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An Instrument to Measure Engagement in Life: Factor Analysis and Associations with Sociodemographic, Health and Cognition Measures

Ruth A. Parslow[a, b] Anthony F. Jorm[a, b] Helen Christensen[b]
Andrew Mackinnon[b]

[a]Orygen Research Centre, University of Melbourne, Melbourne, and [b]Centre for Mental Health Research, Australian National University, Canberra, Australia

Key Words
Mental activities · RIASEC Activity List · Personality attributes · Cognitive skills

Abstract
Background: It has been proposed that active engagement with life may protect against cognitive decline. However, existing instruments for measuring life engagement have covered limited domains. ***Objective:*** To present a new instrument to measure engagement with life; the RIASEC Activities List draws on activities categorised according to interest categories previously developed by Holland: Realistic, Investigative, Artistic, Social, Enterprising and Conventional (RIASEC). ***Methods:*** Participants in a longitudinal, community-based survey were drawn from 3 age groups: 2,404 participants aged 20–24; 2,530 aged 40–44, and 2,551 aged 60–64 years. They provided information on which of 54 selected activities they had performed in the 6 months prior to their survey interview. Other information obtained from participants included measures of sociodemographic characteristics, personality attributes and mental and physical health. Two measures of cognition were also examined. Analyses were conducted separately for men and women in each of the 3 age groups. ***Results:*** Confirmatory factor analyses identified six scales of activity types corresponding to Holland's six interest categories. The number of activities of any type undertaken in the past 6 months was significantly associated with cognitive measures, better physical health, and better mental health although these findings varied for men and women across the 3 age groups. Further, for both men and women in all age groups, performing activities of any type was associated with having higher extraversion and mastery scores, and lower levels of neuroticism. Associations were also found between performing specific types of activities and cognitive measures. ***Conclusions:*** This instrument has the potential to identify more clearly types of activities that may offer cognitive benefits and warrants further testing in longitudinal studies.

Introduction

Engagement in life has been used by health care providers in various disciplines to describe the extent to which an individual is engaged in mental, social and physical activities that give meaning to life at different stages of the

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Dr. Ruth A. Parslow
Orygen Research Centre, University of Melbourne
Locked Bag 10
Parkville, VIC 3052 (Australia)
Tel. +61 3 8346 8223, Fax +61 2 9347 9099, E-Mail rparslow@unimelb.edu.au

life span [1–4]. Level of engagement in life has been identified as an important variable which contributes to, and is affected by, cognitive abilities, physical and mental health [1]. A range of conceptualisations of engagement has been offered. In this article, we draw on the definition by Schooler and Mulatu [5] and take it to be the process of undertaking cognitively complex activities. This construct has been operationalised by noting or counting a range of mental, physical and social activities.

To date, such instruments have been limited in their usefulness for two reasons. First, they have varied considerably both in the number and categorisation of items included. Such instruments have ranged from three broad single-item categories (physically active sports, mentally active sports, and organisational membership) [1], to 64 items grouped into six categories (physical, self-maintenance, social, hobbies and home maintenance, passive and novel information processing) [2]. This variability of measurement instruments raises concerns about the comparability of the analyses on this topic.

Secondly, most instruments used to date have been developed in order to measure life engagement in older age [1, 5–11]. While older individuals are a primary focus of research in this area, there is need for an instrument to measure life engagement and longitudinal changes in that measure that can be usefully applied across age groups. To be relevant to individuals in different life stages, such an instrument would need to include activities that are undertaken in different settings; for example, in the home, at work, in formal education, or as recreation. Development of this measure could allow baseline measures of life engagement to be obtained and compared longitudinally across the life span.

A potential list of activities and interests meeting these requirements has already been developed for application in vocational psychology. In his theory of careers, Holland [12] proposed that individuals could be broadly grouped around a hexagonal structure on the basis of interests and competencies. The six primary categories formed in this way were identified as Realistic, Investigative, Artistic, Social, Enterprising and Conventional (RIASEC) [12]. Holland's Self-Directed Search (SDS) was developed as a tool to assist individuals making initial choices in career and career changes and continues to be used as a career-planning tool today [13]. One component of the SDS covers questions about respondents' views on a wide range of activities they like doing or would like to do [12].

This component of Holland's instrument provides a list of activities and interests grouped into the six primary categories given above. Since the purpose of this instrument was to identify the interests of those not yet in the workforce or seeking career changes, the activities and interests given are not confined to those usually performed in the workplace but also include a range of recreational, educational and home-based activities. This activity list also offers advantages over previously used tools. In particular, it covers a range of activities within each activity category and does not, for example, consider only artistic activities that relate to music. In their empirical study, Kerby and Ragan [14] have previously reported on the usefulness of this structure as a means of classifying leisure activities.

A shortened version of the activities list comprising 54 items was developed by Holland for the Australian setting and has been distributed with an Australian Supplement of the Professional Manual by the Australian Council for Educational Research Limited [15]. This shortened list was updated to include an item on use of personal computers and replaced American terms with Australian equivalents (for example 'drag cars' replaced 'hot rods'). The reliability of this instrument in the Australian setting has previously been tested (Cronbach's α ranging from 0.52 to 0.85 for women and from 0.63 to 0.80 for men) [15]. A slightly modified version of this list, again with 54 items (referred to hereafter as the RIASEC Activity List) has been incorporated into a large community epidemiological project, the PATH Through Life Project, being conducted by the Centre for Mental Health Research, Canberra, Australia. A range of sociodemographic, health, psychological and cognitive measures were also included in the survey.

Using these data, we sought to explore the extent to which life engagement, as measured by performing these activities, was associated with health, personality attributes and cognitive abilities for men and women in the 3 age groups of our study: young adults aged 20–24; those in mid-life aged 40–44, and adults 60–64 years old who are reaching retirement age. Confirmatory factor analyses were undertaken to identify scales in the item pool of the RIASEC Activity List.

Our first major hypothesis was that the activity level, a count of activities performed, would be associated with physical and mental health and measures of both crystallized intelligence and mental speed, and that this association would hold for both men and women across the 3 age groups.

A second, intermediate hypothesis was that individuals' choices concerning the level and type of activities undertaken would be affected by personality attributes.

Previous research has found performance of different types of activities in the RIASEC model to be associated with personality attributes [16] and we expected this association in our sample. Specifically, we hypothesised that those performing more Social activities would have higher levels of extraversion and those seeking to influence others through performing Enterprising activities would report greater levels of mastery over their lives.

Finally, we hypothesized that performing Investigative activities would be associated with having higher scores for both crystallised intelligence and speed measures; an association we expected would hold for both men and women across the 3 age groups and when other confounding factors, including mental and physical health and personality attributes, were taken into account.

Methods

Participants

The PATH Through Life Project is a longitudinal survey of residents living in the Australian Capital Territory and the neighbouring town of Queanbeyan, New South Wales. Potential participants were drawn from 3 age groups: those aged 20–24 years on 1 January 1999; those aged 40–44 years on 1 January 2000; and those aged 60–64 years on 1 January 2001. Sampling frames for this survey were the Electoral Rolls for Canberra and Queanbeyan, Australia. Registration on these rolls is compulsory for all Australians. For the first 2 age groups, potential participants were drawn from a 10-year age range, the minimum range then released for research purposes by the Australian Electoral Commission. As a result, over 40% of the potential participants contacted were not in the targeted age range. The numbers of potential participants found and in the required age group were 4,105 for the 20–24 age group, 3,919 for the 40–44 cohort and 4,378 of those aged 60–64. The numbers of survey participants in each of these groups were 2,404 (20–24), 2,530 (40–44) and 2,551 (60–64) giving response rates for those contacted and known to be in the targeted age range of 58.6% (20–24), 64.4% (40–44) and 58.3% (60–64). This gave a total of 7,485 participants across these 3 age groups from whom data were collected. Participants in our study were more likely to be married, working full-time and have post-graduate qualifications compared with the total population that was sampled.

Measures

PATH Project participants were asked to complete a questionnaire that covered sociodemographic characteristics, measures of well-being, mental and physical health, cognitive function, and activities. Answers were entered by participants onto a handheld computer under the supervision of a professional interviewer who provided assistance in the use of the computer when required.

Participants were asked to indicate whether in the past 6 months, they had undertaken any of the 54 activity items in the RIASEC Activity List. This list of 54 comprised 47 used in Holland's Australian list and 7 items to increase the relevance of the list to the sample being surveyed. For example, 'participated in a science fair or conference' replaced the Investigative activity 'taken a biology course' and 'organized a club, group or gang' replaced the Enterprising activity 'participated in a political campaign'. Since answers to these questions were 'yes' or 'no', information on the frequency of activities was not obtained, but numbers of activities undertaken in each of the 6 categories could be examined. Answers to all activities questions were provided by 7,432 (99.2%) of respondents.

Sociodemographic information used in these analyses included years of education and labour force status: whether the individual was currently employed, unemployed or not in the labour force. Measures of mental and physical health in the past month were obtained from participants' responses to the 12-item Short-Form Health Survey (SF-12) [17]. SF-12 scores have a mean of 50 and standard deviation of 10 with higher scores indicating better physical or mental health.

Personality variables measured included neuroticism, psychoticism, and extraversion from the short form of the revised version of the Eysenck Personality Questionnaire (EPQ-R), and mastery which reflects beliefs that life circumstances are under personal control [18, 19]. Two cognitive measures were used in these analyses as measures of crystallized intelligence and mental speed: Spot-the-Word Test version A (STW) and Symbol-Digit Modalities Test (SDMT), respectively [20, 21].

Statistical Analyses

Confirmatory factor analyses were first undertaken. Our analyses then examined associations between levels of each type of RIASEC activity and personality and cognitive measures. Analyses were undertaken using Mplus 3.11 [22] for the confirmatory factor analyses. This programme is able to factor analyse binary data. It does so by the calculation of tetrachoric correlation coefficients followed by the use of appropriate estimation procedures. Tetrachoric correlations assume that responses to a question about participation in an activity are underpinned by an underlying normally distributed continuous scale. This might be conceptualized as a 'propensity' to undertake the activity concerned. Individuals located above a certain threshold on that continuum participate in the activity whilst those below it do not. Tetrachoric correlations are the bivariate correlations between such underlying continua [23]. Recent research with binary responses [24] has indicated the general robustness of polychoric correlations to skewed non-normal distributions of the underlying continua. Binary items have frequently been subjected to conventional factor analysis by means of calculating the Pearson correlation coefficient (also known as phi). Significant problems can arise from this practice. Most importantly, items which are manifestations of the same factor may not load together due to differences in endorsement rates: a frequently reported activity (such as reading) may tap the same dimension as a rarely reported one (e.g. translating Serbo-Croatian folk tales into Auslan). The correlations between these activities will be attenuated due to the mismatch of the distribution of endorsements. These can produce low loadings and artifactual factors. These problems are eliminated by the use of tetrachoric correlations.

SPSS 11.5 was used for all other analyses.

Results

Confirmatory Factor Analyses

Confirmatory factor modelling proceeded in two stages using the Mplus programme version 3.11 [22]. This programme incorporates options suitable for the factor analysis of dichotomous responses [23, 25]. Tetrachoric correlations between items were estimated and the weighted least squares mean and variance adjusted estimation was employed. First, six latent factors corresponding to each of Holland's activity scales were estimated in each of the 3 age groups separately. Factors were permitted to correlate freely. In the resulting models, all loadings were significantly different from zero. Loadings were scrutinized to determine if any items failed to load substantially on the appropriate latent factor, and to determine whether loadings were consistent across the 3 age groups. Most items loaded strongly or moderately strongly with few loadings less than 0.30. However, two items from the Realistic scale ('made or repaired clothes' and 'cooked meals') and two from the Social scale ('attended religious services' and 'took care of children') had low (<0.30) or inconsistent (i.e., reversed sign) loadings across age groups. These items were eliminated from the second stage of analysis. Six factors were estimated, and fit statistics were calculated for each of the 3 age groups. The adequacy of model fit was assessed by the χ^2 statistic, the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMS), the Comparative Fit Index (CFI), and the Tucker Lewis Index (TLI) [22].

χ^2 values for all models were large and significant. This reflects the large sample sizes involved. The RMSEA ranged from 0.051 (middle-age group) to 0.059 (old group). These values reflect a good fit of the model to the data [26]. SRMS values were 0.097 in the middle-age group and 0.104 in the other groups. These values are only slightly higher than the suggested benchmark of 0.09 [22]. CFI values ranged from 0.80 (young group) to 0.88 (old group) while the TLI ranged from 0.85 (young group) to 0.92 (old group).

While only the RMSEA provided unequivocal support for good fit across groups, the SRMS approached acceptable values. These two indices are important because there is evidence that the former index is sensitive to the misspecification of factor loadings while the latter is sensitive to misspecification of covariances [27]. Hu and Bentler [28] suggest higher cutoffs for the CFI and TLI than achieved for these models. Model fit could be improved (and higher values of these two indices achieved) by the introduction of secondary loadings of items on factors other than their dominant loading and by allowing some item residuals to correlate within factors. Given the strong loading pattern observed for the factors, these refinements are unlikely to impact on the measurement properties of the instrument.

Finally, multiple group models were fitted to the data in order to address the comparability of the structure across age groups. This procedure compared a model in which all loadings and thresholds (where each item is located on its factor) were constrained to be equal across age groups to a model without such constraints. The latter model is equivalent to the simultaneous estimation of separate models for each age group as described above. Mplus has a special procedure (DIFFTEST) that evaluates the statistical significance of the decrement in fit resulting from imposing the constraints between groups. Once again, reflecting the large sample size, this test was highly significant (χ^2 = 2,582.491, d.f. = 55, n = 7,392, $p < 0.0001$). However, other fit indices were similar in the

Table 1. Standardised estimates of loadings for each activity item from RIASEC Activity List on latent factors by age group[b]

Category name and description	Activity items	Age 20–24 (n = 2,384)	Age 40–44 (n = 2,510)	Age 60–64 (n = 2,538)
Realistic – manipulation of objects, tools, machines, animals	Made or repaired clothes[a]	–	–	–
	Fixed mechanical things or appliances	0.89	0.93	0.98
	Built things with wood	0.78	0.82	0.86
	Drove a truck or tractor	0.62	0.66	0.56
	Used metalwork or machine tools	0.81	0.82	0.87
	Worked on cars, bicycles or motorbikes	0.80	0.89	0.87
	Took engineering, woodwork, mechanics course	0.62	0.50	0.49
	Worked in the garden	0.42	0.43	0.32
	Cooked meals[a]	–	–	–

Table 1 (continued)

Category name and description	Activity items	Age 20–24 (n = 2,384)	Age 40–44 (n = 2,510)	Age 60–64 (n = 2,538)
Investigative – observation, investigation of physical, biological, cultural phenomena	Read scientific books or magazines	0.76	0.65	0.61
	Worked in a laboratory	0.85	0.61	0.75
	Worked on a scientific project	0.94	0.72	0.80
	Read about special subjects on own	0.70	0.87	0.84
	Solved maths or chess puzzles	0.56	0.53	0.53
	Did troubleshooting of software on a PC	0.49	0.64	0.72
	Took a science course	0.89	0.60	0.61
	Followed science shows on TV or radio	0.64	0.54	0.54
	Participated in a science fair or conference	0.70	0.67	0.80
Artistic – the creation of art forms, products	Sketched, drew or painted	0.46	0.49	0.42
	Went to or acted in plays	0.66	0.65	0.67
	Played in a band, group or orchestra	0.70	0.45	0.60
	Practiced a musical instrument	0.64	0.47	0.52
	Went to recitals, concerts or musicals	0.67	0.66	0.68
	Took portrait photographs	0.33	0.49	0.52
	Read literature	0.67	0.66	0.73
	Read or wrote poetry	0.56	0.59	0.66
	Took an art course	0.29	0.40	0.42
Social – manipulation of others to inform, train, develop, cure or enlighten	Wrote letters to friends	0.48	0.45	0.53
	Attended religious services[a]	–	–	–
	Belonged to clubs	0.37	0.25	0.19
	Helped others with their personal problems	0.54	0.48	0.49
	Took care of children[a]	–	–	–
	Went to parties or pub	0.58	0.41	0.42
	Went dancing	0.45	0.27	0.24
	Attended meetings or conferences	0.80	0.86	0.87
	Worked as a volunteer	0.54	0.43	0.53
Enterprising – manipulation of others to attain organisational or self-interest goals	Discussed politics	0.58	0.63	0.63
	Influenced others	0.70	0.75	0.75
	Operated own service or business	0.31	0.28	0.49
	Took part in a sales conference	0.43	0.43	0.50
	Was on a committee of a group	0.68	0.69	0.78
	Supervised work of others	0.53	0.70	0.67
	Met important people	0.66	0.75	0.73
	Led a group in accomplishing some goal	0.67	0.79	0.81
	Organised a club, group or gang	0.62	0.62	0.65
Conventional – explicit manipulation of data according to a prescribed plan	Typed papers or letters for self or for others	0.74	0.81	0.85
	Manipulated numbers in business or bookkeeping	0.62	0.70	0.80
	Operated fax machines, PCs and printers	0.84	0.91	0.86
	Kept detailed records of expenses	0.56	0.58	0.69
	Filed letters, reports, records, etc.	0.79	0.80	0.87
	Wrote business letters	0.81	0.89	0.88
	Took a business course	0.55	0.44	0.52
	Took a bookkeeping course	0.53	0.33	0.52
	Did a lot of paperwork in a short time	0.74	0.78	0.80

[a] Item excluded from this stage of the CFA.
[b] Loadings constrained to be equal across all age groups.

Table 2. Correlations amongst activity counts and latent factors, all age groups combined (n = 7,392)

	Realistic	Investigative	Artistic	Social	Enterprising	Conventional
Realistic		0.28	0.06	0.09	0.26	0.14
Investigative	0.38		0.33	0.25	0.36	0.32
Artistic	0.06	0.45		0.39	0.33	0.24
Social	0.13	0.45	0.65		0.49	0.36
Enterprising	0.34	0.49	0.47	0.89		0.54
Conventional	0.18	0.44	0.35	0.65	0.72	

Correlations between activity counts given in the upper diagonal; correlations between factors shown in the lower diagonal.

Table 3. Activities performed in past 6 months

Activity category	Mean number of activities (SD) in each activity category performed in the past 6 months by							
	all participants	men	women	p	age group			p
	(n = 7,432)	(n = 3,652)	(n = 3,780)		20–24 (n = 2,384)	40–44 (n = 2,510)	60–64 (n = 2,538)	
Realistic	2.66 (1.79)	3.72 (1.69)	1.64 (1.19)	<0.001	2.56 (1.84)	2.82 (1.78)	2.60 (1.74)	<0.001
Investigative	2.74 (1.89)	3.11 (1.95)	2.38 (1.75)	<0.001	2.94 (2.08)	2.91 (1.84)	2.37 (1.69)	<0.001
Artistic	2.77 (1.80)	2.54 (1.78)	3.00 (1.79)	<0.001	3.07 (1.94)	2.60 (1.72)	2.67 (1.71)	<0.001
Social	4.43 (1.57)	4.33 (1.59)	4.52 (1.54)	<0.001	4.87 (1.50)	4.28 (1.52)	4.15 (1.59)	<0.001
Enterprising	3.93 (1.57)	4.33 (2.19)	3.53 (2.11)	<0.001	4.05 (2.02)	4.46 (2.18)	3.27 (2.18)	<0.001
Conventional	4.83 (2.28)	4.93 (2.26)	4.73 (2.30)	<0.001	4.70 (2.19)	5.47 (2.05)	4.32 (2.43)	<0.001
All activities	21.35 (7.49)	22.96 (7.49)	19.80 (7.16)	<0.001	22.20 (7.09)	22.54 (7.27)	19.38 (7.67)	<0.001

constrained and unconstrained models (CFI = 0.81, TLI = 0.87, RMSEA = 0.060 in the constrained model, and CFI = 0.85, TLI = 0.90, RMSEA = 0.055 in the unconstrained model; SRMS is not available for multiple group models). Two items on the Social factor showed declining loadings as a function of age. Item 30 (belonged to clubs) fell from 0.37 in the young group to 0.25 in the middle-aged group and 0.19 in the old group. A similar pattern was observed for item 34 (went dancing) with loading of 0.45, 0.27 and 0.24, respectively. Table 1 provides details of loadings for each of the items on the latent factors for the 3 age groups (4 items excluded). Correlations amongst latent factors are provided in table 2. Ranges of Cronbach's α for each the 6 activity group counts with the 4 items excluded as above were as follows: 0.49–0.78 for women; 0.51–0.78 for men; 0.53–0.74 for young adults; 0.47–0.76 for those in mid-life; and 0.54–0.82 for older adults.

Analyses of Activity Groups

Using the revised RIASEC Activity List comprising 50 items, we used ANOVAs to compare mean measures of the number of activities performed in the past 6 months by all participants, by men and women, and by those in each of the 3 age groups. In these analyses we used counts of activities, not factor scores. The advantage of these measures is that they offer simplicity, aid interpretation and allow for easy comparison of results across studies. As can be seen from table 3, men reported undertaking significantly more Realistic, Investigative, Enterprising and Conventional activities and also performed significantly more activities of any type. Those aged between 60 and 64 were least active while participants in the 20- to 24-year age group were most likely to have performed Social and Artistic activities.

In our next analysis, we examined associations between the numbers of activities undertaken and measures of physical and mental health and cognitive functioning.

Table 4. Associations[a] between number of activities performed and measures of physical health, mental health and cognition, by age group and gender

Measure	All participants	Age 20–24		Age 40–44		Age 60–64	
	(n = 7,432)	men (n = 1,153)	women (n = 1,226)	men (n = 1,176)	women (n = 1,317)	men (n = 1,306)	women (n = 1,216)
SF-12 Physical Health							
ΔR^2	0.002	0.001	0.001	<0.001	<0.001	0.040	0.005
Standardised β	0.045	0.026	–0.033	0.014	–0.012	0.126	0.083
p	<0.001	0.396	0.284	0.632	0.687	<0.001	0.011
SF-12 Mental Health							
ΔR^2	0.002	<0.001	0.001	0.006	0.008	0.002	0.002
Standardised β	0.055	–0.001	0.038	0.079	0.099	0.045	0.057
p	<0.001	0.983	0.213	0.010	0.001	0.153	0.084
Cognition Measures							
Spot-the-Word							
ΔR^2	0.021	0.011	0.043	0.010	0.025	0.035	0.023
Standardised β	0.162	0.110	0.223	0.106	0.171	0.214	0.174
p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Symbol Digit Modalities Test							
ΔR^2	0.008	0.007	0.002	0.012	0.017	0.034	0.015
Standardised β	0.100	0.087	0.046	0.117	0.143	0.211	0.142
p	<0.001	0.004	0.133	<0.001	<0.001	<0.001	<0.001

[a] Controlling for labour force status and years of education.

Since age-sex interactions were significantly associated with the dependent measures, this analysis was conducted separately for each of the 6 age-sex subgroups. In each analysis, we also controlled for labour force status and education; the second variable included in view of the argument that activity and education levels are often associated [29]. The number of activities performed was significantly, positively associated with STW for all 6 subgroups and with SDMT for all subgroups except young adult women (table 4). For older men and women, undertaking more activities was also associated with having better physical health while men and women in the midlife age group with higher activity levels also reported better mental health.

Associations between psychological attributes and performing different types of RIASEC activities were then examined by means of partial correlations in which we controlled for labour force status, education, physical and mental health. As seen in table 5, in all age-sex subgroups, the total number of activities performed was significantly, positively correlated with measures of Extraversion and Mastery and negatively associated with Neuroticism. In each age-sex subgroup, those with higher extraversion scores undertook more Social activities and those with higher levels of mastery performed more Enterprising activities. Psychoticism was positively correlated with undertaking Realistic or Investigative activities by women in each of the 3 age groups, and with undertaking Artistic activities for men and women in the youngest age group.

For our final analyses, we used multiple regression to explore associations between types of activities undertaken and cognitive scores (table 6). Again, age-sex interactions were significantly associated with these two dependent measures and the analyses were undertaken separately for the 6 age-sex subgroups. These analyses controlled for a range of potential confounding factors: labour force status; years of education; health, and personality measures. For all age-sex groups, performing Artistic activities was significantly associated with crystallised intelligence, measured by scores for STW. For adults in the 2 older age groups, cognitive ability was also associated with performing Enterprising and Conventional activities. In the oldest age group, undertaking activities of any type other than those classified as Realistic, were all strongly associated with this test.

There were fewer associations between scores on the SDMT and types of activities undertaken. Those with

Table 5. Associations[a] between personality and types of activities performed in the past 6 months; by age group and gender

Personality measure	All activities	Activity category					
		realistic	investigative	artistic	social	enterprising	conventional
Age 20–24							
Men							
EPQ-R extraversion	0.267**	0.180**	–0.049	0.112**	0.308**	0.323**	0.155**
EPQ-R neuroticism	–0.112**	–0.051	–0.054	0.011	–0.134**	–0.111**	–0.095*
EPQ-R psychoticism	0.030	0.086*	0.030	0.119**	–0.021	0.015	–0.090*
Mastery score	0.201**	0.054	0.083*	0.014	0.180**	0.215**	0.212**
Women							
EPQ-R extraversion	0.251**	0.058	0.061	0.167**	0.347**	0.254**	0.095*
EPQ-R neuroticism	–0.144**	–0.045	–0.047	–0.102**	–0.148**	–0.153**	–0.042
EPQ-R psychoticism	0.035	0.095*	0.080*	0.094*	0.000	0.013	–0.109**
Mastery score	0.159**	0.018	0.068	0.095*	0.129**	0.195**	0.090*
Age 40–44							
Men							
EPQ-R extraversion	0.250**	0.146**	0.049	0.184**	0.276**	0.247**	0.085*
EPQ-R neuroticism	–0.143**	–0.090*	–0.082*	–0.094*	–0.109**	–0.109**	–0.060
EPQ-R psychoticism	0.008	0.038	0.059	0.068	–0.004	–0.020	–0.060
Mastery score	0.215**	0.095*	0.055	0.090*	0.160**	0.233**	0.184**
Women							
EPQ-R extraversion	0.236**	0.013	0.094*	0.154**	0.283**	0.297**	0.066
EPQ-R neuroticism	–0.204**	–0.083*	–0.113**	–0.088*	–0.183**	–0.199**	–0.094*
EPQ-R psychoticism	0.041	0.083*	0.082*	0.045	–0.009	0.052	–0.023
Mastery score	0.221**	0.062	0.110**	0.103**	0.157**	0.243**	0.160**
Age 60–64							
Men							
EPQ-R extraversion	0.190**	0.070	0.036	0.106**	0.255**	0.226**	0.048
EPQ-R neuroticism	–0.137**	–0.089*	–0.080*	–0.085*	–0.082*	–0.113**	–0.090*
EPQ-R psychoticism	–0.076*	–0.011	–0.047	–0.014	–0.134**	–0.080*	–0.120**
Mastery score	0.289**	0.135**	0.178**	0.164**	0.180**	0.247**	0.242**
Women							
EPQ-R extraversion	0.250**	0.038	0.120**	0.188**	0.251**	0.279**	0.100**
EPQ-R neuroticism	–0.162**	–0.051	–0.110**	–0.133**	–0.112**	–0.110**	–0.110**
EPQ-R psychoticism	0.018	0.143**	0.120**	0.005	–0.080*	0.032	–0.036
Mastery score	0.207**	0.052	0.119**	0.143**	0.159**	0.186**	0.167**

EPQ-R = Eysenck Personality Questionnaire – Revised.
[a] Controlling for labour force participation, years of education, physical and mental health.
* $p < 0.01$; ** $p < 0.001$.

higher scores were more likely to perform Conventional activities; a finding that held for all 6 age-sex subgroups. Men undertaking Investigative activities also obtained higher scores on this measure although, for women, this finding held only for the 40- to 44-year age group. In the oldest age group, men scoring higher on the SDMT were again more likely to report that they had undertaken all types of activities, except Realistic ones.

Discussion

In this study, we have drawn on an instrument developed to measure individuals' areas of interests to construct the RIASEC Activity List. We then examined the potential for this instrument, comprising counts of activities categorised according to Holland's 6 interest categories, to be used as a tool for measuring an individual's level of engagement with life. The findings from our anal-

Table 6. Associations[a] between cognitive measures and types of activities performed; by age group and gender

Cognitive test	Type of activity	Age 20–24		Age 40–44		Age 60–64	
		men (n = 1,153)	women (n = 1,226)	men (n = 1,176)	women (n = 1,317)	men (n = 1,306)	women (n = 1,216)
Spot-the-Word							
Realistic	ΔR^2	0.008*	0.012**	0.005	0.006**	<0.001	0.001
	Standardised β	–0.093*	0.111**	–0.073	0.079*	0.007	0.033
Investigative	ΔR^2	0.041**	0.026**	0.019**	0.004	0.027**	0.013**
	Standardised β	0.219**	0.173**	0.151**	0.067	0.188**	0.122**
Artistic	ΔR^2	0.062**	0.071**	0.037**	0.039**	0.048**	0.042**
	Standardised β	0.259**	0.276**	0.203**	0.211**	0.235**	0.222**
Social	ΔR^2	0.005	0.007*	0.001	0.014**	0.008*	0.012**
	Standardised β	0.075	0.094*	0.039	0.126**	0.097*	0.118**
Enterprising	ΔR^2	0.005	0.025**	0.013**	0.023**	0.015**	0.012**
	Standardised β	0.077	0.179**	0.122**	0.175**	0.143**	0.128**
Conventional	ΔR^2	0.001	0.003	0.016**	0.014**	0.048**	0.020**
	Standardised β	0.035	0.056	0.137**	0.127**	0.258**	0.159**
All activities	ΔR^2	0.021**	0.055**	0.019**	0.033**	0.047**	0.033**
	Standardised β	0.159**	0.263**	0.150**	0.207**	0.258**	0.217**
Symbol Digit Modalities Test							
Realistic	ΔR^2	0.007	0.001	<0.001	0.009	<0.001	<0.001
	Standardised β	–0.085*	0.033	–0.010	0.094**	0.020	0.011
Investigative	ΔR^2	0.012**	0.001	0.009*	0.012**	0.015**	0.001
	Standardised β	0.119**	0.039	0.105*	0.118**	0.138**	0.035
Artistic	ΔR^2	0.001	<0.001	0.002	0.003	0.010**	0.008*
	Standardised β	0.040	0.020	0.051	0.054	0.109**	0.099*
Social	ΔR^2	0.001	0.002	0.003	0.004	0.006*	0.005
	Standardised β	0.041	–0.055	0.061	0.063	0.083*	0.076
Enterprising	ΔR^2	0.009*	0.001	0.016**	0.005*	0.006*	0.001
	Standardised β	0.104*	0.035	0.138**	0.082*	0.091*	0.032
Conventional	ΔR^2	0.011**	0.007*	0.027**	0.026**	0.051**	0.048**
	Standardised β	0.114**	0.089*	0.178**	0.173**	0.265**	0.249**
All activities	ΔR^2	0.007*	0.002	0.017**	0.024**	0.029**	0.018**
	Standardised β	0.089*	0.049	0.141**	0.175**	0.201**	0.159**

[a] Controlling for labour force participation, education, mental and physical health, personality measures.
* $p < 0.01$; ** $p < 0.001$.

yses of attributes of, and activities undertaken by, a representative sample of 7,485 community residents indicate that using counts of activities in line with the Holland interest categories may provide a useful means of assessing the level of life engagement and its association with cognitive functioning across the life span. Most of the categories include activities that involve passive, integrative and novel information processing. The RIASEC Activity List does not distinguish between these types of activities. However, it is not evident that such differentiation necessarily directly or significantly improves the value of an instrument as a measure of life engagement [8].

Confirmatory factor analysis performed on the 54 individual activities indicated that, after omission of 4 activity items, the factor structure of the RIASEC Activity List is relatively robust. Importantly, it remains largely invariant across the 3 age groups, making it a useful as-

sessment tool for at least 5 of its 6 scales. However, because of the reduction in factor loadings of 2 of the remaining 7 items of the social scale in the older age group, we conclude that further research on the measurement properties of this sub-scale is desirable and that between-group comparisons of this sub-scale need to be interpreted with caution.

Cronbach's α varied substantially between scales suggesting that some may have unacceptable reliability. It must be appreciated that α is a measure of internal consistency. It represents the lower bound of test reliability: actual test reliability may be much higher than the internal consistency of the scale [30]. Test-retest data may prove important in determining scale reliability in future research.

The summary measure, number of activities performed, was consistently linked to cognitive abilities for both men and women of each age group. Older men and women who performed more activities also reported better physical health. This finding confirms that this count is likely to provide a measure of life engagement across the age range. Longitudinal studies will indicate whether, for an individual, changes in this measure reflect corresponding changes in cognitive abilities.

Our findings support the view that the level of active engagement reflects psychological health including feelings of mastery over life although, of course, conclusions about the direction of that link cannot be drawn from this cross-sectional study. Those undertaking higher numbers of these activities reported lower levels of neuroticism and higher levels of mastery and extraversion. For women in all 3 age groups, however, performing Realistic or Investigative activities was associated with higher levels of psychoticism as measured by the EPQ-R. It has been suggested that this measure reflects unwillingness to conform to social norms rather than proneness to psychosis [31]. This attribute would have been required of women who previously took on activities in male-dominated mechanical and scientific domains and this correlation is strongest for women in the oldest age group. Our finding that this relationship also holds for the younger age groups suggests that young women may still see working in such areas as stretching the boundaries of socially acceptable roles.

We had hypothesised that undertaking Investigative activities would be associated with higher cognition scores. STW scores were positively associated with undertaking Investigative activities for all age-sex subgroups except women aged 40–44. Similarly, such an association between SDMT and Investigative activities did not hold for women in the remaining 2 age groups.

It is interesting to note that having undertaken activities categorised as Realistic (that is, requiring the manipulation of objects, tools, machinery and animals) has relatively little association with cognitive measures. Further, for men aged between 20 and 24, performing such activities is negatively associated with our two cognition measures. Possible reasons for why this association does not persist for the older age groups could be that men who begin with a strong mechanical orientation develop other interests as they grow older or that the role of cognitive ability in influencing selection of Realistic activities has varied across cohorts.

Another finding of interest is the association between undertaking Conventional activities and the two measures of cognition. Previous researchers have suggested, although not tested, that performance of Conventional activities is unlikely to be associated with measures of intelligence [32]. Our findings do not support this assumption. We found a positive relationship between SDMT and Conventional activities for all age-sex subgroups, and between STW and Conventional activities for all but the youngest age group. Again, the causal direction of this association cannot be inferred from these analyses. To draw such inferences requires longitudinal data. Information collected from participants in further waves of this study may provide the opportunity to explore this issue in more detail.

One limitation of our study is that participants were asked whether or not they had performed activities in the last 6 months but not the frequency with which they had undertaken such activities. Information concerning frequency of activity performance could be expected to provide a better indication of the extent to which activity levels and individual attributes are associated.

This study has drawn on Holland's interest categories to develop the RIASEC Activity List. Results from this study have established that this instrument can be used as a measure of life engagement across the life span. Further testing of this instrument will be needed to confirm whether or not it is appropriate for those in older age groups. Its application in longitudinal studies will allow identification of key factors that are associated with change in the RIASEC score.

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