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The role of activity engagement in the relations between Openness/Intellect and cognition

Andrea Soubelet [a,*], Timothy A. Salthouse [b]

[a] Université de Provence, U.F.R. de Psychologie et Sciences de l'Education, 29, Avenue Robert Schuman, 13621 Aix en Provence, France
[b] Department of Psychology, 102 Gilmer Hall, University of Virginia, Charlottesville, VA 22904-4400, USA

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ABSTRACT

The current project investigated why people with high levels of Openness/Intellect tend to have higher levels of cognitive functioning than people with lower levels of Openness/Intellect. We hypothesized that the positive relationship between Openness/Intellect and cognition might be attributable to more open people being more likely to engage in cognitively stimulating activities that are beneficial for cognitive functioning. Three conceptualizations of activity engagement based on: (a) self ratings of duration and intensity of engagement; (b) perceived routineness of one's activities; and (c) disposition to engage in cognitively stimulating activities, were investigated as possible mediators of the Openness/Intellect–cognition relations. Although several of the relevant simple correlations were of moderate size and statistically significant, we found little evidence that activity engagement mediated the relations between Openness/Intellect and cognition.

1. Introduction

One of the most robust relations between aspects of personality and cognitive functioning is that between the personality dimension of Openness/Intellect and various measures of cognition (e.g., Ackerman & Heggestad, 1997; DeYoung, Peterson, & Higgins, 2005; Fleischhauer et al., 2010; Gow, Whiteman, Pattie, & Deary, 2005; Gregory, Nettelbeck, & Wilson, 2010). Although apparent across samples of different ages and with different measures of cognition, the reasons why people who describe themselves as more open tend to perform better on many cognitive tests than people with lower ratings of Openness/Intellect are not yet known.

People with higher levels of Openness/Intellect are described as intellectually curious individuals, who seek cognitive stimulation, pursue manifold interests and have appreciation for a variety of experiences. Investment theories, and in particular the model of the personality-intelligence interface developed by Chamorro-Premuzic and Furnham (2004), postulate that people with high levels of Openness/Intellect engage more in intellectual activities that provide learning opportunities and that this engagement improves crystallized abilities (for a review of theories on personality-intelligence associations and investment traits, see von Stumm, Chamorro-Premuzic, & Ackerman, 2011). In contrast, the relation between Openness/Intellect and fluid abilities is assumed in this model to operate from fluid abilities to Openness/Intellect (Chamorro-Premuzic & Furnham, 2004). That is, high levels of fluid abilities could be a prerequisite for high levels of Openness/Intellect and the development of curious personalities, which in turn may lead to the development of crystallized ability.

Although the causal direction from Gf to Openness/Intellect is plausible, it is also possible that people with high levels of Openness/Intellect more frequently engage in intellectual activities which not only increase the amount of knowledge, but also improve the efficiency of fluid abilities and other aspects related to information processing. That is, people high in Openness/Intellect may engage more frequently in activities that stimulate and enhance several aspects of their cognitive functioning, including both crystallized and fluid abilities. Consistent with this idea, Openness/Intellect has been found to be associated with more involvement in activities (e.g., Hultsch, Hertzog, Small, & Dixon, 1999), and activity engagement has been found to be associated with level of both crystallized and fluid abilities and also memory and speed components of cognition (e.g., Hultsch et al., 1999; Jopp & Hertzog, 2007). However, there have apparently not been any direct tests of the mediational role of activity engagement on the relation between Openness/Intellect and cognitive functioning, and this was a primary aim of the current project.

Several aspects of cognition were assessed in this project, i.e., crystallized ability and fluid ability as well as memory and speed of processing. Activity engagement was assessed with an activity

* Corresponding author. Tel.: +33 616 208 616; fax: +33 442 953 720.
E-mail addresses: soubelet.andrea@gmail.com (A. Soubelet), salthouse@virginia.edu (T.A. Salthouse).

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inventory consisting of a list of 22 activities (i.e., Salthouse, Berish, & Miles, 2002). The research participants were asked to estimate the number of hours engaged in each activity, and for activities with at least some engagement, to also rate the cognitive demands of the activity. Unlike some prior studies of activity engagement, participants did not merely indicate whether they engaged in each activity, but instead reported the amount of time they spent engaged in each activity in a typical week. Furthermore, participants provided ratings of the cognitive demands of each activity, which allowed us to examine engagement only for activities with the highest rated cognitive demands, in addition to total amount of engagement across all activities.

It is possible that it is not activity engagement, per se, that is critical in the relation between Openness/Intellect and cognition, but rather how the activities are perceived in terms of being routine or demanding. We therefore investigated the role of subjective perceptions of amount of activity engagement with the Environmental Demands questionnaire (Martin & Park, 2003), which assesses feelings of busyness and routine in everyday life.

The compound label of Openness/Intellect derives from an old debate on how best to describe the content of this personality trait (e.g., Johnson, 1994). Recent studies have provided evidence that the trait is comprised of two somewhat distinct aspects (e.g., De Young, Quilty, & Peterson, 2007; see also DeYoung, Shamosh, Green, Braver, & Gray, 2009); engagement in sensation and perception (e.g., "See beauty in things that others might not notice"), and intellectual engagement and perceived intelligence (e.g., Avoid philosophical discussions" [reversed]). Because the Openness/Intellect measure used in the current project consisted of only 10 items (from the 50-item version of the Big-Five 5 Broad Domains, Goldberg, 1992), we were not able to make distinctions between the two components. However, we were interested in the possibility that at least some of the relations between Openness/Intellect and cognition are attributable to a specific disposition to seek out cognitive stimulation and engage in effortful cognitive processing. We measured this disposition with the Need for Cognition scale (Cacioppo, Petty, Feinstein, & Jarvis, 1996), which was specifically designed to assess people's need for complex thinking and effortful reasoning.

Although the Need for Cognition and Openness/Intellect constructs are similar in some respects, Openness/Intellect can be considered to be a broader personality trait that encompasses more dimensions (e.g., affective, sensory, attitudes, and preferences) than the Need for Cognition disposition. Consistent with this idea, Fleischhauer et al. (2010) provided evidence for a strong relation of Need for Cognition to the Openness to Ideas facet ($r = 0.67$), but small to moderate relations of Need for Cognition to other facets of Fantasy, Aesthetics, Feelings, Actions and Values (all $r \leqslant 0.26$) of the NEO-PI-R of Costa and McCrae (1992). The authors also suggested that Need for Cognition assesses individual differences in cognitive resource allocation to a greater extent than does Openness/Intellect. We were interested in determining whether the tendency to exert more cognitive effort and seek out information processing might be the primary mechanism responsible for the relation between Openness/Intellect and cognition, and therefore Need for Cognition was examined as a potential mediator of the Openness/Intellect–cognition relation.

The primary method used to investigate our hypotheses was mediational analysis. For each potential mediator (X) our examination of mediation consisted of three steps. First, we examined the relations between Openness/Intellect (O/I) and the hypothesized mediator (i.e., O/I-X). Next, we examined the relation of the hypothesized mediator to the measures of cognition (i.e., X-Cog). Finally, we examined whether the relations between Openness/Intellect and cognition were reduced after controlling the variance in each potential mediator (i.e., [O/ICog]·X). Indirect effects were estimated with the bootstrap procedure described by Preacher, Rucker, and Hayes (2007).

The sample in the current project consisted of over 2200 adults who performed a comprehensive battery of cognitive tests and completed questionnaires assessing aspects of engagement in activities, perceived busyness or routine, the "Big Five" dimensions of personality and Need for Cognition. A broad assessment of cognition was obtained from 16 variables representing four abilities (crystallized ability, fluid ability, memory ability and speed ability). Prior research (e.g., Salthouse, Pink, & Tucker-Drob, 2008) has established that the cognitive variables are both reliable and valid, and all of the self-report scales had good reliabilities (i.e., mean of 0.88 and range from 0.80 to 0.93). The sample included adults ranging from 18 to 96 years of age, and because age is correlated with both Openness/Intellect and cognitive ability, all analyses included age as a covariate.

2. Method

2.1. Participants

The sample consisted of 2257 adults between 18 and 96 years of age who all had Mini Mental Status Exam (Folstein, Folstein, & McHugh, 1975) scores of 27 or greater, thereby minimizing the likelihood that any of the participants were demented. Participants were recruited through newspaper advertisements, flyers and referrals from other participants. Further descriptions of the participants, and the methods of recruitment, are provided elsewhere (e.g. Salthouse et al., 2008). Characteristics of the sample are presented in Table 1. It can be seen that the mean age was 50.3 (SD = 18.6) and that 64.6% of the participants were female. Most of the participants had at least some college education, with a mean of nearly 16 years of formal education, and reported themselves to be healthy, with a mean of about two on a self-report scale ranging from 1 (for excellent) to 5 (for poor).

2.2. Materials and procedure

Three 2-h sessions were conducted in the laboratory by trained research assistants. During these sessions, participants were administered several cognitive tests designed to assess one of four cognitive abilities. The questionnaires described below were completed at home.

Cognitive tests: The cognitive tests were designed to assess Fluid Intelligence (Gf) with tests of reasoning (Matrix Reasoning, Shipley Abstraction, Letter Sets) and spatial visualization (Spatial Relations, Paper Folding, Form Boards), Crystallized intelligence (Gc) with tests of vocabulary (WAIS Vocabulary, Picture Vocabulary, Synonym Vocabulary, Antonym Vocabulary), Episodic Memory with verbal memory tests (Word Recall, Paired Associates, Logical Memory), and Perceptual Speed with substitution and comparison tests (Digit Symbol, Letter Comparison, and Pattern Comparison).

Table 1
Means and standard deviations of the sample characteristics.

	Mean	SD	Age *r*
N	2257		
Age	50.3	18.6	
Female (%)	64.6		0.01
Years of education	15.8	2.7	0.22*
Health rating	2.2	0.9	0.12*
Activity limitation	1.8	0.9	0.24*
Openness/Intellect	36.7	6.2	−0.06*

Note: Health rating on a scale ranging from 1 (excellent) to 5 (poor). Health-related activity limitation was rated on a scale ranging from 1 (very little) to 5 (very much).
* $p < 0.01$.