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Association of personality with physical, social, and mental activities across the lifespan: Findings from US and French samples

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Despite evidence for its health-related benefits, little is known on the psychological predictors of the participation in leisure activities across the lifespan. Therefore, this study aimed to identify whether personality is associated with a variety of different types of activities, involving physical, cognitive, and social components. The samples included individuals from the second wave of the National Study of Midlife in the United States (N = 3,396) and community-dwelling French individuals (N = 2,917) aged between 30 and 84. Both samples completed measures of the five-factor model of personality. To create an activity index, we combined the physical, social, and cognitive (games and developmental) activities performed at least once a month. In both samples, individuals who scored higher on extraversion and openness were more likely to engage in a variety of activity types. The findings were consistent across two samples from different western societies and suggest that extraversion and openness contribute to social, cognitive, and physical functioning across the lifespan.

A substantial body of research has emphasized the benefits associated with an active lifestyle for successful ageing (Bielak, Anstey, Christensen, & Windsor, 2012; Gow, Corley, Starr, & Deary, 2012; Hertzog, Kramer, Wilson, & Lindenberger, 2009; Jopp & Hertzog, 2007; Menec, 2003; Wilson *et al.*, 2002, 2010). Specifically, it has shown that cognitive, physical, and social activities are associated with a wide range of outcomes in old age, including better cognitive performance (Bielak *et al.*, 2012; Jopp & Hertzog, 2007), improved well-being (Menec, 2003), reduced risk of incident Alzheimer's disease (Wilson *et al.*, 2002, 2010), better functional health (Tykkanen *et al.*, 2013), and decreased mortality risk (Paganini-Hill, Kawas, & Corrada, 2011; Pynnönen, Törmäkangas, Heikkinen, Rantanen, & Lyyra, 2012). Therefore, given their implications towards health, cognitive functioning, and well-being, the factors that promote or obstruct the adoption of an active lifestyle are a major public health concern.

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The effects of the variety of activities

Although previous research has separately related cognitive, physical, and social activities to positive outcomes, more recent research has revealed that those who engage in a broader activity spectrum benefit more than those who engage in only one activity type (Carlson *et al.*, 2012; Karp *et al.*, 2006; Menec, 2003; Podewils *et al.*, 2005; Wang *et al.*, 2013). For example, studies have found that participating in a variety of lifestyle activity types is more predictive than participating more frequently in a single activity type, which can significantly reduce the incident impairment risk on measures sensitive to cognitive ageing and risk for dementia (Carlson *et al.*, 2012; Podewils *et al.*, 2005; Wang *et al.*, 2013). Wang *et al.* (2013) found a dose–response effect of the combination of different activity types on cognition, such that individuals who engaged in low levels of activity experienced a global cognitive decline, those who engaged in high levels of activity, regardless of the type, maintained their cognition, and those who engaged in all activity types improved their cognition. A composite measure of the number of activities has also been associated with higher well-being (Menec, 2003), better physical functioning (Agrigoroaei & Lachman, 2011; Carlson *et al.*, 2012; Lachman & Agrigoroaei, 2010), and lower risk of dementia (Karp *et al.*, 2006). Therefore, assessing a variety of activity types is thus a surrogate measurement of an individual's exposure to environmental enrichment and complexity (Carlson *et al.*, 2012).

Individuals who engage in a variety of activity types are more likely to exercise several skills and abilities that may support physical and psychological health at older age. For example, organizational and memory skills are needed to schedule, attend, and shift among activities. Therefore, the so-called active lifestyle may be best captured by a variety of different activities in which individuals engage, rather than by how frequent they participate in each activity type, either considered in isolation or averaged across domains. Previous studies have only examined the psychological correlates of the frequency of involvement in a single type of activity, and comparatively less attention has been devoted to the psychological predictors of such variety-of-activity indexes. Such an index provides a more complete account of an individual's lifestyle and reflects the degree of exposure and interaction with the physical and social world. Thus, this study adopts a more comprehensive approach to account for an individual's activity lifestyle and tests whether a variety index is related to personality traits.

Personality and activities

Participation in leisure activities across the lifespan varies depending upon an individual's age (Hultsch, Hertzog, Small, & Dixon, 1999; Jopp & Hertzog, 2007; Menec, 2003; Shaw, Liang, Krause, Gallant, & McGeever, 2010), educational level (Jopp & Hertzog, 2007), and health status (Jopp & Hertzog, 2010). However, beyond these demographic and health-related variables, an individual's participation in activities may reflect, in part, their characteristic way of thinking, feeling, and behaving (i.e., their personality traits). The traits defined by the Five Factor Model of Personality (Digman, 1990; extraversion, neuroticism, openness, agreeableness, and conscientiousness) have been found to drive the type of activities in which individuals are involved. Extraversion (reflecting an orientation towards positive emotions, sociability, and energy) has been associated with frequent social (Asendorpf & Wilpers, 1998; Jopp & Hertzog, 2010; Oerlemans, Bakker, & Veenhoven, 2011; Ozer & Benet-Martinez, 2006; Watson, Clark, McIntyre, & Hamaker, 1992), cognitive (Wilson *et al.*, 2005), and physical activities (De Moor, Beem, Stubbe, Boomsma, & De Geus, 2006; Rhodes & Smith, 2006). Conversely, findings concerning

neuroticism (a propensity to experience distress, anxiety, and negative emotions) have been mixed. Some studies have found a relationship between this trait and lower frequencies of each type of activity (De Moor *et al.*, 2006; Krueger, Wilson, Shah, Tang, & Bennett, 2006; Ozer & Benet-Martinez, 2006; Rhodes & Smith, 2006; Wilson *et al.*, 2005), and other studies have not found such a relationship (Jopp & Hertzog, 2010; Rhodes & Courneya, 2003). Openness (a tendency to search for a variety of new ideas, values, and experiences) has been related to participation in frequent cognitive activities (Hogan, Staff, Bunting, Deary, & Whalley, 2012; Hultsch *et al.*, 1999; Soubelet & Salthouse, 2010) and perhaps to a higher level of physical activity (Tolea *et al.*, 2012; but see Rhodes & Smith, 2006). Conscientiousness (self-disciplined, planful, and organized individuals) has been related to higher levels of physical activity (Rhodes & Smith, 2006) and more social relationships (Asendorpf & Wilpers, 1998). There has been mixed evidence for conscientiousness and cognitive activity among undergraduate students. Those who scored high on conscientiousness achieved better results in an academic context (Noftle & Robins, 2007), but were less engaged in developmental activities (defined as intellectual and creative activities; Jopp & Hertzog, 2007), such as going to the museum or reading (McManus & Furnham, 2006). Other studies have also failed to report an association between conscientiousness and such developmental activities in a sample of adults (Jopp & Hertzog, 2010). Finally, agreeableness (reflecting cooperativeness and altruism) has received less attention for the prediction of leisure activity, but has been found to relate positively to social activities (Asendorpf & Wilpers, 1998; Jopp & Hertzog, 2010) and negatively to cognitive activities (Jopp & Hertzog, 2010; McManus & Furnham, 2006), while no relationship has been found with physical activity (Rhodes & Smith, 2006). Previous research has focused on the association of personality traits with the frequency of involvement in each type of leisure activity. A few studies have examined the association of personality with a mean activity frequency. However, there is a scarcity of research which has simultaneously examined the full Five Factor Model and frequency of involvement in a range of different activities. In addition, no study to date has examined whether the pattern of relationships observed replicate across different countries. Most studies have focused on restricted samples of young or middle-aged adults, and few have been conducted on samples that encompass a wide age range, from young adulthood to old age. Most importantly, the extent to which personality is associated with a variety of leisure activities types has not been investigated before.

The present study

On the basis of the evidence reviewed above, one would expect that individuals who score lower on neuroticism and higher on the other four major dimensions of personality would have a higher activity frequency. The strongest hypotheses, however, can be formulated for extraversion and openness. The inner tendency of extraverted individuals to be energetic, enthusiastic, sociable, and to seek excitement may lead them to engage in a range of different physical, social, and cognitive activities. In addition to their predominant characteristics, each of these types of activities hold a social component (Karp *et al.*, 2006), which may attract extraverted people. The propensity for intellectual curiosity, to prefer variety over familiarity, and the willingness to entertain novel ideas and experiences, which characterize open individuals, may contribute to their involvement in diverse cognitive, but also novel, physical, and social activities. Furthermore, the flexibility associated with an openness to experience may facilitate the shift between different kinds of activity types.

In addition to the hypotheses mentioned above, we also expected a moderating effect of age, such that the relationship between extraversion, openness, and diverse activities would change across the lifespan. There are at least two arguments for an interaction with age. First, studies based upon the Selective Optimisation and Compensation model (SOC, Baltes & Baltes, 1990) have reported that older adults respond to age-related loss by reducing the diversity of their activities and focusing on their most preferred and meaningful activities (Lang, Rieckmann, & Baltes, 2002). Second, personality traits change across the lifespan (McCrae, Terracciano, & 78 Members of the Personality Profiles of Cultures Project, 2005; Roberts, Walton, & Viechtbauer, 2006; Terracciano, McCrae, Brant, & Costa, 2005). These personality changes hold potential behavioural and health-related consequences (Graham & Lachman, 2012; Turiano *et al.*, 2012). Given that extraversion and openness decline across the lifespan (Terracciano *et al.*, 2005), and with the exposure to age-related limitations, it is likely that extraverted and open individuals may reduce the variety of their activities.

This study tests the above questions using data from two large cross-sectional samples with a broad age coverage and from two distinct western societies, France and the United States. We combined the findings to provide a meta-analytic summary and to examine the consistency of effects across cultures and different measurement methods.

Method

Participants

MIDUS sample

Participants were from the second wave of the Midlife in the US survey (MIDUS 2), which was conducted between 2004 and 2006 (a 9-year follow-up study of the MIDUS 1 cohort conducted between 1995 and 1996). Of the 7,108 participants who took part in MIDUS 1, 4,963 participated in MIDUS 2 (75% total response rate, see Radler & Ryff, 2010 for more information on participant retention). MIDUS 2 participants who had available data on measures of interest were included in this study, which led to our final sample of 3,396 individuals aged between 30 and 84 (see Table 1). Around 68% had more than a high school education and 72% reported being married at MIDUS 2. The analysis sample was slightly younger, $t(4960) = 2.60$, $p < .01$, more educated, $t(4954) = -6.19$, $p < .001$, healthier, $t(4039) = 4.62$, $p < .001$, less extraverted, $t(4010) = 4.31$, $p < .001$, more conscientious, $t(4010) = -3.05$, $p < .01$, and less open, $t(3973) = 2.18$, $p < .05$. There were slightly more women in the sample who presented missing data on the variables of interest.

French sample

Data on personality and activities were combined from four independent studies focusing on personality, quality of life, and well-being conducted throughout France from September 2011 to July 2012. Participants from these four studies were community-dwelling adults who were recruited using print and web-based advertisements in Internet forums, newsletters, occupational settings, and clubs. From a total number of 4,850 individuals, we selected participants aged 30–84 (for consistency with the MIDUS sample) who also had valid data on personality, activities, and covariates. The

Table 1. Means and standard deviations, for the variables under study among French (N = 2,917) and MIDUS sample (N = 3,396)

	French sample (N = 2,917)		MIDUS sample (N = 3,396)	
Variables	*M*/%	*SD*	*M*/%	*SD*
1. Gender (% female)	64	–	54	–
2. Age	59.46	13.06	55.12	12.00
3. Education	6.49	2.18	7.34	2.52
4. Disease burden	1.13	1.28	2.37	2.40
5. Activity index	0.68	0.73	2.54	0.95
6. Extraversion	3.08	0.80	3.09	0.57
7. Neuroticism	2.79	0.85	2.06	0.63
8. Openness	3.49	0.65	2.89	0.53
9. Agreeableness	4.09	0.50	3.44	0.50
10. Conscientiousness	3.96	0.60	3.47	0.44

Note. Gender (coded as −1 for women and 1 for men). No direct comparisons of the two samples should be made due to different scales.

final sample included 2,917 individuals (see Table 1). Around 73% of these individuals had more than a high school diploma and 75% had a partner. Participants with complete data were older, $t(4766) = -19.02$, $p < .001$, slightly more educated, $t(4824) = -2.39$, $p < .05$, less healthy, $t(4840) = -5.27$, $p < .001$, more agreeable, $t(4654) = -5.20$, $p < .001$, and more conscientious, $t(4619) = -7.86$, $p < .001$, than those with incomplete data.

Measures

Covariates

In both samples, age (in years), gender (coded as −1 for women and 1 for men), educational level, and disease burden were included as covariates given their known relationships with leisure activities (e.g., Hultsch *et al.*, 1999; Jopp & Hertzog, 2007, 2010; Parisi *et al.*, 2012). In both samples, disease burden was measured as the sum of diseases and conditions reported by the participants on a pre-established list (Agrigoroaei & Lachman, 2011). Education was operationalized using a scale composed of 12 intervals corresponding to sequential educational milestones in the MIDUS sample, from 1 (*no grade school*) to 12 (*doctoral level degree*), and using a scale composed of 10 intervals from *no grade school* to *doctoral level degree* in the French sample.

Personality-MIDUS

Personality in the MIDUS 2 sample was assessed using the Midlife Development Inventory (Johnson & Krueger, 2004; Lachman & Weaver, 1997). Participants were asked how much 25 adjectives that assess neuroticism, conscientiousness, extraversion, openness, and agreeableness described themselves on a scale ranging from 1 (*not at all*) to 4 (*a lot*; for more details, see Graham & Lachman, 2012; Turiano *et al.*, 2012). In this study, Cronbach's alpha for the five factors were as follows: extraversion = .75, agreeableness = .80, conscientiousness = .58, neuroticism = .75, and openness = .77.

Personality-French sample

Personality traits were evaluated with the French version of the Big Five Inventory (BFI-Fr, Plaisant, Courtois, Réveillère, Mendelsohn, & John, 2010) initially developed by John, Donahue, and Kentle (1991). Participants rated their agreement on 45 self-descriptive easy-to-understand statements that assess the five personality traits of neuroticism, conscientiousness, extraversion, openness, and agreeableness. Each item was rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). In this study, Cronbach's alpha for the five factors were: extraversion = .82, agreeableness = .70, conscientiousness = .76, neuroticism = .84, and openness = .79.

Activities-MIDUS

Physical activity was measured with four items that assessed the participant's frequency of vigorous and moderate leisure physical activities in the summer and winter months on a 6-point scale (1 = *never*, 2 = *less than once a month*, 3 = *once a month*, 4 = *several times a month*, 5 = *once a week*, 6 = *several times a week*; see Cotter & Lachman, 2010). The mean was computed across summer and winter ratings for both activity types, which provided an overall physical activity frequency. On the basis of prior research (Jopp & Hertzog, 2007, 2010; Parisi, Stine-Morrow, Noh, & Morrow, 2009), we divided cognitive activities in the MIDUS 2 into two groups, games and developmental activities. To create the games scale, we averaged the self-reported frequencies of participants who engaged in word games, such as crossword puzzles or scrabbles, played cards or other games, such as bridge or chess, on a 6-point scale (1 = *never*, 2 = *once a month*, 3 = *several times a month*, 4 = *once a week*, 5 = *several times a week*, 6 = *daily*; Jopp & Hertzog, 2010; Parisi *et al.*, 2009). We followed the same procedure for the developmental activities. In line with previous research (Jopp & Hertzog, 2007, 2010; Lachman, Agrigoroaei, Murphy, & Tun, 2010; Parisi *et al.*, 2009; Soubelet & Salthouse, 2010; Wilson *et al.*, 2002, 2010), we averaged the participant's frequency of engaging in the following activities: reading books or magazines; writing letters, stories, or journal entries; using a computer, such as sending e-mail or searching the internet; and attending educational lectures or courses. Social activities were measured with three items that asked about the participant's frequency of attending meetings of union, sports, or other social groups outside the job in a typical month.

Activities-French sample

To maximize consistency with the MIDUS measures, we only selected specific activities from the French sample. Existing inventories (Jopp & Hertzog, 2007, 2010) and prior research on the activity–cognition relationship (Hultsch *et al.*, 1999; Wilson *et al.*, 2002, 2010) guided our selection of activity measures for the French sample. For each activity, individuals indicated their participation frequency on a 9-point Likert scale with the response options of 0 (*never*), 1 (*less than once a year*), 2 (*about once a year*), 3 (*2 or 3 times a year*), 4 (*about once a month*), 5 (*2 or 3 times a month*), 6 (*about once a week*), 7 (*2 or 3 times a week*) and 8 (*daily*). Participants were asked to indicate their participation frequency in seven physical activities (weight lifting, aerobics, swimming, ball sports, cycling, running, and walking). Drawing upon previous research (Jopp & Hertzog, 2007, 2010; Parisi *et al.*, 2009), cognitive activities were represented by two distinct scales labelled as games and developmental activities. We included five games (i.e., scrabble, puzzle, board games, crossword, and cards) in the games scale. The developmental

activity scale included seven activities (reading books, reading newspapers, writing letters, writing a novel, attending public lectures, attending educational courses, and using a computer). The social activity scale was based upon Jopp and Hertzog (2010) and assessed participants by using a three-item scale (frequency of engaging in political activities, attending club meetings, and attending organized social events). As with the MIDUS sample, items were averaged across their respective scale to give a mean participation frequency in physical, cognitive (games and developmental), and social activities.

Variety-of-activity index

Building upon prior research (Carlson *et al.*, 2012), we computed an index that reflected the number of activity types that an individual participated in. In each sample, the total number of activities endorsed once a month or more was considered as a measure of variety. A score of 0 (*less than once a month*) or 1 (*at least once a month*) was assigned to the mean computed for each activity category: physical, games, developmental, and social. One composite score that measured the variety of a participant's activity types was obtained in each sample by summing the assigned score for each activity. Possible scores ranged from 0 to 4, with a higher score reflecting a higher variety of activity types.

Data analysis

In both the French and MIDUS samples, multiple regression analyses were conducted using the variety-of-activity index as a criterion, and covariates (i.e., gender, age, education, and disease burden), personality traits, and personality by age interactions as predictors. Continuous variables were mean-centred before running the analyses. In addition to the activity index, regression analyses were performed to predict the frequency of each activity type controlling for the same set of covariates.[1]

A prospective meta-analysis was conducted to combine the results from the two samples. The individual data were not combined because of the differences in the measures used. The t-values and sample sizes were used for each analysis. No assumption was made about effects being identical across samples, so the random-effect model was used. The 'Comprehensive Meta-Analysis' software package was used for the meta-analysis.

Results

Descriptive statistics (means and standard deviations) for the two samples are presented in Table 1.

MIDUS

To test the main hypothesis, regression analyses were conducted to examine the association between personality traits and the variety-of-activity index (see Table 2).

[1] *Additional analyses were conducted with the index modelled as an ordinal variable. Ordered multinomial logistic regression analyses revealed the same pattern of relationships in each sample.*

Table 2. Summary of regression analysis of the variety-of-activity index on personality traits in the MIDUS sample (N = 3,396)

Variables	β	*B*	*SEB*
Age	−.08***	−.00	.00
Gender	−.07***	−.07	.01
Education	.25***	.09	.00
Disease burden	.01	.00	.00
Extraversion	.08***	.13	.03
Neuroticism	−.08***	−.12	.03
Openness	.06**	.10	.03
Agreeableness	−.03	−.06	.04
Conscientiousness	−.00	−.01	.04

Note. *Final model*: Adjusted R^2 = .10, $F(9, 3386)$ = 43.23, $p < .001$.
**$p < .01$; ***$p < .001$.

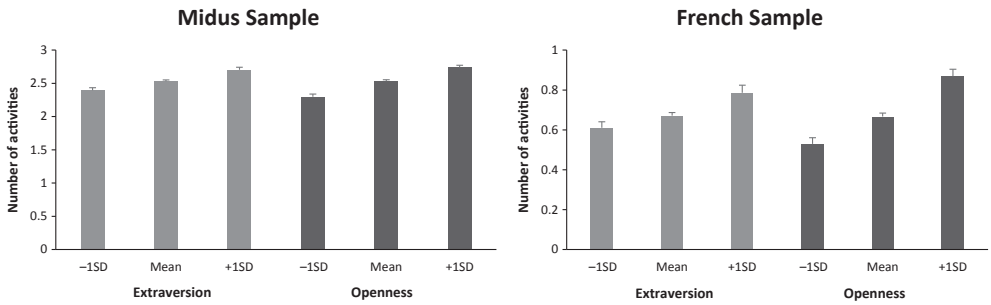

Figure 1. Number of activities as a function of extraversion and openness for the MIDUS sample (left panel) and the French sample (right panel). *Note*. Error bars are standard errors.

Taken together, personality variables explained 2% of the variance for the variety of activity types, beyond gender, age, education, and disease burden. Consistent with our hypothesis, both extraversion (β = .08, $p < .001$) and openness (β = .06, $p < .01$) were associated with the variety of activity types. Figure 1 illustrates a linear relation between the engagement in an increasing variety of activity types and both extraversion and openness. Neuroticism was inversely associated with the activity index (β = −.08, $p < .001$; see Table 2). Finally, the results did not confirm our hypothesis of a moderating role of age. Indeed, no significant openness by age (β = .01, *ns*), nor extraversion by age interactions (β = −.01, *ns*), were found.

French sample

The same analyses were conducted in the French sample. Consistent with our hypotheses, we found significant associations with extraversion (β = .07, $p < .001$) and openness (β = .10, $p < .001$) with the activity index (see Table 3, Figure 1). As in the MIDUS sample, personality variables explained 2% of the variance for the variety of activity types, beyond age, gender, education, and disease burden. Compared to the MIDUS sample, education was less strongly associated with the activity index in the French

Table 3. Summary of regression analysis of the variety-of-activity index on personality traits in the French sample (N = 2,917)

Variables	β	*B*	*SEB*
Age	.06**	.00	.00
Gender	−.06**	−.04	.01
Education	.18***	.06	.00
Disease burden	.00	.00	.01
Extraversion	.07***	.06	.02
Neuroticism	.03	.03	.02
Openness	.10***	.11	.02
Agreeableness	.04*	.06	.03
Conscientiousness	.02	.02	.02

Note. Final model: Adjusted R^2 = .06, $F(9, 2907) = 20.65$, $p < .001$.
*$p < .05$; **$p < .01$; ***$p < .001$.

sample. Although a linear pattern of relationship was found in the MIDUS, the difference in extraversion was mostly apparent for more active people in the French sample. In addition and unexpectedly, agreeableness was also positively associated with the variety of activity types ($\beta = .04$, $p < .05$). The other personality factors were not significantly associated with the variety-of-activity index. No significant openness by age ($\beta = -.00$, *ns*) nor extraversion by age interactions ($\beta = -.01$, *ns*) were found.

Meta-analysis and activity components

The meta-analysis confirmed a highly significant association with extraversion and openness with the activity index (ps < .01). Extraverted and open individuals reported higher involvement in a variety of activity types.

The results for each type of activity are separately reported in Table 4 for the two samples, with a meta-analytic summary presented in Table 5. As could be expected, extraverted individuals were more engaged in social and physical activities. Those who scored high on openness and conscientiousness reported more frequent intellectual activity. No associations were found between agreeableness and neuroticism and any activity (Table 5).

Discussion

From a public health perspective, understanding the predictors for the involvement in a variety of activity types is an important issue. Using data from two large samples from different socio-cultural contexts and with a broad age span, this study identified personality factors associated with the participation in a variety of leisure activities. As expected, after controlling for age, gender, education, disease burden, and the other personality domains, extraversion and openness were both associated with a higher likelihood of being engaged in a variety of physical, cognitive, and social activities. The results for extraversion and openness were consistent across the French and US samples, despite sampling, measurements, and cultural differences. The involvement of extraverted individuals in different activities may reflect their tendencies to be energetic and sociable, to seek excitement, and to experience positive emotions. The propensity to

Table 4. Summary of regression analysis of leisure activities on personality traits, controlling for sociodemographic variables and disease burden in the French sample (N = 2,917) and the MIDUS sample (N = 3,396)

Variables	Physical activity	Developmental activity	Games	Social activity
MIDUS sample				
Age	−.24***	−.08***	.10***	.00
Gender	.05**	−.12***	−.15***	−.01
Education	.19***	.40***	.02	.16***
Disease burden	−.02	−.02	.02	.03
Extraversion	.09***	.00	−.01	.10***
Neuroticism	−.01	−.03*	−.04*	−.05**
Openness	.07***	.20***	.08***	−.00
Agreeableness	−.06***	−.02	.02	−.01
Conscientiousness	.03	.05**	−.04*	.00
French sample				
Age	−.28***	.11***	−.06**	.05*
Gender	.06**	−.12***	−.09***	.08***
Education	.10***	.32***	−.05**	.13***
Disease burden	−.08***	.01	.06**	−.00
Extraversion	.04*	.01	−.01	.10***
Neuroticism	.00	.03	−.00	−.00
Openness	−.01	.14***	.00	.07***
Agreeableness	.03	.03	.06**	.04*
Conscientiousness	.01	.02	.00	−.01

Note. *p < .05; **p < .01; ***p < .001. Coefficients are standardized coefficients.

entertain new ideas and experiences and to prefer variety to familiarity is characteristic of open individuals and may lead them to be actively engaged in a broad range of different activity types. This relationship may also be explained by the higher cognitive ability of open individuals (Sharp, Reynolds, Pedersen, & Gatz, 2010; Sutin *et al.*, 2011), which may facilitate their involvement in various activities.

Our second hypothesis of a moderating role of age in the personality-activity relationship was not confirmed for extraversion and openness across the two samples. Studies conducted within the SOC model (Baltes & Baltes, 1990) have found that when experiencing an age-related decline in health, some people may be able to compensate through the use of new and alternative means to maintain their level of functioning. The broad repertoires of extraverted and open individuals may facilitate the search and the use of alternative, new activities to replace previous ones when faced with age-related barriers, allowing the maintenance of such an active lifestyle. This compensatory process may be facilitated by the higher energy and enthusiasm of extraverted individuals and the greater flexibility of open individuals. In addition, building upon prior research within the SOC (Lang *et al.*, 2002), these individuals may be able to increase the variability in time investments across different activities through the wise and variable allocation of their time resources, which may increase their chances of getting the most out of these activities.

This study was the first to reveal that personality is associated with the adoption of an active lifestyle across multiple domains, involving a combination of frequent physical, cognitive, and social activities. This finding is important because the number of leisure

Table 5. Summary of results from the meta-analysis combining the French and MIDUS samples

Activities	Variety index	Physical	Games	Developmental	Social
Extraversion	.06 (.04, .09)***	.06 (.02, .09)**	−.01 (−.04, .01)	.01 (−.02, .03)	.08 (.06, .11)***
Neuroticism	−.02 (−.13, .08)	−.00 (−.03, .02)	−.02 (−.06, .01)	−.00 (−.07, .06)	−.03 (−.07, .02)
Openness	.07 (.03, .12)**	.03 (−.01, .08)	.03 (−.03, .09)	.16 (.12, .21)***	.03 (−.04, .10)
Agreeableness	.00 (−.06, .07)	−.01 (−.10, .07)	.04 (−.00, .08)	.00 (−.05, .05)	.01 (−.04, .07)
Conscientiousness	.00 (−.02, .03)	.02 (−.00, .04)	−.02 (−.06, .02)	.04 (.01, .07)*	−.01 (−.03, .02)

Note. *$p < .05$; **$p < .01$; ***$p < .001$. 95% confidence intervals are between parentheses.

activity types a person is involved in is associated with better well-being, cognition, and lower risk of dementia (Carlson *et al.*, 2012; Karp *et al.*, 2006; Menec, 2003; Wang *et al.*, 2013). Thus, this study extended previous research by identifying factors that motivate the adoption of a beneficial lifestyle. In addition, our findings complement previous studies on the association of personality with a range of health- and cognitive-related outcomes among older adults (Sharp *et al.*, 2010; Sutin *et al.*, 2011; Terracciano *et al.*, 2013; Tolea *et al.*, 2012; Turiano *et al.*, 2012). Although the relationship between personality traits and an active lifestyle is frequently cited as an explanation of their positive consequences in old age (Sharp *et al.*, 2010; Tolea *et al.*, 2012), studies have essentially focused on the frequency of involvement in each type of leisure activity or on their relationship with a mean activity frequency. Therefore, this study was the first to establish an association between personality and a more comprehensive activity index. It remains to be tested to what extent the variety-of-activity index mediates the association between personality traits and health (see Wilson *et al.*, 2005).

This study also provides a comprehensive coverage of the contribution of personality traits on the frequency of participation in each activity type across the lifespan. Previous studies have focused on young and middle-aged adults, and few have been conducted in a lifespan sample that covers a wide age range. Consistent with existing knowledge (Krueger *et al.*, 2006; Rhodes & Smith, 2006; Wilson *et al.*, 2005), the meta-analytic procedure we used to combine both samples revealed that extraversion was positively associated with participation in physical and social activities. Although neuroticism has been related to a lower frequency of participation in physical, social, and cognitive activities in some research (Krueger *et al.*, 2006; Ozer & Benet-Martinez, 2006; Rhodes & Smith, 2006; Wilson *et al.*, 2005), this study is more consistent with those that failed to report such relationships (Jopp & Hertzog, 2010; Rhodes & Courneya, 2003).

Different predictive patterns were found for games and developmental activities. More specifically, no traits were found to contribute to games, whereas both openness and conscientiousness were positively associated with developmental activities, such as reading and attending courses and conferences. The finding of a positive contribution of conscientiousness on developmental activities stands in contrast with prior research conducted among small samples of adults, which did not provide evidence for this association (Jopp & Hertzog, 2010). As a whole, these results suggest that the use of an overall cognitive activity score (Soubelet & Salthouse, 2010; Wilson *et al.*, 2005), encompassing both games and developmental activities, may obscure specific and distinctive relationships with personality traits. Similarly, some contrasting patterns were found. These patterns suggest that the association of personality with the variety-of-activity index does not necessarily reflect the association of personality with the frequency of participation in each specific type of activity.

Openness contributed to a higher variety of activity types, but was only related to the frequency of developmental activity. The propensity for diversity over routine and the search for novelty of open individuals may lead them to choose to participate at a moderate frequency in a range of different activities, providing different cognitive, physical, and social experiences, than to be engaged only in a restricted set of activities. Although they may be frequently engaged in developmental activities, open individuals may preserve a significant amount of time to engage in other leisure activities.

In contrast, while conscientiousness was also associated with developmental activities, this trait was not related to the number of activity types. The tendency towards order and self-discipline of conscientious individuals may facilitate the planning, participation, and persistence in frequent developmental activities, but may be associated

with less flexibility for engaging in other leisure activities, which may not be perceived as priorities. Taken as a whole, through a comprehensive approach, this study highlights that distinctive and common patterns of relationships exist between personality and an active lifestyle for broader and more specific types of activities.

Beyond those common patterns, the results also revealed cross-cultural differences in the contribution of personality traits on activities. Neuroticism was negatively associated with the activity index in the US sample, but not among the French sample, whereas agreeableness was positively related to the variety of activity types in the French, but not in the American sample. In addition, neuroticism was negatively related to several types of activities in the MIDUS but not in the French sample, which is consistent with existing mixed findings (Jopp & Hertzog, 2010; Krueger *et al.*, 2006; Ozer & Benet-Martinez, 2006). These different patterns, if replicated in future studies, may reflect the influence of culturally specific factors surrounding participation in leisure-time activities. For example, the environmental, social, and financial barriers may be more pronounced in the United States, which may cause more stress and anxiety and less participation among emotionally unstable American individuals. The social component of activities is likely to be more emphasized in France than in the United States, leading to more participation of agreeable French individuals.

Despite its strength, this study had several limitations that should be considered when interpreting the results. The cross-sectional design precluded drawing strong inferences about the role of personality traits in predicting future involvement in an active lifestyle. Although this study focused on activities as dependent variables, it is likely that an active lifestyle, involving physical, cognitive, and social activities, could shape personality traits. Longitudinal studies are needed to test for the reciprocal relationship between personality and the combination of leisure activities in old age. Because of this design, age and cohort effects were confounded, thus requiring a cautious interpretation of differences between the age groups. The disease burden measure was computed as an unweighted mean, which limits the extent of the investigation to which different diseases affect the adoption of an active lifestyle depending upon their severity. In addition, this research focused only on a combination of different categories of activities and did not consider the number of specific kinds of activities within a given domain. For example, future research may wish to identify whether personality is related to the number of different physical activities within the broad physical activity domain. Meta-analyses with only two samples have been used in epidemiology (e.g., Gardener, Spiegelman, & Buka, 2009; Minton, Richardson, Sharpe, Hotopf, & Stone, 2008) and genome-wide association studies (e.g., Kapoor *et al.*, 2013; Terracciano *et al.*, 2010), but having two samples limits the range of analyses often performed in larger meta-analyses. The personality measures were brief, particularly in the MIDUS sample. Questionnaires that assess the facets of each domain could provide a more in-depth picture of the association of personality with leisure activities. For example, extraversion included components such as sociability, activity, excitement-seeking, and positive emotions. It is possible that there are differences among these facets in their correlation with the type and frequency of activities. A more thorough personality assessment could also reduce measurement error. However, despite the measurement error that comes with a short measure of personality, the main effects were robust and replicated across samples. The effect sizes were seemingly small, but these effects can have broad implications at the population level and were of reasonable magnitude given the complexity and multifactorial nature of the phenomenon under investigation. The associations reported were also in the range of those observed in other studies, linking personality traits to complex behaviours and health outcomes, such as cigarette smoking,

inflammation, and metabolic syndrome. Furthermore, prior research has emphasized that the personality effects are similar or larger than those of other risk factors for many important outcomes (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Sutin *et al.*, 2010).

In conclusion, this study contributes to existing knowledge on psychological traits associated with the adoption of an active lifestyle across the lifespan. More specifically, based upon an investigation in two different large samples and a meta-analysis, it reveals that personality not only contributes to participation in specific activities, but is also associated with a variety of stimulating activities that involve physical, cognitive, and social components. The findings of a consistent pattern across two different western societies suggest that extraverts and open individuals may have intrinsic tendencies towards a more active lifestyle. These findings pave the way for future research aiming at a better understanding of the factors that play a role in the maintenance of cognitive and physical functioning across the lifespan and especially in old age.

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