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The Relationship between Negative Emotion Perception Bias and Visuo-spatial Representation Ability in Accordance to Aggressiveness Level*

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The purpose of this study was to investigate the relationship between the self-reported aggressiveness level measured by the Korean version of Aggression Questionnaire (K-AQ), and the computerized cognitive tasks (emotion perception task and mental rotation task). Participants were divided into three groups according to their self-reported aggressiveness levels (low-range, middle-range, and high-range), and their performances in the two computerized cognitive tasks were examined. Results demonstrated that in emotion perception task, the low-range K-AQ score group showed a lower bias score toward negative emotion perception compared to middle-range and high-range groups. This suggests that there was an increase in the tendency of participants to show a negative emotional bias to a certain extent with increased level of self-reported aggressiveness, and the level of negative emotional bias seems to be maintained once the aggressiveness level reaches the higher-end of the spectrum. However, there was no significant group difference for the bias score toward positive emotion perception. In mental rotation task, there was a significant group difference in response times, where participants in the middle-range aggression group showed slower response times compared to both low-range and high-range groups. But, there was no group differences in their accuracy rates. This suggests that visuo-spatial representation ability may not be static in nature but it seems to decline to a certain extent in accordance to the aggressiveness level. This exploratory study has examined the negative emotion perception bias and visuo-spatial representation ability in relation to the level of aggression by dividing the aggressiveness level into three levels. The implications of investigating human emotion on a continuous spectrum is discussed.

Keywords: Aggression, emotion perception ability, Visuo-spatial representation ability, Self-reported assessment test

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There exists many different classifications of what we call “emotions”, and aggressiveness is one of the main properties that classifies emotion which has become the center of attention in our recent society. The term “aggression” has many definitions, but in general, aggression is broadly defined as an action that harms others (Berkowitz, 1993; Brehm & Kassi, 1990; Gormly, 1993; Myers, 1990). Since aggression has detrimental effects on personality and social development, numerous studies have been conducted on aggression (Dodge & Crick, 1990; Parke & Slaby, 1983). Some examples of behavioral issues related to aggression are excessive

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drinking, violence, drug abuse, and many of these behavioral problems have become the center of greater problems in society (Locke & Mahalik, 2005). In addition, harmful psychological and physical aftereffects induced by aggression have further aggravated the problem (Henton, Cate, Koval, Lloyd, & Christopher, 1983; Sugarman & Hotaling, 1983). As a result, these aggression induced behaviors in turn have led to greater social maladjustment problems in society (Chase, Treboux, O'Leary, & Strassberg, 1998; O'Leary & Cascardi, 1998; Gouze, 1987; Milich & Dodge, 1984). It is also believed that specifying the characteristics of aggression is important because aggression is closely related to cognitive performance, such as executive function, attention, and emotion perception (Giancola, Moss, Martin, Kirisci, & Tarter, 1996; Micai, Kavussanu, & Ring, 2015; Shields & Cicchetti, 1998).

As described above, it is important to understand the cognitive and psychological characteristics related to aggressiveness in order to understand aggression. The reason for this is that understanding cognitive and psychological characteristics in relation to aggression can be a useful tool in interpreting the underlying data to understand various behavioral problems that may be caused by aggressive tendencies. Cognitive traits related to aggression are thought to be closely related to the process of perceiving external emotional stimuli. This is because individuals with aggressive tendencies are more likely to perceive the external emotional stimuli in a negative way and they tend to detect negative emotional stimuli better than other emotional stimuli. These characteristics are considered to be the typical characteristics related to aggression. However, the aggression related negative emotion perception bias has not been studied extensively as it may accompany ancillary cognitive deficits. In this study, we aim to examine the possibility of reduced emotion perception ability and visuo-spatial representation ability among individuals who are classified as having higher levels of aggression, and evaluate whether reduced visuo-spatial representation ability could be one of the behavior indications of secondary cognitive impairment related to aggression. Moreover, aggressive individuals may show negative emotion perception bias as visually perceiving facial and gestural expressions may be difficult task (Raine, Yaralian, Reynolds, Venables, & Mednick, 2002). Therefore the purpose of this study was to investigate the relationship between emotional perceptual bias and visuo-spatial representation ability in relation to the level of aggression.

In this study, we used K-AQ (Korean Version of Aggression Questionnaire), which is a Korean version of the self-report aggression questionnaire, to measure the aggressiveness level. Two computerized cognitive tasks, called the emotion perception task and mental rotation task, were used to investigate the characteristics of aggression in relation to the cognitive abilities measured by these tasks. In emotion perception task, participants were asked to judge whether the presented stimuli were all the same or different, and this measure can be used to calculate the bias score toward positive and negative emotion perception (Montagne, Kessels, De Haan, & Perrett, 2007; Austin, 2004). Previously, it was reported that the level of aggression is related to the decrease of emotion perception ability, which leads to a bias in emotion perception (Best, Williams, & Coccara, 2002; Fine, Trentacosta, Izard, & Mostow, 2004; Gery, Miljkovitch, Berthoz, & Soussignan, 2009; Hoaken, Allaby, & Earle, 2007; Kret & Gelder, 2013; Sato, Uono, Matsuura, & Toichi, 2009). For example, Best, Williams, and Coccaro (2002) showed that patients with aggressive impulse control disorders have greater difficulty in perceiving negative emotional stimulus more than healthy individuals, and hence have a bias toward negative emotion perception.

For mental rotation task, participants had to determine whether the presented figures were the same or different. Two figures were presented on the computer screen, where one was the standard stimulus and the other was a novel stimulus. Participants had to figure out whether the novel stimulus was the same as the standard stimulus. The novel stimulus was manipulated so that it was rotated in the two or three-dimensional space by a certain degree of the visual angle (Johnson, 1990; Pietsch

& Jansen, 2012; Moreau, Mansy-Dannay, Clerc, & Guerrién, 2011; Parsons, 1987). In general, the visuo-spatial representation ability is measured by the mental rotation task, and such ability is known to be related with general executive function (Miyake, Friedman, Rettinger, Shah, & Hegarty, 2001; Parsons, Larson, Kratz, Thiebaux, Bluestein, Buckwalter, & Rizzo, 2004). The reason for measuring the visuo-spatial representation ability could be found in the Raine et al.(2002). Raine et al. (2002) reported that the reason for the aggressiveness was due to the inability to process information related to the viuso-spatial representation of the stimulus, which will cause the inability to perceive emotions from the facial expressions or body movements of other people. This makes it even harder for them to perceive the negative feedback of the aggressive behavior of the other individuals and thus to correct their behavior precisely. This makes it impossible to perceive the negative feedback of the aggressive behavior of the other individuals and thus to correct their behavior precisely. This could be seen as a reason for sustaining aggressive behavior. Therefore, the visuo-spatial representation ability could be regarded as one of the cognitive characteristics that may be related to the aggressive tendency. Some other studies have also reported that higher levels of aggression are related to the lower ability in executive function (Giancola & Zeichner, 1994; Micai, Kavussanu, & Ring, 2015; Séguin & Zelazo, 2005; Séguin, Boulerice, Harden, Tremblay, & Pihl, 1999; Wood & Liossi, 2006).

Thus, based on the results from previous studies, it is expected that higher levels of aggression will lead to lower performance in these cognitive tasks, and that the higher levels of task difficulty might be associated with greater discrepancy in the performance of individuals. Therefore, the present study aims to confirm the individual characteristics involved in emotion perceptual ability and visuo-spatial representation ability that seems to be in close relation to aggressiveness, which is one of the core properties of emotion. Thus, this study is an exploratory study to examine the relationship between aggressiveness and two computerized cognitive tasks that look at the emotion perception ability and visuo-spatial representation ability.

Method

Participants

A total of 220 participants took part in this study. Thirty-seven participants who failed to comply with the experimental procedures were excluded from the final data analysis. Hence, data from 183 participants were analyzed. The average age of the participants was 22.25 years (SD = 3.64), and there were 135 men and 48 women. Participants were divided into three groups according to their self-reported aggression scores measured by the Korean version of Aggression Questionnaire (K-AQ): 62 participants were assigned to Low-range group (score range: 31-45), 62 participants were assigned to Middle-range group (score range: 46-57), and 59 participants were assigned to High-range group (score range: 58-75). There was a statistically significant group difference in their K-AQ scores ($F(2, 180)=593.723$, $p<.01$). Participants who met any of the following exclusion criteria were not eligible for the study. The exclusion criteria were : 1) Known history of neurological impairment due to a stroke or brain damage, 2) Individuals diagnosed with mental retardation, 3)

Table 1. The number of participants and the scores of K-AQ in each group

	Number of participants	K-AQ score		
		Mean	Standard deviation	Range
Group 1 (low-range K-AQ group	62(male: 48 female: 14)	40.31	3.70	31-45
Group 2 (middle-range K-AQ group)	62(male: 41 female: 21)	51.42	3.28	46-57
Group 3 (high-range K-AQ group)	59(male: 46 female: 13)	64.83	4.69	58-75

Known impairment of major sensory organs, 4) Known history of substance abuse or gambling addiction, 5) Individuals who are unable to participate voluntarily, 6) Individuals with severe medical conditions that may interfere with one's ability to participate in the study. The demographic information and K-AQ scores of each group is described in Table 1. All participants gave informed consent to participate in the experiment.

Self-report aggression questionnaire

The Korean version of Aggression Questionnaire (K-AQ) was used to provide a self-reported measure of participant's aggressiveness level (Seo & Kwon, 2002). This questionnaire, originally developed by Buss and Perry(1992), consists of four sub-scales which include levels of physical aggression, verbal aggression, anger and hostility. The final score of this questionnaire can range from 27 to 135 points, where higher score indicates higher aggressiveness level.

Computerized cognitive task

The first computerized cognitive task that was used is called the emotion perception task, and this task measures the individual's biased emotion perception toward positive and negative facial stimuli (Ekman, 1992; Ekman, 1992; Edwards et al., 2002; Montagne et al., 2007). Participants were presented with 2 to 8 facial stimuli and were told to judge whether the displayed stimuli have all the same or different facial expressions. Participants were given a maximum of 5 seconds to make their judgments and they had to click either the "same" or "different" button on the computer screen using a mouse (Fig. 1). The four experimental conditions according to the presentation of the facial stimuli were as follows: All Positive (AP), All Negative (AN), Positive among Negatives (PN), and Negative among Positives (NP). In addition, the number of stimuli in each experimental condition was 14, and a total of 56 stimuli were presented. All experimental stimuli were randomly presented. The negative emotional bias score was achieved by subtracting the response time of AN from the response time of NP, and the positive emotional bias score was achieved by subtracting the response time of AP from the response time of PN. The negative emotion bias score in this case would indicate that greater attentional shifts were made to negative emotional stimuli among other emotional stimuli. Since attention is focused in identifying the negative stimuli, this in turn leads to relative difficulty in perceiving other emotional stimuli. Therefore, individuals with negative emotion bias would have greater difficulty and have increased response times in identifying whether or not the presented stimuli all belong to the same emotional category. In this study, negative emotion bias is measured by comparing the response times between the conditions where the presented stimuli were all negative (AN condition) versus when the presented stimuli had fewer negative emotions among other emotional stimuli (NP condition). In order to compute this negative emotion bias score, latencies and accuracy rates for AN condition and NP condition are compared instead of comparing AN condition and PN condition. This is because PN condition has more

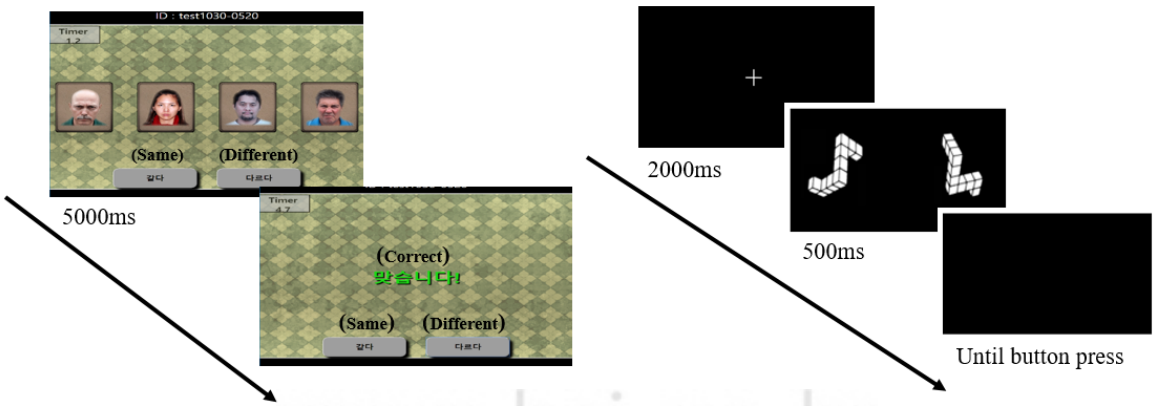

Figure 1. Experimental paradigms of emotion perception task (left) and mental rotation task (right)

negative emotional stimuli than positive emotional stimuli which is inadequate in comparing the individual's response to different proportions of negative emotional stimuli as PN condition has similar proportions of negative emotional stimuli as in the AN condition. The positive emotional perception bias score can also be computed and interpreted in similar ways. Therefore, both negative and positive emotion perception bias scores can be computed from the four experimental conditions in this task. Hence, a bias toward negative emotional stimuli when negative emotional stimuli are presented among the positive ones can be labeled as the negative emotional bias, whereas a bias toward positive emotional stimuli when positive emotional stimuli are presented among the negative ones can be labeled as the positive emotional bias. For example, it will take longer time to judge whether the presented stimuli are all the same or not if we have a negative emotion perception bias as our attention may easily shift toward the negative emotional stimulus. Thus, if you have greater number of negative emotional stimuli presented in a trial, the longer it would take for the individual to judge whether the presented stimuli all belong to the same emotional category. This would indicate that individuals with a higher negative emotional bias would respond to the task much slowly compared to those who do not show such emotional bias. In the same manner, it would also tend to be more time-consuming to judge the positive emotional stimuli in case of the positive emotion perception bias.

The second computerized cognitive task was called the mental rotation task developed by Shepard and Metzler (1974). This task measures one's ability to mentally rotate three-dimensional (3D) figures which is known to be one of the crucial abilities in visuo-spatial processing (Metzler & Shepard, 1974; Johnson, 1990; Pietsch & Jansen, 2012; Moreau et al., 2011; Parsons, 1987). Participants were presented with two 3D figures for 500ms and were told to judge whether these two figures were the same or different by pressing the keyboard button accordingly (Fig. 1). Thus, the experiment condition of this task was degree of rotation, namely in 7 angles (0°, 30°, 60°, 90°, 120°, 150° and 180°). Twenty eight stimuli were presented for each experimental condition, so a total of 196 stimuli were presented to the participants. All experimental stimuli were randomly presented.

Experimental procedure

All participants were given self-report aggression questionnaires first and then proceeded to two computerized cognitive tasks, where the order of the cognitive tasks was counterbalanced among participants.

Results

In the current study, we investigated the results of K-AQ and the performance of each cognitive tasks (emotion perception task and mental rotation task) to specify the characteristics of aggressiveness levels. The first hypothesis of this study was that individuals with higher aggressiveness level would have lower levels of emotion perception ability which related to the ability to recognize and discriminate positive and negative emotional stimuli. Bias score toward emotional stimuli was calculated in order to assess whether individuals with different aggressiveness levels exhibit positive or negative emotion perception bias toward positive or negative emotional stimuli. It is expected that as individual's emotion perceptual ability decreases, the ability to recognize certain emotional stimuli would become biased. The second hypothesis was that individuals with higher aggressiveness level would show a decrease in the ability to perform the mental rotation task, and hence demonstrate a deterioration of visuo-spatial representation ability.

In emotion perception task, a mixed-design ANOVAs were conducted on the accuracy rates and response times for each computerized cognitive tasks: 3 Groups (low-range, middle-range, high-range aggressiveness) by 2 Conditions (positive emotional bias and negative emotional bias). For accuracy rate analysis, there was a significant main effect of condition, where there was a difference in accuracy rates between emotional bias scores for positive and negative emotional stimuli ($F(1, 180)=89.500$, $p<.01$, $\eta_p^2=.332$). Also, although there was

no significant main effect of group, interaction effects between group and condition was statistically significant (F(2, 180)=3.460, p<.05, η_p^2=.037). LSD post-hoc test on the condition main effect showed that the bias score toward positive emotional stimuli was much more prominent than the bias score toward negative emotional stimuli (p<.01). But further post-hoc tests on the interaction effect between group and condition revealed no group differences for each of the emotion bias scores toward positive and negative emotional stimuli. For response time analysis, there were significant main effects of condition (F(1, 180)=246.038, p<.01, η_p^2=.578) and group (F(2, 180)=4.430, p<.05, η_p^2=.047) between the emotional bias scores for positive and negative emotional stimuli. However, the interaction effect between group and condition was not statistically significant (p>.05). LSD post-hoc test on the condition main effect showed stronger emotional bias score toward the negative emotional stimuli compared to the emotional bias score toward the positive ones (p<.01). Even though the interaction effect between group and condition was not significant, post-hoc test on the interaction effect showed a significantly lower negative emotional bias in the low-range aggression group compared to both middle-range and high-range groups (p<.01; p<.01). There was no group difference between the middle-range and high-range aggression groups (p>.05). In addition, there was no group difference in the positive emotional bias scores. All data descriptions are outlined in bar graphs in Table 2, Figure 2 and 3.

In mental rotation task, a mixed-design ANOVAs were conducted on the accuracy rates and response times : 3 Groups (low-range, middle-range, high-range aggressiveness) by 7 Conditions (rotation angle of the object by 0°/30°/60°/90°/120°/150°/180° degrees). For accuracy rate analysis, there was a

Table 2. Performance on emotion perception task for each group. The values indicated within brackets denote standard error

	PN		NP		AP		AN		Emotional bias			
									Negative Emotion (NP - AN)		Positive Emotion (PN - AP)	
	Acc	RT	Acc	RT	Acc	RT	Acc	RT	Acc	RT	Acc	RT
K-AQ (31-45)	0.87 (0.01)	1672 (43)	0.91 (0.01)	1739 (43)	0.99 (0.01)	1577 (40)	0.91 (0.01)	1913 (46)	0.00 (0.01)	-174 (31)	-0.12 (0.01)	95 (27)
K-AQ (46-57)	0.91 (0.01)	1588 (52)	0.92 (0.01)	1595 (54)	0.99 (0.00)	1559 (54)	0.94 (0.01)	1880 (54)	-0.02 (0.01)	-285 (25)	-0.08 (0.01)	29 (27)
K-AQ (58-75)	0.88 (0.01)	1644 (62)	0.91 (0.01)	1683(60)	0.99 (0.00)	1569 (53)	0.90 (0.01)	1977 (63)	0.02 (0.02)	-294 (31)	-0.11 (0.01)	75 (28)

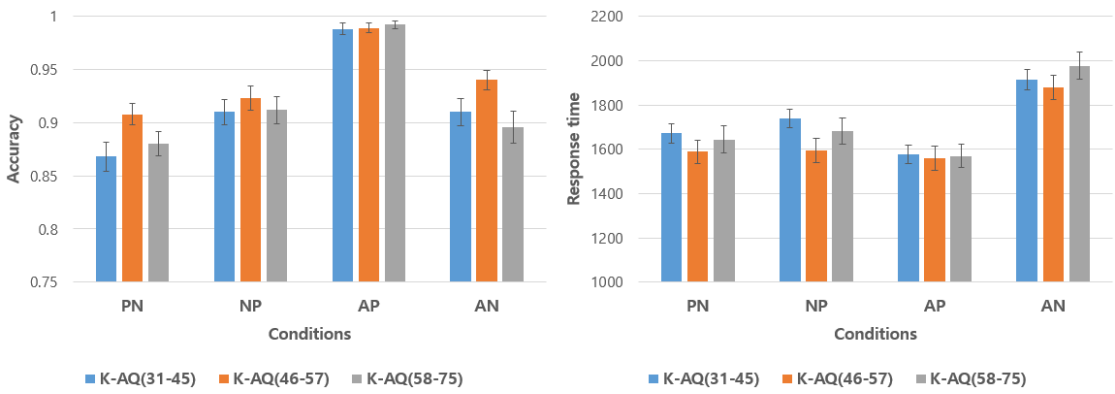

Figure 2. Performance on emotion perception task for each group (left: accuracy rates, right: response times). The line in the bar graph indicates the range of standard error

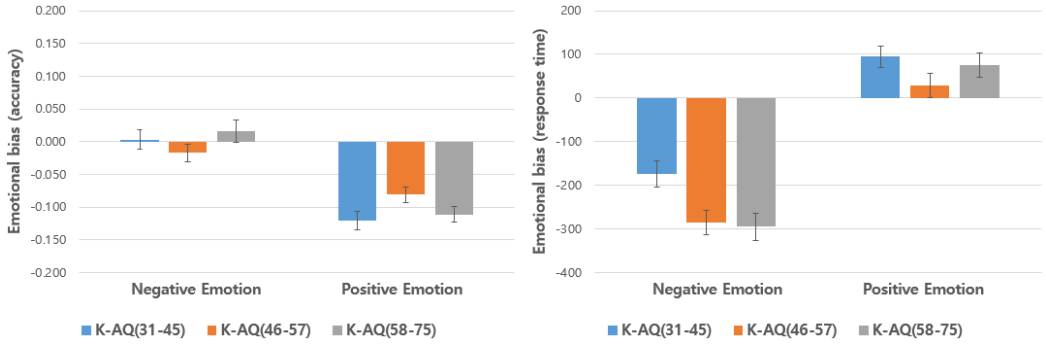

Figure 3. Positive and negative emotion bias scores for each group in emotion perception task (left: accuracy, right: response time). The line in the bar graph indicates the range of standard error

significant main effect of condition (F(6, 1080)=9.321, p<.01, η_p^2=.049). However, there was no significant main effect of group nor interaction effect between group and conditions (p>.05).. Hence, subsequent post-hoc test of the condition main effect was not performed as it was not relevant to the purpose of this study. For response time analysis, a significant main effect of condition was found (F(6, 1080)=2.691, p<.05, η_p^2=.015), and the main effect of group was also statistically significant (F(2, 180)=3.308, p<.05), η_p^2=.035). However, there was no interaction effect between condition and group (p>.05).. LSD post-hoc test on the group main effect showed that middle-range aggression group had a significantly faster response times compared to both the low-range and high-range groups (p<.01; p<.01). LSD post-hoc test on the condition main effect was not performed as it was not relevant to the purpose of this study. The details of the results are displayed in Table 3 and Figure 4.

Table 3. Performance on mental rotation task for each group. The values indicated within brackets denote standard error

	Degree of rotation													
	0°		30°		60°		90°		120°		150°		180°	
	Acc	RT	Acc	RT	Acc	RT	Acc	RT	Acc	RT	Acc	RT	Acc	RT
K-AQ (31-45)	0.59 (0.01)	1258 (48)	0.59 (0.01)	1209 (45)	0.57 (0.01)	1286 (50)	0.54 (0.01)	1282 (45)	0.59 (0.01)	1234 (48)	0.58 (0.02)	1253 (48)	0.56 (0.01)	1253 (50)
K-AQ (46-57)	0.58 (0.01)	1405 (64)	0.59 (0.01)	1385 (64)	0.55 (0.02)	1425 (67)	0.53 (0.01)	1401 (63)	0.59 (0.01)	1388 (65)	0.57 (0.01)	1402 (68)	0.53 (0.01)	1346 (61)
K-AQ (58-75)	0.57 (0.01)	1214 (50)	0.58 (0.01)	1213 (48)	0.55 (0.01)	1207 (46)	0.55 (0.01)	1234 (55)	0.57 (0.01)	1214 (49)	0.57 (0.01)	1234 (49)	0.53 (0.01)	1181 (45)

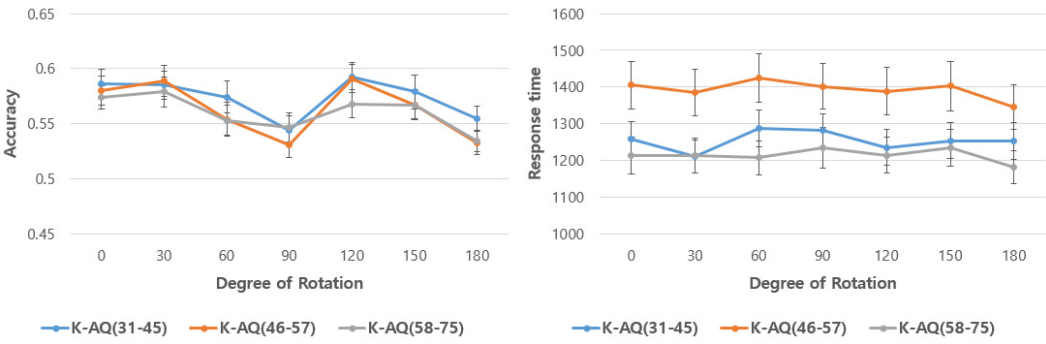

Figure 4. Performance on mental rotation task for each group (left: accuracy rates, right: response times). The line in the bar graph indicates the range of standard error

Discussion

In this study, the relationship between the self-report aggression questionnaire (K-AQ) and computerized cognitive tasks (emotion perception task and mental rotation task) were examined.

In emotion perception task, results revealed that participants in the middle-range and high-range aggression groups showed greater bias toward negative emotion perception compared to those in the low-range group. As the results reported in previous studies, higher aggressiveness level led to an increase in the perceptual bias for negative emotional stimuli. Previous studies such as Best et al.,'s study (2002) investigated the relationship between orbital and medial prefrontal cortices and impulsive aggression by examining the difference in emotion perceptual ability in facial recognition task between the groups of impulsive aggressive patients and aged-matched controls. Best et al.'s study (2002) have indicated that the impulsive aggressive patients who had greater aggressive tendency demonstrated perceptual bias toward negative emotion where they had a tendency in judging neutral faces as having negative emotions. The impulsive aggressive patient group also showed difficulty in recognizing negative emotional stimuli which depicted emotional faces of anger, disgust, or surprise. In relation to this previous results, the current study may be related to such dysfunction of orbital and medial prefrontal circuit that is manifested through self-reported higher levels of aggressiveness. In addition, in a study which examined the facial affect recognition among violent offenders, non-violent offenders and non-offenders according to their aggressiveness levels, they have revealed that the violent offenders groups showed significantly lower performance in determining facial stimuli, hence a deficit in emotion perceptual ability, compared to two other groups (Hoaken et al., 2007). In a study that examined the performance of facial and bodily expressions related to emotion recognition among violent offender and control groups have also revealed that those individuals in the violent offender group showed greater negative emotion perception bias when they were presented with aggressive emotional stimuli (Kret & Gelder, 2013). Similarly, Sato et al, (2009) conducted the facial expression recognition task among the delinquents group, and their results demonstrated that their accuracy rates were significantly lower than those of the age-matched control group. Sato et al. (2009) concluded that individuals in delinquents group had a tendency to misjudge the facial expressions for disgust and angry faces due to the negative emotion perception bias. Gender differences in emotion perception ability have also been reported in studies like Fine et al., (2004), where female adolescent students with higher aggressiveness levels showed a reduced emotion perceptual ability when compared with male adolescent students.

with higher aggressiveness levels.

In mental rotation task, participants in the middle-range aggression group showed lower performance levels compared to those individuals assigned to the other two groups. This result is contrasted to the results reported in previous studies where higher aggressiveness levels were associated with lower ability in visuo-spatial representation. The reason for such difference could be due to the close relationship between visuo-spatial representation ability and the actual physical aggressiveness level reported in previous studies (Berman & Siega, 1976; Virkkunen & Luukonen, 1977; Moffiu, 1990; Richman, Stevenson & Graham, 1982; Feshbach & Price, 1984; Loney, Frick, Mesha, & McCoy, 1998; Speltz, Deklyen, Caldenon, Greenberg, & Fisher, 1999; Owens, Shaw, & Giovannell, 2001). Previous literature have continuously confirmed a relationship between visuo-spatial representation ability and the levels of aggression: Berman and Siega (1976) reported that the verbal-performance and spatial IQ deficits in deliquents when compared to age-matched controls, and Virkkunen and Luukonen (1977) have found not only significant reduction in verbal IQ but also in spatial IQ among individuals who suffered from antisocial personality disorders. Moffitt (1990) have found a significant visuo-motor deficits in individuals with persistent antisocial behavior from the age of three years old. Richman, Stevenson, and Graham (1982) study have also

supported such finding in that persistent spatial and verbal deficits found in children at the age of three, was a significant predictor of them becoming an antisocial children later on. Previous studies have also shown similar results for younger population. Feshbach and Price (1984) have demonstrated that lower spatial ability was associated with increased level of aggression in kindergarten children, and Loney, Frick, Mesha, and McCoy (1998) have reported a spatial IQ deficit of young children (age 6-13 years) who suffered from conduct problems coupled with exhibit callous-unemotional traits. In Spelz, Deklyen, Calderon, Greenburg, and Fisher's study (1999), boys with early onset psychological disorders showed an impairment in visuo-motor performance at the age of 4 to 5 years compared to age-matched controls, and a significant verbal and spatial IQ deficits were also associated with low-income preschool-aged boys suffering from both externalizing problems and attention related problems (Owens, Shaw, & Giovannelli, 2001). Saarinen et al. (2015) have also examined the relationship between aggressiveness and visuo-spatial representation ability in young children, where they have classified children according to the presence or absence of aggression. In summary, these studies have revealed that those group who showed higher levels of physical aggression was involved with lower performance in visuo-spatial representation ability, which in turn suggests a negative correlation between the levels of physical aggression and the ability to visually and spatially represent objects or faces (Giancola & Zeichner, 1994; Micai et al., 2015; Wood & Liossi, 2006).

The results of the current study are comparable to those of the previous studies on a number of dimensions. First, the present study showed a reduction of visuo-spatial representation ability to a certain extent with increased level of self-reported aggressiveness, and this ability seems to be maintained or enhanced once the aggressiveness level reached the higher-end of the spectrum. Results from the mental rotation task showed that there was no statistical difference between the accuracy rates between the experimental conditions but there was a significant difference in the response times analysis, which in turn suggests that the level of aggression seems to be related to the cognitive processing speed associated with the visuo-spatial representation ability. In other words, the level of aggression seems to have an influence on the mechanism that suppresses and controls the processing of visuo-spatial representation. This suggests that if the level of aggression continues to increase, the visuo-spatial representation ability is degraded to a certain extent until it reaches a maintenance level but after such maintenance level the ability is actually enhanced. Hence, this is in line with previous studies in that cognitive factors may play a role in visuo-spatial representation ability in accordance to the levels of aggressiveness. One possible explanation for this result is that those individuals with higher levels of aggressiveness may perceive and react to external emotional stimuli more sensitively in order to detect potential threats from the external environment, which in turn leads to an improvement in visuo-spatial representation ability. This implies that high performance in visuo-spatial representation ability at low- versus high-range aggressiveness states may be reflecting a qualitatively different cognitive processing.

Results from the emotion perception task have shown that there was an increase in the negative emotion perception bias scores in accordance to the increased levels of aggressiveness. However, the negative emotion perception bias scores increased to a certain level of aggressiveness but the bias score was maintained without further increase when the aggressiveness level further increased to the higher-end of the aggression spectrum. Such behavior outcome could be associated with the enhanced visuo-spatial representation ability which adapts individuals to be highly sensitive to their external environments and incoming stimuli, which may in turn raise the overall sensitivity of emotional stimuli.

These results are only partially consistent with the findings reported in previous studies, and the reason behind this could be attributed to the way how the experimental groups were subdivided. The experimental groups in this study were divided according to their

range of aggressiveness levels rather than an all-or-nothing, binary scale (presence vs. absence of aggression). Thus, the incremental differences in the aggressiveness scales may be involved in the differences in cognitive processing of emotion perception and visuo-spatial representation abilities. Previous studies have provided meaningful demonstrations of the intimate relationship between aggression and cognitive abilities according to individual's diagnosis of aggressiveness measured by the presence or absence of aggression. However, perhaps, more in-depth research on the subdivisions of aggressiveness is needed in order to reveal the relationship between aggression and the subtle differences or shifts in cognitive characteristics involved in human emotion discrimination. Since human emotion is a concept that cannot be categorized into a single solid category, but rather lies on a continuum where the level of emotion perception can differ according to different cognitive factors, caution and careful manipulation of the aggressiveness spectrum should be considered when investigating the interplay between aggression and relevant cognitive characteristics that may be involved in emotion perception.

Thus, the present study is meaningful in that it preliminarily explored the possible relationship between the computerized cognitive tasks with different ranges of aggressiveness levels. In particular, this study examined the cognitive factors that may be related to emotion perception and visuo-spatial representation abilities in accordance to different levels of aggression. This study provides an important first step in closely examining the individual differences that may be involved in emotion perception and visuo-spatial representation abilities in relation to a continuous state of aggression which was measured by self-reported aggressiveness scales. Results from this study suggests that the visuo-spatial representation ability can potentially have an influence on the negative emotion perception bias in accordance to individual's aggressiveness levels, and such finding adds a significant value to the study of emotion since it allows for an in-depth understanding of the underlying mechanisms of human emotion perception.

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공격성 수준에 따라 나타나는 부정적 정서지각 편향성과 시공간적 표상 능력 연구

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본 연구의 목적은 공격성 수준을 측정한 한국형 자기보고식 설문 검사(K-AQ)와 전산화된 인지 과제(정시지각과제와 심상회전과제)와의 관련성을 탐구하는 것이다. 실험 참가자들은 K-AQ 점수에 따라 세 집단으로 나뉘어졌으며(낮은 집단, 보통인 집단, 그리고 높은 집단), 각 집단의 두 인지 과제 수행 결과를 비교하였다. 정서지각과제 수행 결과, K-AQ 점수가 낮은 집단이 다른 두 집단에 비해 부정적 정서 지각 편향성이 유의미하게 낮게 나타났다. 이는 공격성 수준이 일정 수준까지 증가할 때는 부정적 정서지각 편향성이 증가하지만, 공격성 수준이 그 이상으로 계속해서 증가할 경우에는 부정적 정서지각 편향성이 더 이상 증가하지 않고 일정하게 유지되었음을 의미했다. 반면에, 집단 간에 긍정적 정서지각 편향성에는 차이가 없었다. 또한, 심상회전과제 수행 결과, K-AQ 점수가 보통인 집단이 다른 두 집단에 비해 과제 수행 시간이 유의미하게 느리게 나타났으며 과제 수행 시 나타난 정답률에는 유의미한 차이가 없었다. 이는 공격성 수준이 일정 수준까지 증가할 때는 시공간적 표상 능력이 저하되지만 그 이후에 공격성 수준이 계속해서 증가하면 시공간적 표상 능력이 향상됨을 의미했다. 결과적으로, 본 연구에서는 기존 선행연구와는 다르게 공격성 수준을 연속적 척도에서 다양하게 나누고 공격성 수준에 따라 변화하는 부정적 정서지각 편향성과 시공간적 표상 능력을 면밀하게 확인할 수 있었으며, 이는 인간의 정서가 연속적 척도 내에 있기 때문에 이와 관련된 인지적 특성에 관한 연구도 연속적 수준 내에서 이뤄져야 함을 의미했다.

주제어: 공격성, 정서 지각 능력, 시공간적 표상 능력, 자기보고형 검사