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Object-Spatial Imagery Types of Japanese College Students

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This study investigated the object-spatial imagery types found among Japanese college students. First, we examined the descriptive statistics of the Japanese version of the Object-Spatial Imagery Questionnaire object-spatial imagery scales, which measure respondents' tendencies with respect to object-spatial imagery types. Although the means of these subscales were lower than those of the original versions, the raw score distributions and gender differences were similar to those obtained using the original version. Additionally, we compared imagery types among students in seven different academic departments. Specifically, the results showed specific patterns of imagery type among students in each department, indicating that the object-spatial imagery type model is applicable to Japanese college students and that individual imagery type data would be helpful for career guidance.

Keywords: Object-Spatial Imagery Style; Object Imagery Type; Spatial Imagery Type

Introduction

Cognitive neuroscience and behavior research have demonstrated that visual imagery processing comprises two processes: object and spatial imagery processing (Farah, Hammond, Levine, & Calvanio, 1998; Kosslyn, 1994; Levine, Warach, & Farah, 1985; Ungerleider & Mishkin, 1982). These processes can be distinguished from each other both anatomically and functionally. Object imagery processing is activated when participants process objects or scenes in terms of color, shape, size, and brightness; this type of processing is linked to the ventral system. Spatial imagery processing is activated when participants process object location, movement, spatial relations, and transformations; this type of processing is linked to the dorsal system.

These two processing pathways of visual imagery in the brain have also been associated with individual differences in visual imagery processing. Recently, the research group of Kozhevnikov (Blajenkova, Kozhevnikov, & Motes, 2006; Blazhenkova & Kozhevnikov, 2010; Kozhevnikov, Kosslyn, & Shephard, 2005; Kozhevnikov, Blazhenkova, & Becker, 2010) proposed a new model of cognitive style (object-spatial imagery style) for preferences with respect to visual imagery. This new cognitive style model divides people into object imagers and spatial imagers. Object imagers tend to create colorful, pictorial, high-resolution images of individual objects or scenes; they perform very well on object measures (e.g., the Degraded Pictures Test [DPT]). Spatial imagers tend to use imagery to represent object locations and movement and spatial relations among objects; they have an advantage on spatial imagery tests (e.g., the Mental Rotation Test [MRT]).

Blajenkova et al. (2006) recently developed the Object-Spatial Imagery Questionnaire (OSIQ) as a tool for measuring individuals' object-spatial imagery type. Research using the OSIQ has reported that scores on the OSIQ's object imagery scale were specifically related to performance on object visualization tests or imagery questionnaires, such as the DPT or the Vividness of Visual Imagery Questionnaire (VVIQ), whereas scores on the OSIQ's spatial imagery scale were specifically related to performance on spatial imagery tests, such as the Paper Folding Test (PFT) or MRT (Blajenkova et al., 2006, Blazhenkova & Kozhevnikov, 2010). These imagery types have also been associated with interpretations of kinematics graphs and appreciation of abstract art (Blazhenkova & Kozhevnikov, 2010). Additionally, neuroimaging research has revealed differences in brain activity between object imagers and spatial imagers while they imagined that they were creating line drawings of common objects, such as pianos or pairs of scissors (Motes, Malach, & Kozhevnikov, 2008).

Furthermore, educational research has reported that object imagery plays a crucial role in creative thinking among visual artists (Kassels, 1991; Rosenberg, 1987), and spatial imagery is important for performance in professions such as machine design and engineering (Hegarty & Waller, 2005; Smith, 1964). Recently, Blazhenkova and Kozhevnkov (2010) showed that students majoring in visual arts succeeded on object measures such as the DPT or the VVIQ but performed poorly on spatial imagery tasks such as the MRT or the PFT, whereas students majoring in science showed the opposite performance pattern. These results suggested that individual imagery abilities relate to individual aptitude in specialized areas.

However, there are large differences in cognitive style between Asians and Europeans/Americans (Nisbett, Peng, Choi, & Norenzayan, 2001; Sternberg, 1997). Therefore, it is necessary to determine whether the cognitive style model of object-spatial imagery type obtained from participants in Europe and America may be applicable to Japanese individuals. The primary goal of the present study is to investigate object-spatial imagery type in Japanese college students. Additionally, if imagery type is associated with college major or academic performance, then individual tendencies with respect to imagery type might be helpful for vocational guidance and education.

Hence, the secondary goal is to investigate object-spatial imagery type in students belonging to certain specialized departments, such as art, engineering, and medicine.

Methods

Participants. The participants were 914 undergraduate and graduate students (493 male, 451 female) from Morioka Welfare and Medical College, Iwate University, Iwate Medical University, Morioka University, and Iwate Industrial Technology Junior College. Their ages ranged 18 - 49 years (M = 19.08, SD = 1.72). They were comprised by 86 (15 male, 71 female), 96 (47 male, 49 female), 114 (54 male, 60 female), 164 (58 male, 106 female), 173 (80 male, 93 female), 106 (64 male, 42 female), and 175 (145 male, 30 female) students in art, welfare, agriculture, education, literature, medicine, and engineering departments, respectively.

Questionnaire. We used the Japanese version of the OSIQ (J-OSIQ), which was translated from the original version into Japanese by Kawahara and Matsuoka (2012). Similar to the original version, the J-OSIQ consists of object and spatial imagery scales (15 items each) to assess the tendency to employ the object and spatial imagery types, respectively. The J-OSIQ was confirmed to have high internal consistency reliability (Cronbach's α = .83 and .82 for the object and spatial imagery scales, respectively) by Kawahara and Matsuoka (2012). The questionnaire used a five-point scale (1 = totally disagree to 5 = totally agree).

Procedure. The questionnaire was administered in groups of 50 - 150 participants. After being informed about the purpose of the research and assured of their privacy by the researcher, the participants were asked to read each item of the J-OSIQ and respond by choosing one of the points on the scale. No time limit was imposed for the completion of the questionnaire.

Result

Before analyses, we recoded the scores of reverse items (i.e., totally disagree = 5, totally agree = 1). Scores on the object and spatial imagery scales of the J-OSIQ were calculated by averaging the ratings of the items loading on each subscale.

The means and standard deviations on the two subscales of the J-OSIQ were M = 3.18 (SD = .62) and M = 2.39 (SD = .63) for the object and spatial imagery scales, respectively. For comparisons of ratings between the object and spatial imagery scales of the J-OSIQ, the relationships between raw scores on the J-OSIQ subscales and participants' percentiles are shown in **Figure 1**.

Furthermore, z-scores on the two J-OSIQ subscales were calculated in order to confirm the normality of these scores' distributions. The distributions of the object imagery z-score (z_{obj}) and the spatial imagery z-score (z_{spat}) are shown in **Figure 2**. One-sample Shapiro-Wilk tests revealed that although the distribution of z_{obj} was normal (W = .997, p = .136, *Skewness* = .041), that of z_{spat} was not (W = .988, p = .001, *Skewness* = .362).

Gender differences were found in both subscales of the J-OSIQ (t = 3.72, p < .001 for the object scale; t = −11.51, p < .001 for the spatial scale). Female participants had higher object imagery scores than male participants, whereas male participants had higher spatial imagery scores than female participants.

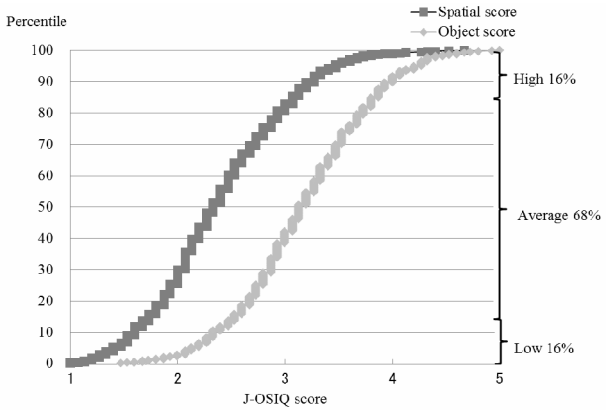

Figure 1.
Distribution of raw scores on J-OSIQ object and spatial imagery scales (percentiles).

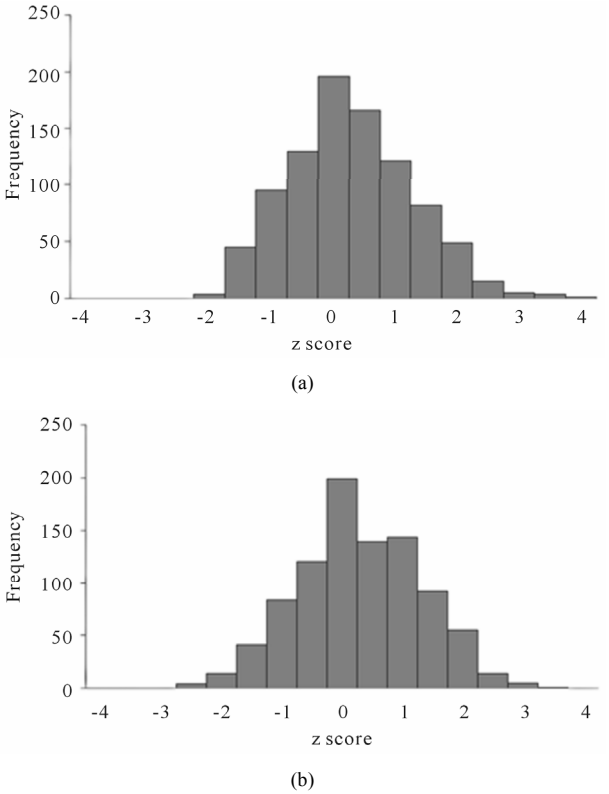

Figure 2.
Distributions of z-scores on object and spatial imagery scales. (a) Spatial imagery z-scores; (b) Object imagery z-scores.

Student's t-tests on the difference between actual and average z_{obj} and z_{spat} scores were conducted to assess the object and spatial imagery types of students in each field of study. The analysis revealed that the art students' z_{obj} scores were significantly higher than average (t = 5.71, p < .001), whereas their z_{spat} scores were significantly lower than average (t = −2.89, p < .01); the engineering student's z_{obj} and z_{spat} scores showed the opposite pattern to those of the art students (z_{obj}, t = −2.52, p < .05; z_{spat}, t = 11.00, p < .001). In addition, both the z_{obj} and z_{spat} scores of medical students were significantly higher than average (z_{obj}, t = 2.24, p < .05; z_{spat}, t = 3.99, p < .001). In con-

trast, those of the welfare students were significantly lower than average (z_{obj}, $t = -2.83$, $p < .01$; z_{spat}, $t = -3.00$, $p < .01$). The education and literature students scored significantly lower than average only in z_{spat} (education, $t = -3.14$, $p < .01$; literature, $t = -7.23$, $p < .001$). Finally, the agriculture students' z_{obj} and z_{spat} scores did not significantly differ from average values.

Additionally, a one-way ANOVA was performed to examine the differences in z_{obj}/z_{spat} scores among the students in seven departments. The students' z_{obj} scores differed significantly among departments, $F(6, 907) = 11.07$, $p < .001$. Multiple comparisons with Bonferroni correction showed that the art students' z_{obj} scores were significantly higher than those of students in the other six fields. Furthermore, z_{obj} scores were significantly higher in medical and education students than welfare students. Similarly, a one-way ANOVA on z_{spat} scores revealed significant differences among students in different departments, $F(6, 907) = 34.12$, $p< .001$. Multiple comparisons with Bonferroni correction showed that the engineering students' z_{spat} scores were significantly higher than those of students in the other six departments. In addition, the medical students' z_{spat} scores were significantly higher than those of students in the art, welfare, education, and literature departments. The patterns of z_{obj} and z_{spat} scores in each field of study are shown in **Figure 3**.

Discussion

The purpose of the present study was to examine object-spatial imagery type in Japanese college students.

First, we investigated object-spatial imagery type in Japanese college students by the means, standard deviations, score distributions, and gender differences of the object and spatial imagery scales of the J-OSIQ. The means and ratings of the J-OSIQ object imagery scale tended to be higher than those of the J-OSIQ spatial imagery scale. Furthermore, gender differences were found on both the object and spatial imagery scales of the J-OSIQ. These results are consistent with those of previous studies (Blajenkova et al., 2006; Blazhenkova & Kozhevnikov, 2009) that assessed the reliability of the original version of the questionnaire. On the other hand, although the means of the two J-OSIQ subscales were slightly lower than those of the original version (object imagery scale = 3.59; spatial imagery scale = 2.93), these values are more in line with those of Kawahara and Matsuoka (2012), who developed the J-OSIQ (object imagery scale = 2.89; spatial imagery scale = 2.49).

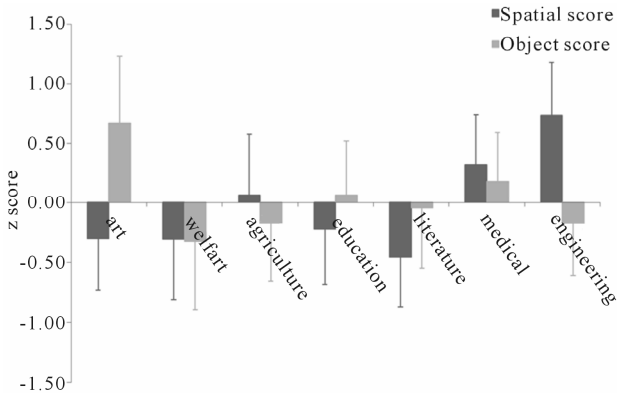

Figure 3.
Object and spatial imagery z-scores for students in seven different departments.

Overall, the descriptive statistics and gender differences of the J-OSIQ in this study are consistent with those of previous studies (Blajenkova et al., 2006; Blazhenkova & Kozhevnikov, 2009; Kawahara & Masuoka, 2012).

Second, we investigated the patterns of the object and spatial imagery types of students in various academic fields. The art students showed above-average z_{obj} scores and below-average z_{spat} scores, whereas the engineering students showed a score pattern opposite to that of the art students. These results support those of previous studies (Blazhenkova & Kozhevnikov, 2010; Kozhevnikov et al., 2010), in which artists and scientists showed trade-off between the object and spatial imagery types. At the same time, this study also revealed that welfare students showed below-average z_{obj} and z_{spat} scores and that medical students showed above-average values. These results do not correspond to trade-off between the object and spatial imagery types. However, there is evidence showing that professionals in humanities or social science are advantaged in verbal rather than visual imagery processing (Blazhenkova & Kozhevnikov, 2009). Therefore, students majoring in education, welfare, or literature may prefer verbal processing over visual imagery processing. Additionally, many medical skills require both analytic processing (which is involved with spatial imagery) and creative processing (which is closely related to object imagery; Fujioka, 1987). Hence, above-average scores on both z_{obj} and z_{spat} might be obtained by medical students because their educational training requires both analytic and creative thinking. These findings suggest that the relationship between object and spatial imagery types is not necessarily characterized by a trade-off; therefore, trade-off theory is limited to students in departments such as art and engineering.

Furthermore, we also compared the tendencies with respect to object-spatial imagery type among students in seven different academic fields. The results indicated that the art students had the highest z_{obj} scores and that the engineering students had the highest z_{spat} scores among the seven departments. These results reveal that among the seven studied fields, the tendency to use the object and spatial imagery types is the largest among students majoring in art and engineering, respectively. In conclusion, the different patterns of object-spatial imagery type among students in seven different academic fields demonstrated that the students in each department have specialized tendencies in terms of object-spatial imagery type.

In summary, the present study showed that the cognitive style model of object-spatial imagery type is applicable to Japanese college students. Additionally, the differences in imagery type between students in seven different academic fields led us to the conclusion that object-spatial imagery style is closely related to academic curiosity and professional aptitude; therefore, individual imagery type data might be helpful for future interventions involving career guidance and educational training. Recently, a new model of cognitive style (object-spatial-verbal cognitive style) added a verbal dimension to the two imagery dimensions proposed by Blazhenkova and Kozhevnikov (2009). Therefore, additional research on cognitive style, including the verbal type, would be required in order to determine individuals' object-spatial-verbal cognitive styles.

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