

# Age-specific sex differences in human personality structure: a cross-sectional study in Japan

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The present study investigated age-specific sex differences in the reciprocal action of personality factors of personality structure, using a three-factor personality model. The subjects were 280 healthy adolescents (15-17 years) and 337 elderly individuals who were not inpatients (65-98 years). Psychometric properties of BASIC-3 Personality Inventory indicated high homology between adolescents and elderly. A positive association between Sociability and Novelty-Seeking personality was found in all groups. In addition, the relationship between Novelty-Seeking and Neuroticism, and Sociability and Neuroticism personality traits displayed contrasting differences when the subjects were categorized by sex. Our findings suggest that there are age-specific sex differences in personality structure, and these results may contribute to psychological intervention for the elderly.

## Introduction

Psychologically, aging is a continuous process that specifies and modulates the individual personality, which depends on the internal (biological) and external (environmental) context. This process appears to be involved in the experience of traumatic events, development of biological function, and socio-cultural status<sup>1)</sup>. Previous studies have consistently shown that some personality traits of elderly people (over 65 years) are quantitatively different from those of adolescents (15-26 years)<sup>2-7)</sup>. For example, cross-sectional studies using a five-factor personality model indicated that elderly people showed lower Neuroticism, Extraversion, and Openness personality traits, and higher Agreeableness and Conscientiousness traits than adolescents<sup>2)</sup>. In general, Extraversion assesses an individual's proneness towards positive emotions and sociability. The personality domain of Neuroticism assesses emotional adjustment and stability. The domain of Openness refers to an individual's interest in culture and preference for new

activities and emotions. Agreeableness is concerned with an individual's interpersonal relationships and strategies; people high in Agreeableness are trusting, straightforward, and empathic whereas those who score low are arrogant, manipulative, and unconcerned about others. Conscientiousness relates to the control of impulse, as well as to differences in the ability to plan, organize, and complete behavioral tasks. In addition, a longitudinal study using the California Psychological Inventory found lower scoring for Extraversion and Flexibility, and higher scoring for Control/ Norm orientation in elderly than in adolescents<sup>4)</sup>. Interestingly, the effect of aging on the major factors of personality is common over different cultures, and similar patterns of age differences were seen in different cultures in both males and females<sup>2)</sup>. Therefore, it was thought that these are universal maturational changes in the adult personality. However, the structural changes of personality, as an integrative system of the reciprocal action of personality factors in aging are not known.

Human behavior is highly complex, and personality

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・ 性格構造における年齢特異的な性差について～日本の横断的調査から

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traits do not function as one personality trait to one behavior relationship, but rather, as numerous personality traits to one behavior relationship. Thus, the essential concept for understanding human behavior is the reciprocal action of personality traits as personality structure. Recently, a novel personality inventory, the BASIC-3, which is based on the BASIC-3 personality association model (BASIC-3 model), was developed to assess the reciprocal action of fundamental personality traits/ mental activity<sup>8)</sup>. This model focuses on three directions of mental activity. It includes external (bilateral) activity, external (unilateral) activity, and internal activity, and these factors are considered to underlie the personality structure. Each of the three directions is used to describe personality traits such as Sociability, Novelty-Seeking, and Neuroticism. A conceptual similarity of the BASIC-3 personality traits is found in the three-factor and five-factor models<sup>9-12)</sup>. Unlike the previous personality model, the BASIC-3 model emphasizes the degree of inter-correlation among each of three personality factors. The BASIC-3 model hypothesizes that psychometric properties of the reciprocal action of three personality factors describes a basic structure of individual personality. Thus, using this model, it is possible to detect structural differences in personality and the internalizing and externalizing status of mental activity in individuals. In this study, to understand age-specific sex differences in the reciprocal action of personality factors of personality structure, we investigated personality structure in adolescents and elderly using the BASIC-3 model.

## Materials and Methods

### Participants

The subjects involved in this study in Japan were 280 healthy adolescents (138 male and 142 female) and 337 elderly people who were not inpatients (161 male and 176 female). The mean age of the participants was 15.74 ( $SD=0.46$ , range, 15-17) years for adolescents and 74.64 ( $SD=7.16$ , range, 65-98) years for elderly people. After obtaining informed consent, participants completed the BASIC-3 personality inventory (BASIC-3 PI). The study was approved by institutional (Juvenile Training School of Yachimata) review board.

### Measures

Personality assessment for adolescents was conducted using BASIC-3 PI, the details of which have been described previously<sup>8)</sup>. Briefly, BASIC-3 PI is a self-reported 32-item inventory based on the psycho-developmental theory of personality and three directions of mental activity model. The BASIC-3 personality factors consist of Sociability, Novelty-Seeking, and Neuroticism, which are regarded as fundamental personality components and comprise an individual personality structure. To reduce the burden on older participants and facilitate the test reliability, the BASIC-3 PI-short version was developed and used to assess personality structure in elderly people. To develop the BASIC-3 PI-short version, we isolated 15 items (6 items for Sociability, 5 items for Novelty-Seeking, and 4 items for Neuroticism) from the original BASIC-3 PI (Table 1) and transformed the scale from the 5-point Likert scale to a 2-point (yes/no) scale. Item selections for the short version were according to values of factor loading in adolescence and we isolated items as easy to answer for elderly.

To assess the differences in psychometric properties of the BASIC-3 PI-short version or personality structure between adolescents and elderly people under homogeneous conditions, the results of the BASIC-3 PI were transformed into the BASIC-3 PI-short version when we processed the data for adolescents. The validity, reliability, and psychometric properties of the BASIC-3 PI-short version were evaluated in the initial analysis.

### Statistical analysis

The data was analyzed using JMP Version 5.0 (SAS Institute, Cary, NC). No *T*-score transformations for the personality scores were calculated. Internal consistency of BASIC-3 PI-elderly version was assessed by means of Cronbach's coefficient. Confirmatory factor analysis was performed on the item-level personality scores using Varimax rotations. To evaluate item-level inter-correlation coefficient among the BASIC-3 personality factors, Pearson's correlation coefficient was used. Values of  $p<0.05$  were considered statistically significant and judged to indicate significant association.

## Results

### Psychometric properties of BASIC-3 PI-short version

The results of psychometric properties of the BASIC-3 PI-short version in adolescents and elderly are shown in Tables 1 and 2. The 15 items of the Sociability, Novelty-Seeking, and Neuroticism scales were subjected to confirmatory factor analysis (Varimax rotated, three factor solution). In adolescents, S1, S4, and NS3 scales did not load on the hypothetical factor when a threshold of 0.30 was considered statistically

significant. On the other hand, only the NS3 scale did not load on the hypothetical factor of Sociability in the elderly. It is noteworthy that there was consistently high similarity in the distribution of factor loading for the three hypothetical personality factors between adolescents and elderly ( $r=0.76-0.95$ , Table 1).

Inter-correlation analysis between hypothetical BASIC-3 personality factors and each of the 15 items revealed that each item was completely associated with the alternative BASIC-3 personality component according to the three hypothetical personality factors

**Table 1. Confirmatory factor analysis of BASIC-3 PI-short version in adolescents and elderly**

A priori factors and items		Factor loading	
		Adolescents	Elderly
<b>Sociability facets (S)</b>			
S1	I like to play in a bustling street more than inside the house.	.48	.25
S2	I like group activities.	.67	.41
S3	I prefer jobs that let me work alone. (Reverse scored)	.55	.66
S4	I really enjoy talking to people.	.32	.25
S5	I usually prefer to do things alone. (Reverse scored)	.71	.70
S6	I don't need to have many friends. (Reverse scored)	.70	.70
<b>Novelty-Seeking facets (NS)</b>			
NS1	I enjoy listening to loud music.	-.52	.31
NS2	I enjoy going to unknown places.	-.57	.67
NS3	I don't like sporting competitions. (Reverse scored)	-.15	.17
NS4	I enjoy doing thrilling things.	-.66	.68
NS5	I want to lead a life that is stimulating every day.	-.69	.54
<b>Neuroticism facets (N)</b>			
N1	I am apprehensive about the future.	.68	-.63
N2	I am anxious about rumors about myself.	.64	-.61
N3	I sometimes think that I am a helpless human being.	.66	-.49
N4	I sometimes can't sleep because of worry.	.42	-.71

**Table 2. Inter-correlations between BASIC-3 PI-short version in adolescents and elderly**

Item	BASIC-3 personality factors					
	Sociability (S)		Novelty-Seeking (NS)		Neuroticism (N)	
	Adolescents	Elderly	Adolescents	Elderly	Adolescents	Elderly
S1	<b>.59</b>	<b>.59</b>	.33	.42	-.14	-.05
S2	<b>.69</b>	<b>.63</b>	.24	.29	-.03	-.03
S3	<b>.49</b>	<b>.54</b>	-.10	.10	-.08	-.15
S4	<b>.52</b>	<b>.49</b>	.28	.13	.10	.14
S5	<b>.70</b>	<b>.60</b>	.21	.22	-.14	-.14
S6	<b>.66</b>	<b>.60</b>	.11	.18	.03	-.16
NS1	.21	.09	<b>.61</b>	<b>.41</b>	.00	-.02
NS2	-.02	.17	<b>.54</b>	<b>.65</b>	-.02	-.05
NS3	.26	.32	<b>.46</b>	<b>.53</b>	-.14	-.24
NS4	.21	.28	<b>.67</b>	<b>.61</b>	-.01	-.06
NS5	.20	.20	<b>.62</b>	<b>.56</b>	-.01	-.03
N1	-.17	-.12	-.21	-.14	<b>.65</b>	<b>.71</b>
N2	.13	.06	.11	.00	<b>.61</b>	<b>.56</b>
N3	-.14	-.10	-.18	-.06	<b>.64</b>	<b>.59</b>
N4	-.01	-.09	.10	-.17	<b>.59</b>	<b>.74</b>

Note: The most strongly inter-correlated factor for each item is indicated in bold.

Table 3. Cronbach's alpha coefficients of BASIC-3 PI short version

	No. of items	Adolescents	Elderly
Sociability	6	0.66	0.59
Novelty-Seeking	5	0.50	0.43
Neuroticism	4	0.46	0.55

( $r=0.41-0.74$ , Table 2) for both adolescents and elderly. Internal consistency estimated with Cronbach's alpha ranged from 0.46 to 0.66 for adolescents and 0.43 to 0.59 for elderly (Table 3). These results indicated that the BASIC-3 PI-short version reflects the same three hypothetical personality factors in adolescents and elderly.

**Personality Association Analysis**

We next examined the inter-correlation among the BASIC-3 personality factors. Strong association between Sociability and Novelty-Seeking was found in all groups ( $r=0.28-0.45$ ;  $p<0.0001$ , Fig. 1). In male subjects, elderly showed negative association between Novelty-Seeking and Neuroticism ( $r=-0.16$ ,  $p=0.038$ , Fig. 1 B), and Sociability and Neuroticism ( $r=-0.22$ ,  $p=0.005$ , Fig. 1 B). In contrast, in female subjects, negative association between Sociability and Neuroticism was found in adolescents ( $r=-0.16$ ;  $p=0.0028$ , Fig. 1 A). Although not reaching statistical significance ( $p=0.18$ ), the negative association between

Sociability and Neuroticism in female adolescents showed a similar tendency to the association between Novelty-Seeking and Neuroticism (Fig. 1 A).

**Discussion**

First, we evaluated the psychometric properties of the BASIC-3 PI-short version in adolescents and elderly. Cronbach's alpha of each personality factor ranged from 0.43- to 0.66. Considering the low number of items (6 items for Sociability, 5 items for Novelty-Seeking, and 4 items for Neuroticism), the internal consistency of the BASIC-3 PI-short version appears to be moderate. Confirmatory factor analysis and inter-correlation analysis confirmed that the BASIC-3 PI-short version has homologous construct validity with the original BASIC-3 PI. Additionally, factor analysis of the BASIC-3 PI-short version indicated high homology ( $r=0.76-0.95$ ) in factor structures between adolescents and elderly, suggesting that the BASIC-3 model is a universal personality theory of mental activity.

In the present study, using a novel personality model, BASIC-3, we addressed the structural personality differences between adolescents and elderly. We found age-specific sex differences in personality structure, which were previously undetected. The positive association between Sociability and Novelty-Seeking in all groups is a well-established concept of personality research<sup>11, 12</sup>. Interestingly, the relationship between Novelty-Seeking and Neuroticism, and Sociability and Neuroticism personality traits displayed contrasting differences when the subjects were categorized by sex. These findings suggest that elderly men tend to show Neuroticism-negatively associated behavior when compared to elderly women.

These structural differences in individual personality may underlie a variety of human behavior, such as social behavior, interpersonal attitude, and cognitive process. When comparing the present results concerning sex differences in personality structure, the age differences in personality structure with developmental change remain controversial. Because the present study was cross-sectional, it is possible that age differences reflect birth cohort effects rather than physical/ psychological development. In addition, cultural changes over the past century may explain the generational differences. The younger generation has

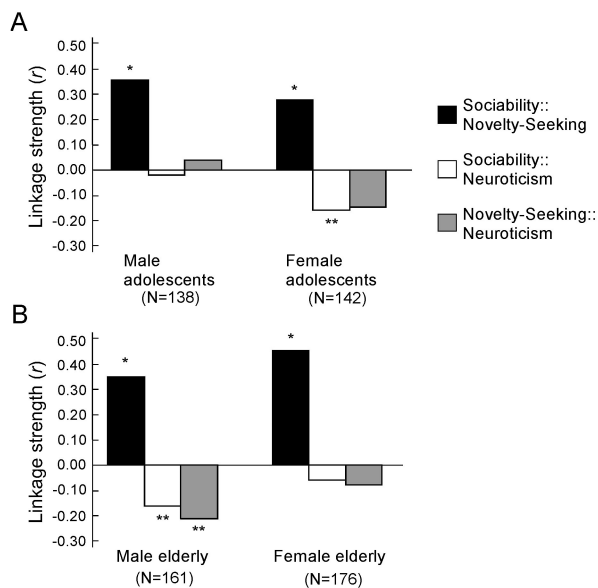


Fig. 1. Personality association in adolescents (A) and elderly (B).

\* $p<0.0001$ , Pearson correlation coefficient.  
 \*\* $p<0.05 - 0.005$ , Pearson correlation coefficient.

experienced different health care and nutrition than the older generation, and elderly subjects who participated in this study experienced World War II. Thus, it is conceivable that such generational incompatibility might influence age differences in personality structure<sup>13, 14</sup>.

In summary, the present study showed sex differences in personality structure, using the BASIC-3 model. Also, the adult personality is shaped by biological and environmental contexts in relation to aging. We speculate that numerous experiences impose structural change in individual personality, as a result of adaptive mechanisms of mental activity. The BASIC-3 model may lead to better understanding of the fundamentals of mental activity, and these results may contribute to psychological intervention for the elderly.

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