of age. In this context, we also analysed the presence of gender differences since previous research has reported differences in personality between men and women that may have repercussions for gender differences in metamemory skills.

Realism in confidence judgements

The metamemory realism of confidence judgements concerns the match between the confidence judgements and the correctness of the recalled memories over many recall instances (see e.g., Lichtenstein et al. 1982; Yates 1994). Two different aspects of metamemory realism have been identified, both of which were included in the present research. One has to do with *calibration bias* that refers to the match between the *level* of a person's confidence in the correctness of his/her answer and their actual correctness. The other aspect refers to the person's ability to use his or her confidence judgements to *discriminate* between correct and incorrect memories. In this context, it also deserves to be noted that realism in confidence is a function of both the correctness of the recalled memories and the level of confidence in the recalled memories and that as noted by Leippe (1980) both correctness and confidence may be influenced by factors that do not influence the other.

The realism in confidence judgements and age

Research addressing the realism in confidence judgements of semantic memory performance in advanced age is sparse, especially for 75-year olds and above and the results have been somewhat conflicting. Some studies have shown improved realism with age. For example, Pliske and Mutter (1996) reported a tendency for the older group to show less overconfidence ($P < .08$) and significantly better discrimination, as measured using the gamma correlation and Dodson et al. (2007) reported better calibration for moderate and difficult questions (as measured by the "calibration error score") and no age differences for easy questions. Moreover, the older participants evinced better discrimination than the younger as measured by the gamma correlation. Other researchers have found no age differences in the level of overconfidence (Dahl et al. 2009; Hansson et al. 2008), or in slope, that is, the ability to separate correct from incorrect answers by means of the level of one's confidence judgements (Dahl et al. 2009; Perlmutter 1978). Finally, Crawford and Stankov (1996) reported that older people showed poorer realism in that they showed more overconfidence and worse discrimination. However, the two studies with the largest number of participants in high ages reported no effect of age for the level of overconfidence or slope (Dahl et al. 2009; Hansson et al. 2008). A limitation of both these studies is that they used cross-sectional data.

Personality and the realism of confidence judgements

What is the role of personality in determining the realism in confidence judgements? The model described by Kröner and Bierman (2007) attempts to answer this question. On a general level, the model states that *response confidence* depends on two factors: domain-specific competence and a domain-general self-concept. It predicts that when a person has domain-specific competence, response confidence is essentially based on this competence. When no domain-specific competence is held, confidence judgements are assumed to be based on the self-concept (e.g., various types of self-perceptions including the performance level in similar tasks and other tasks). Kröner and Bierman (2007) tested their model on younger adults, using a spelling test, a perceptual test, a test of inductive reasoning and a self-concept questionnaire and found support for the notion that the source of confidence judgements can be found both in domain-specific competence and in general factor competence (self-concept). In brief, personality is most likely to have an influence on the realism in confidence judgements when domain knowledge is low.

In this context, it is relevant to note that research has shown the existence of a stable level in a person's confidence judgements *independently of the correctness of the confidence judged memory performance* (Jonsson and Allwood 2003; Kleitman and Stankov 2001, 2007; Pallier et al. 2002). This has been called the *self-confidence factor* (Kleitman and Stankov 2007). In contrast, previous research has found that a person's current mood state is not likely to influence the level of realism in confidence judgements (Allwood and Björhag 1991; Allwood et al. 2002). Of relevance to the self-confidence factor, previous research has shown that older adults are likely to have conceptions about the typical memory ability of their age group. As shown in research by Hertzog and colleagues such conceptions are likely to convey that the memory skills of older people are declining (Hertzog 2002). Findings reported by Perrig-Chiello et al. (2000), in line with these results, showed that elderly participants between 65 and 94 complained that their memory was worse than in the past and that participants older than 75 tended to experience that their memory had declined more than persons between 65 and 75. The same research showed that the majority of the participants estimated their memory to be 'the same' (57%) or 'better' (34%) than people of the same age. In addition, 65% of the participants evaluated their performance on a composite memory task to be either 'rather bad' or 'bad'.

On a more abstract level, more general tendencies in individuals' psychological functioning falls under the label of the person's *personality* and different aspects of a person's personality profile are likely to interact with the different parts of the person's self-concept. One of the most important theories of personality is the five factor theory (Costa and McCrae 1988). It states that personality can be defined by five behavioural dispositions or traits (the Big-Five): 1. *Neuroticism*: worrying, nervous and emotional insecure 2. *Extraversion*: sociable, active, talkative and optimistic 3. *Openness*: curious, broad interests, creative and untraditional 4. *Agreeableness*: soft-hearted, trusting, helpful and forgiving 5. *Conscientiousness*: organised, reliable, self-disciplined and punctual.

Some of these traits are likely to influence confidence judgements and their realism, for example by having an influence on the level of the person's general self-confidence. For example, Extraversion can be expected to be associated with higher confidence independently of whether one's answer is correct or not, thus leading to increased overconfidence. This expectation was supported by Schaefer et al. (2004) using general knowledge questions and a student sample. Likewise, Pallier et al. (2002) found a correlation between a facet of Extraversion and overconfidence. Other research, also using student samples, has found Extraversion to be correlated with positive self-esteem (Amirkhan et al. 1995) and to optimism (Williams

1992). Sometimes dispositional optimism, i.e., a generalised tendency to expect positive outcomes, is even seen as a facet of Extraversion (e.g., Amirkhan et al. 1995). Schaefer et al. (2004) also reviewed previous research showing that narcissism is associated with extraversion and that narcissistic personalities are more likely to show overconfidence than less narcissistic personalities.

Likewise, it seems reasonable to expect that persons high on Neuroticism might show lower confidence but not lower correctness. Williams (1992) found that Neuroticism was highly correlated with pessimism and negatively correlated with optimism. Moreover, Amirkhan et al. (1995) found that Neuroticism was (negatively) correlated with self-esteem. Persons high on Neuroticism may also be more likely to draw on negative conceptions about themselves. For the participants in this study, this might involve the notion of declining memory capabilities in older adults (Hertzog 2002). Neuroticism may thus bring down the general level of confidence independently of whether one's answer is correct or not, thus leading to less overconfidence (or even to underconfidence) in one's retrieved answers. Since previous research has reported women to be more anxious (part of Neuroticism) than men (e.g., McLean and Anderson 2009), this could lead to women showing lower levels of overconfidence than men.

However, Neuroticism has not always showed the expected correlations. For example, Schaefer et al. (2004) did not find a correlation between Neuroticism and confidence. As another example, in two very large cross-sectional national samples Neuroticism showed a weak negative correlation with age in the British sample and a weak positive correlation with age in the German sample (Donnellan and Lucas 2008). In contrast, Extraversion showed a similar negative correlation with age in both samples. Finally, the correctness of the memory report may also influence the realism in confidence. Higher levels of Openness may primarily be associated with higher correctness levels, irrespective of the person's general confidence level, which would help to bring down the person's level of overconfidence. However, this expectation has only partly been confirmed in research on younger adults. Schaefer et al. (2004) found significant correlations between Openness and correctness and Openness and confidence, but no correlation between Openness and overconfidence. This was interpreted as that individuals high on Openness, have a general tendency to seek out situations which provide new information. The latter gives a broader knowledge base which is reflected in a higher proportion of correct answers on tests including general knowledge questions.

It should be noted that all research has not been supportive of a link between personality and realistic confidence judgements. Kleitman and Stankov (2007), using undergraduate students, found that the Big-Five personality

factors did not contribute significantly in a regression analysis where cognitive ability and “metacognitive processes” had been entered first.

To sum up, research suggests that it may to some extent be possible to predict realism in confidence based on personality factors. Given the model by Kröner and Bierman (2007) presented above, the proportion of variance in confidence explained by personality can be expected to not be very large since personality might act mostly through its influence on features of the person’s self-concept. More specifically, as argued above, we expected that, irrespective of the level of correctness, higher levels of Extraversion would be associated with higher confidence levels and that higher levels of Neuroticism would be associated with lower confidence levels. Moreover, we expected higher levels of Openness to be associated with higher correctness levels and lower overconfidence. Since previous research on the relation between personality and realism in confidence has been done on young adults, we wanted to test if these results would also hold for older adults.

We also analysed whether possible differences in the personality profile of the different age segments of the participants would be associated with differences in the realism in the confidence judgements. Finally, we analysed gender differences in order to see if differences in personality between men and women among older adults would be associated with differences in confidence and realism in confidence. Here, we expected that higher Neuroticism in women would be associated with lower overconfidence.

Method

Participants

The total number of participants was 1,384. Nine birth cohorts from 1910 to 1943 were examined at 60 ($n = 191$), 66 ($n = 206$), 72 ($n = 177$), 78 ($n = 166$), 81 ($n = 155$), 84 ($n = 200$), 87 ($n = 150$), 90 ($n = 99$) and 93 ($n = 40$) years of age in a cross-sectional design taken from the Swedish National study on Ageing and Care (SNAC-Blekinge) (Lagergren et al. 2004). With the restriction that persons with a reduction in cognitive understanding were excluded (MMSE score below 24, see Folstein et al. 1975), this sample is representative of the non-demented, community living elderly between 60 and 93 years of age.

Care was taken in the data collection to ensure proper equidistance between birth dates and examinations. Persons between 60 and 81 years of age were selected randomly for the study and stratified according to gender and age. All persons over 81 years of age were included in the study. The gender distribution in the total sample was 41.7% men and 58.3% women.

Materials

Ten general knowledge questions (GKQs), deemed appropriate for the age groups studied, were used. The questions were a subset of questions that have been successfully used in our previous research on adults. Each question had two answer alternatives and the participant’s task was to choose the alternative he/she thought was the correct one. Examples of the questions are: ‘What is a Pegasus? A: A creature that is half human and half horse. B: A horse with wings.’, ‘In which country is the city of Mecca found? A: Saudi Arabia B: Iran’. The correctness for the specific questions ranged from .45 to .79. This indicates that the level of difficulty for the questions range from ‘medium’ to ‘difficult’. After each question, the correctness of the chosen answer alternative was rated on a scale ranging from 50% (‘guessing’) to 100% (‘absolutely sure that the answer is correct’). Only the numbers 50, 60, 70, 80, 90 and 100 could be used. A reliability analysis of the confidence judgements showed a Cronbach alpha value of .78.

Personality was measured by a Swedish version of the NEO-FFI questionnaire (Costa and McCrae 1989). The questionnaire, which previously has been used in the Swedish version used here (Rennemark and Berggren 2006), consists of 60 items that describe personality traits. A Likert-scale with steps from 1 (do not agree at all) to 5 (agree completely) was used. A higher total score on a specific personality factor indicates that the individual was more likely to behave in line with the description of that factor.

Procedure

The data for this study was collected in the participants’ homes. Informed consent was obtained from all participants.

Measures of realism in confidence judgements

The basic measures were *Correctness* (an individual’s proportion correct answers) and *Confidence* (average of an individual’s confidence judgements). Two measures of the calibration bias aspect were used: *Calibration* and *Over-/underconfidence*. The formula for the Calibration measure is:

$$\text{Calibration} = 1/n \sum_{t=1}^T n_t (\text{conf}_m - c_t)^2$$

Here n is the total number of questions answered by the participant, T is the number of confidence classes used, c_t is the proportion of correct answers for all items in the confidence class conf_t , n_t is the number of times the confidence class conf_t was used and conf_m is the mean of

the confidence ratings in confidence class t . Thus, Calibration is computed by first dividing participants' confidence ratings into a number of confidence classes (50–59, 60–69, 70–79, 80–89, 90–99 and 100). Next, for each confidence class, the difference is taken between the mean confidence for the items and the proportion of correct items. Finally, the squared differences multiplied by the number of responses in the confidence class are summed over the confidence classes and then divided by the total number of items.

Over-/underconfidence is computed in the same way as Calibration, except that the difference for each confidence class is not squared before it is added to the differences for the other confidence classes. The Over-/underconfidence measure indicates whether an individual is overconfident (positive value) or underconfident (negative value). Calibration is perfect and Over-/underconfidence is absent when their values are zero. The Cronbach's alpha value for Calibration was .65 and for Over-/underconfidence .59.

The participants' ability to discriminate correct answers from incorrect answers by means of the confidence judgements was measured by means of the *Slope* measure (the average confidence for incorrect answers subtracted from the average confidence for correct answers). This measure is also affected by the calibration bias aspect but has an advantage in that it is intuitively easy to understand.

Results

In order to provide a more comprehensive picture of the results, the age groups were aggregated into three groups: Old (60, 66, 72), Older (78, 81, 84) and Oldest (87, 90, 93).

Personality and age

We first investigated the relation between personality and age with metamemory abilities excluded from the analysis. The purpose of this was to better understand the relation between personality and realism in confidence for the different age groups. Neuroticism was found to increase significantly with age $F(2, 1210) = 7.25, P = .001, \eta^2 = .01$, while Extraversion, $F(2, 1214) = 45.64, P < .001, \eta^2 = .07$, Openness $F(2, 1212) = 51.37, P < .001, \eta^2 = .08$, Conscientiousness $F(2, 1210) = 34.46, P < .001, \eta^2 = .08$ and Agreeableness $F(2, 1211) = 6.45, P = .002, \eta^2 = .01$ decreased (see Table 1 for means).

Metamemory and age

When analysing the data without the personality aspects, the result showed a some general overconfidence, independent of age (see Table 1). The proportion of correct

answers decreased significantly with age (see Table 1), $F(2, 1227) = 9.12, P < .001, \eta^2 = .02$. The level of the confidence judgements was also found to decrease significantly as a function of age, $F(2, 1227) = 8.56, P < .001, \eta^2 = .01$ (see Table 1 for means). No significant age differences were found for Calibration or Over-/underconfidence (see Table 1 for means), or for Slope.¹

Metamemory measures, personality and age

Five hierarchical regression analyses were performed to analyse the combined effect of Age, Years of education and Personality (NEO-FFI) on Correctness, Confidence and the metamemory measures Calibration, Over-/underconfidence and Slope. The correlations between these variables can be seen in Table 2. Multivariate outliers were excluded using the Mahalanobi's distance procedure. The distributions of Calibration, Over-/underconfidence and Slope were found to be positively skewed and were, therefore, transformed (Calibration and Over-/underconfidence were square root transformed and Slope was log-transformed). The transformed variables were used in the regression analyses. The means and standard deviations in Table 1 are the untransformed values. In the regression analyses for Correctness and the three metamemory measures Age was entered in step one, Age and Years of education in step two and Age, Years of education and the five Personality variables were entered in step three. Due to the small effect sizes ($R^2 < .02$), the results of the regression analyses are not reported for the three metamemory measures.

The result of the analysis for Correctness is shown in Table 3. Age was found to significantly contribute to the model in step one ($\beta = -.08$). This though, was no longer the case in step two and three where Age no longer accounted for a significant part of the variance. The partial correlation between Age and Correctness was $-.084$ in step one but decreased to $-.058$ in step two and to $-.028$ in step three. Years of education were also found to significantly predict Correctness in step two ($\beta = .12$) and in step three ($\beta = .08$). When the Personality variables were included (step three) Neuroticism, Extraversion and Openness were found useful as predictors and significantly contributed to the explained variance (see Table 3). As can be seen in Table 2, these variables were relatively highly correlated between themselves.

In the analysis for Confidence, Correctness was added as a predictor (see Table 4).² In step one Age was entered, in

¹ The results for the realism in confidence judgments have been more extensively reported in Dahl et al. (2009).

² Correctness was not used as a predictor for the metamemory measures since these are formal functions of Correctness and Confidence.

Table 1 Means and standard deviations for NEO-FFI (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness) and the metacognitive measures of the three different age groups in total and

by gender (Old = 60, 66 and 72 years old; Older = 78, 81 and 84 years old; Oldest = 87, 90 and 93 years old)

	Total			Men			Women		
	Old	Older	Oldest	Old	Older	Oldest	Old	Older	Oldest
Neuro	26.8 (6.7)	27.6 (7.1)	27.4 (7.0)	25.2 (6.2)	26.1 (6.9)	27.6 (5.8)	28.1 (6.9)	28.1 (7.0)	29.7 (7.7)
Extra	40.2 (6.1)	37.0 (6.7)	35.5 (8.7)	40.4 (6.3)	37.5 (6.6)	36.3 (9.3)	40.0 (5.9)	36.7 (6.7)	35.1 (8.6)
Open	36.6 (4.7)	34.0 (5.5)	32.7 (6.7)	36.4 (4.4)	34.7 (4.9)	32.6 (7.2)	36.8 (5.0)	33.3 (5.8)	32.8 (6.5)
Agree	41.8 (4.5)	40.6 (5.9)	40.7 (6.8)	41.0 (4.3)	40.6 (5.2)	39.8 (6.7)	42.4 (4.6)	40.6 (6.3)	41.1 (6.9)
Conscien.	45.7 (6.0)	43.1 (7.6)	41.4 (7.9)	46.1 (5.9)	44.0 (7.2)	42.2 (6.3)	45.4 (6.0)	45.5 (7.7)	41.0 (8.5)
Correctness	.65 (.15)	.63 (.16)	.60 (.17)	.66 (.16)	.65 (.15)	.63 (.16)	.64 (.15)	.61 (.17)	.58 (.17)
Confidence	.75 (.11)	.73 (.11)	.71 (.13)	.78 (.11)	.74 (.11)	.74 (.13)	.72 (.11)	.71 (.11)	.70 (.12)
Calibration	.11 (.08)	.11 (.09)	.11 (.08)	.12 (.08)	.11 (.08)	.11 (.07)	.10 (.08)	.11 (.09)	.11 (.09)
O/U conf	.10 (.17)	.11 (.17)	.11 (.18)	.12 (.17)	.11 (.16)	.11 (.16)	.08 (.17)	.10 (.18)	.12 (.19)
Slope	7.2 (15.6)	7.0 (15.1)	4.7 (11.5)	7.7 (13.5)	7.8 (15.3)	4.6 (10.8)	7.7 (13.5)	6.2 (15.0)	6.4 (11.7)

Note: *Neuro* Neuroticism, *Extra* Extraversion, *Agree* Agreeableness, *Conscien.* Conscientiousness, *O/U conf.* Over-/Underconfidence

Table 2 Correlations of central study constructs ($n = 1,384$)

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1. Correctness	1.00	.26**	-.39**	-.61**	.17**	-.10**	.15**	-.09**	-.03	.16**	.06	.03
2. Confidence		1.00	.28**	.31**	.03	-.10**	.20**	-.19**	.13**	.26**	.06*	.13**
3. Calibration			1.00	.66**	.03	-.03	-.01	-.04	.10**	-.01	-.01	.05
4. O/U conf				1.00	-.11**	.01	-.02	-.06	.11**	.01	.03	.07*
5. Slope					1.00	-.08*	.05	-.01	-.03	-.02	.02	-.01
6. Age						1.00	-.28**	.14**	-.28**	-.30**	-.10*	-.24**
7. Years of education							1.00	-.14**	.08**	.18**	.02	.13**
8. Neuroticism								1.00	-.31**	-.02**	-.12**	-.27**
9. Extraversion									1.00	.44**	.37**	.58**
10. Openness										1.00	.39**	.45**
11. Agreeableness											1.00	.46**
12. Conscientiousness												1.00

Note: * $P < .05$, ** $P < .01$

Table 3 Summary of regression analysis (Hierarchical) predicting correctness, using age, years of education and the NEO-FFI variables

	<i>B</i>	<i>SE</i>	β	R^2	Adj. R^2
Correctness					
Step 3				.07	.06
Age	-.001	.001	-.028		
Years of education	.003	.001	.083*		
Neuroticism	-.001	.001	-.106*		
Extraversion	-.003	.001	-.135*		
Openness	.007	.001	.205*		
Agreeableness	.001	.001	.026		
Consciousness	<.001	.001	-.017		

Table 4 Summary of regression analysis (Hierarchical) predicting confidence using age, years of education, correctness and the NEO-FFI variables

	<i>B</i>	<i>SE</i>	β	R^2	Adj. R^2
Confidence					
Step 4				.15	.15
Age	<.001	<.001	.025		
Years of education	.004	.001	.118		
Correctness	.14	.02	.194*		
Neuroticism	-.003	.001	-.147*		
Extraversion	<.001	.001	-.016		
Openness	.006	.001	.216*		
Agreeableness	.001	.001	-.031		
Consciousness	<.001	.001	-.012		

step two Years of education, in step three Correctness and, finally, in step four the Personality variables were entered. Age was found to contribute significantly to the variance in step one ($\beta = -.09$) but not in the later steps. The partial correlation between Age and Confidence was $-.093$ in step one and decreased to $-.055$ in step two. Years of education was also found to significantly contribute in step two ($\beta = .17$), but not in step three and four. In step three, Correctness was found to contribute significantly ($\beta = .24$), and this contribution persisted in step four ($\beta = .19$). Moreover, in step four Neuroticism and Openness were also found to be significantly related to Confidence (see Table 4).

Gender differences

Women were found to score significantly higher on Neuroticism $F(2, 1209) = 31.31, P < .01, \eta^2 = .03$ and Agreeableness $F(2, 1211) = 6.42, P = .01, \eta^2 = .005$, and significantly lower on Conscientiousness $F(2, 1209) = 5.94, P = .02, \eta^2 = .005$. Analysing metamemory performance separately showed that men scored significantly higher on Correctness $F(1, 1229) = 12.71, P < .01, \eta^2 = .01$ and Confidence $F(1, 1229) = 45.92, P < .01, \eta^2 = .04$, (see Table 1 for means) than women, but not on Calibration, Over-/underconfidence and Slope. No significant three-way interactions (Age $\times$ Gender $\times$ Personality) were found on any of the metamemory measures.

Discussion

The present study investigated the relation between the Big-Five personality traits and the realism in confidence among 60–93 year-old adults. The data showed very little difference between the different age groups in the level of realism in the confidence judgements.

The results of the regression analysis for confidence showed that Correctness only contributed to the level of confidence to about the same extent as the personality factor Openness and that Neuroticism contributed negatively. However, Openness and Neuroticism only gave very small contributions to the three metamemory measures.

For the metamemory measures, the correlations showed that of the Big-Five personality variables Extraversion was associated with both calibration and over-/underconfidence and that also Conscientiousness was associated with over-/underconfidence. The results for Extraversion are in line with Schaefer et al. (2004) who investigated undergraduate students and found a positive association between Extraversion and Over-/underconfidence. Our study indicates that this relation holds also for older adults. However, when the contribution of the personality variables was

tested in a hierarchical regression analysis including also other variables, their explanatory value was found to be very small.

It should also be noted our study did not give support for the expected association between Neuroticism and a lower level of overconfidence. This was unexpected and not in line with the trend in previous research results. However, as noted above, previous research has also showed that Neuroticism is not as reliable a predictor of confidence as Extraversion (e.g., Schaefer et al. 2004).

Our results also showed personality differences for the different cohorts in this study (60–93 years old) that were in line with the results presented by Terracciano et al. (2005) and by Baltes et al. (2006). More specifically, we found less Extraversion and less Openness for the older participants in our sample (see Table 1). However, although older participants evinced less of the personality traits that were associated with overconfidence, the level of realism was not better for the older segment of the participants in this study. Similarly, no gender differences were obtained in spite of the fact that we, as expected, found gender differences in the Big-Five personality traits for the participants in our study.

One possibility why the changes in personality did not show an association with calibration and over-/underconfidence is that the differences in personality just noted were too small to have an impact on the measures of realism in confidence. Alternatively, there were other factors (not investigated in our study) that counteracted the fulfilment of this expectation. Examples of such factors are decline in frontal lobe functioning and/or reduced executive functioning (Pansky et al. 2009). Further research is called upon to investigate this issue.

On a general level, the different cohorts participating in our study have to some extent had different conditions affecting their lives. In general, among our participants, these differences relate to the presence for later born participants of, for example, a higher standard of living, more advanced technology and improved education. One identified consequence of cohort is the so called Flynn effect (Flynn 1987; Neisser 1997). The Flynn effect means that people in industrialised countries since the first half of the last century have increased their score on classical intelligence tests. The explanation of the Flynn effect is not clear but may relate to the different living conditions mentioned above. However, it is more specifically the score for the General-fluid (Gf) factor that has increased over time, not the score on the General-crystallised factor (Gc) (Neisser 1997). The Gc factor relates to knowledge about facts that was tested in the task used in the present study. However, there still remains the possibility that the Gf-increase over time may have influenced the results in our study since Gf-level might influence the realism in confidence through the

confidence judgements. Research results arguing against this possibility are reviewed below.

Some limitations of this study should be noted. The first and most serious is that the design was cross-sectional rather than longitudinal. This means that our conclusions have to be treated with some caution until they may be confirmed by research using a longitudinal design. Also our selection of knowledge questions, although carefully selected to be suitable for the age group may, apart from not being a random sample, also have been biased in other ways that we have not foreseen. This is a problem that this study shares with other prior studies that have used researcher selected questions.

To conclude, we found that the Big-Five personality factors only predicted differences in the realism in the participants' confidence judgements to a very small extent. This study used a large sample of participants but the effect sizes in this context were very small. Likewise, despite the differences in personality found the different cohorts and between males and females no effect of age (except for slope) or gender differences in the realism of confidence judgements were found. These observations indicate that personality as measured by the NEO-FFI only plays a minor role in determining the realism of confidence judgements of semantic memory performance for older adults.

Other factors than personality appear to be more important for determining individual differences in the level of probabilistic confidence judgements in older people. On the basis of Kröner and Bierman's model (2007) and other research, domain-specific knowledge would be expected to usually have the most important influence on confidence since the knowledge task is in the focus of attention when a confidence judgement is made and thus generates easily available information. However, as noted by Kröner and Bierman and researchers in the Brunswikian tradition (e.g., Gigerenzer et al. 1991) the extent to which domain-specific knowledge is important depends on the extent to which task-inherent cues are readily available to the person when performing the task. Given these observations, it is not surprising that, as shown by for example, Klayman et al. (1999) and Jonsson and Allwood (2003) knowledge domain is also a factor that influences confidence and realism in confidence. Moreover, as discussed in the 'Introduction' section, when the individual's domain-specific knowledge is less informative other cues will receive attention, such as information about one's own general and specific abilities and knowledge as represented in the self-concept. In contrast, research by Hansson et al. (2008) shows that general cognitive capacity, as evidenced in intelligence, short-term memory capacity and general response speed, is not well correlated with the level of probability confidence judgements.

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References

- Allwood CM, Björhag C-G (1991) Mood and the realism of confidence judgments of one's own answers to general knowledge questions. *Scand J Psychol* 32:358–371
- Allwood CM, Granhag PA, Jonsson A-C (2002) Does mood influence the realism of confidence judgments? *Scand J Psychol* 43: 253–260
- Amirkhan JH, Risinger RT, Swickert RJ (1995) Extraversion: a "hidden" personality factor in coping? *J Pers* 63(2):189–212
- Baltes PB, Lindenberger U, Staudinger UM (2006) Lifespan theory in developmental psychology. In: Lerner RM (ed) *Handbook of child psychology*, vol 1. Wiley, New York, pp 569–664
- Costa PT, McCrae RR (1988) Personality in adulthood: a six year longitudinal study of self reports and spouse ratings on the NEO personality inventory. *J Pers Soc Psychol* 54:853–863
- Costa PT Jr, McCrae RR (1989) The NEO-PI/NEO-FFI manual supplement. Psychological Assessment Resources, Inc, Odessa, FL
- Crawford J, Stankov L (1996) Age differences in the realism of confidence judgments: a calibration study using tests of fluid and crystallized intelligence. *Learn Individ Differ* 8:83–103
- Dahl M, Allwood CM, Hagberg B (2009) The realism in old people's confidence judgments of answers to general knowledge questions. *Psychol Aging* 24(1):234–238
- Dodson CS, Bawa S, Krueger LE (2007) Aging, metamemory and high-confidence error: a misrecollection account. *Psychol Aging* 22:122–133
- Donnellan MB, Lucas RE (2008) Age differences in the Big Five across the life span: evidence from two national samples. *Psychol Aging* 23:558–566
- Flavell JH (1979) Metacognition and cognitive monitoring: a new area of cognitive-developmental inquiry. *Am Psychol* 34: 906–911
- Flynn JR (1987) Massive IQ gains in 14 nations: what IQ tests really measure. *Psychol Bull* 101:171–191
- Folstein M, Folstein SE, McHugh PR (1975) "Mini-Mental State" a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 12:189–198
- Gigerenzer G, Hoffrage U, Kleinbölting H (1991) Probabilistic mental models: a Brunswikian theory of confidence. *Psychol Rev* 98:506–528
- Hansson P, Rönnlund M, Juslin P, Nilsson L-G (2008) Adult age differences in the realism of confidence judgments: overconfidence, format dependence, and cognitive predictors. *Psychol Aging* 23:531–544
- Hertzog C (2002) Metacognition in older adults implications for application. In: Perfect T, Benett S (eds) *Applied metacognition*. Cambridge University Press, United Kingdom
- Jonsson A-C, Allwood CM (2003) Stability and variability in the realism of confidence judgments over time, content domain, and gender. *Pers Individ Differ* 34:559–574
- Keleman WL, Frost PJ, Weaver CA (2000) Individual differences in metacognition: evidence against a general metacognitive ability. *Memory Cogn* 28:92–107
- Klayman J, Soll JB, Gonzales-Vallejo C, Barlas S (1999) Overconfidence: it depends on how, what and whom you ask. *Organ Behav Hum Decis Process* 79:216–247

- Kleitman S, Stankov L (2001) Ecological and person-oriented aspects of metacognitive processes in test-taking. *Appl Cogn Psychol* 15:321–341
- Kleitman S, Stankov L (2007) Self-confidence and metacognitive processes. *Learn Individ Differ* 17:161–173
- Koriat A (2006) Metacognition and consciousness. In: Zelazo PD, Moscovitch M, Thompson E (eds) *Cambridge handbook of consciousness*. Cambridge University Press, New York
- Koriat A, Goldsmith M (1996) Monitoring and control processes in the strategic regulation of memory accuracy. *Psychol Rev* 106:490–517
- Kröner S, Biermann A (2007) The relationship between confidence and self-concept towards a model of response confidence. *Intelligence* 35:580–590
- Lagergren M, Fratiglioni L, Hallberg I-L, Berglund J, Elmståhl S, Hagberg B et al (2004) A longitudinal study integrating population, care and social services data. The Swedish National study on Aging and Care (SNAC). *Aging Clin Exp Res* 2:158–169
- Leippe MR (1980) Effects of integrative memorial and cognitive processes on the correspondence of eyewitness accuracy and confidence. *Law Hum Behav* 4:261–274
- Lichtenstein S, Fischhoff B, Phillips LD (1982) Calibration of probabilities: the state of the art of 1980. In: Kahneman D, Slovic P, Tversky A (eds) *Judgment under uncertainty: heuristics and biases*. Cambridge University Press, Cambridge, pp 306–334
- McLean ER, Anderson CP (2009) Brave men and timid women? A review of the gender differences in fear and anxiety. *Clin Psychol Rev* 29:496–505
- Neisser U (1997) Rising score on intelligence. *Am Sci* 85:440–447
- Nelson TO, Narens L (1994) Why investigate metacognition? In: Metcalfe J, Shimamura AP (eds) *Metacognition*. The MIT Press, London, pp 1–25
- Pallier G, Wilkinson R, Danthiir V, Kleitman S, Knezevic G, Stankov L et al (2002) The role of individual differences in the accuracy of confidence judgments. *J Gen Psychol* 129:257–299
- Pansky A, Goldsmith M, Koriat A, Pearlman-Avni S (2009) Memory accuracy in old age: cognitive, metacognitive, and neurocognitive determinants. *Eur J Cogn Psychol* 21(2/3): 303–329
- Perlmutter M (1978) What is memory aging the aging of? *Dev Psychol* 14:330–345
- Perrig-Chiello P, Perrig WJ, Stähelin HB (2000) Differential aspects of memory self-evaluation in old and very old people. *Aging Mental Health* 4:130–135
- Pliske RM, Mutter SA (1996) Age differences in the accuracy of confidence judgments. *Exp Aging Res* 22:199–216
- Rennemark M, Berggren T (2006) Relationships between work status and leisure life-style at the age of 60 years old. *Eur J Ageing* 3:82–88
- Schaefer PS, Williams CC, Goodie AS, Campbell WK (2004) Overconfidence and the Big Five. *J Res Pers* 38:473–480
- Terracciano A, McCrae RR, Brant LJ, Costa PT Jr (2005) Age differences in five personality domains hierarchical linear modelling analyses of the NEO-PI-R scales in the Baltimore Longitudinal Study of Aging. *Psychol Aging* 20:493–506
- Williams DG (1992) Dispositional optimism neuroticism and extraversion. *Pers Individ Differ* 13:475–477
- Yates JF (1994) Subjective probability accuracy analysis. In: Wright G, Ayton P (eds) *Subjective probability*. Wiley, New York, pp 381–410