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## Theory of mind in Koreans with schizophrenia: A meta-analysis

Myeong Ju Song<sup>a</sup>, Hye Im Choi<sup>a</sup>, Seon-Kyeong Jang<sup>a</sup>, Seung-Hwan Lee<sup>b</sup>, Satoru Ikezawa<sup>c</sup>, Kee-Hong Choi<sup>a,\*</sup><sup>a</sup> Department of Psychology, Korea University, Seoul, South Korea<sup>b</sup> Department of Psychiatry, Ilsan Paik Hospital, Inje University, Goyang, South Korea<sup>c</sup> National Center Hospital, National Center of Neurology and Psychiatry, Tokyo, Japan

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## ABSTRACT

Previous meta-analytic studies conducted in Western countries have consistently revealed impairments in theory of mind (ToM) in schizophrenia. However, there is no systematic meta-analytic review of ToM deficits in individuals with schizophrenia in non-Western countries. In addition, ToM impairments in individuals with schizophrenia have not been investigated in the distinctive domains (i.e., verbal vs. visual, or affective vs. cognitive). The current meta-analytic study systematically synthesized 13 studies comparing ToM performance of adults with schizophrenia ( $n=377$ ) and that of healthy controls ( $n=386$ ) in Korea. The results indicate that Koreans with schizophrenia showed overall large ToM impairments ( $d=-1.273$ ) but intact performance in control tasks that require a similar amount of cognitive demand as ToM tasks do. Large impairments in affective and cognitive ToM ( $d=-1.445$  and  $-1.202$ , respectively) and verbal and visual ToM ( $d=-1.239$  and  $-1.221$ , respectively) were found in Koreans with schizophrenia. There were no differences in magnitude between affective and cognitive ToM or between verbal and visual ToM. These results suggest that Koreans with schizophrenia experience substantial impairments in various ToM domains. Comprehensive multi-modality-based assessment targeting various ToM domains should be considered for treatment planning of individuals with schizophrenia.

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## 1. Introduction

Theory of mind (ToM) refers to the representation or mentalization of the mental states of others, and is considered essential for predicting the thoughts, feelings, and behaviors of others (Corcoran et al., 1995). Impairment in ToM is a key characteristic in individuals with schizophrenia, and interferes with successful social integration (Roncone et al., 2002; Brüne, 2005). Previous meta-analytic studies consistently reported moderate to large impairments in ToM for individuals with schizophrenia in Western countries (mean effect size  $d=1.21$  in Sprong et al. (2007);  $d=0.99$  in Bora et al. (2009b);  $d=0.88$  in Chung et al. (2014)).

Despite evidence supporting the role of culture in the development of social cognition including ToM (Bandura, 2002), to our knowledge, there is no systematic meta-analytic review of ToM in non-Western samples with schizophrenia. Given that social cognition, including

Abbreviations: ToM, theory of mind; RISS, Research Information Sharing Service; PANSS, Positive and Negative Syndrome Scale; ES, effect size

\* Correspondence to: Department of Psychology, Korea University, Liberal Arts Building, Sungbuk-Ku, Anam-Dong, Seoul 136-701, South Korea. Fax: +82 2 3290 5390.

E-mail address: [keehongchoi@gmail.com](mailto:keehongchoi@gmail.com) (K.-H. Choi).

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ToM, is culture-sensitive (Liu et al., 2008), it is essential to investigate whether ToM impairments reported in Western samples with schizophrenia are also characteristic of non-Western samples.

Korea has a collectivistic orientation where social support, especially family support, is crucial to enhance social cognitive development (Kim and Park, 1999). Compared to Western countries, many Koreans with schizophrenia depend more on their family members for living than on residential psychiatric rehabilitation facilities (Kim et al., 2010). Unfortunately, individuals with schizophrenia in Korea have low levels of societal and familial network and support (Han et al., 1996). As compared to other OECD countries, Korea has a longer inpatient hospitalization system and hospital detention policy (varying from 65 to 271 days per year, based on the Korean National Health Insurance data, 2006). Furthermore, involuntary hospitalization rates among inpatients in Korea have been reported as high as 89.3% (Jang, 2010, unpublished thesis), compared to the 3.2–30% in European Union countries (Salize and Dressing, 2004). This high rate implies not only a lack of social support but also impairs adaptation to the community after discharge (Brugha et al., 1993). Furthermore, the high rates of recurrent hospitalization (28.3%) of Koreans with schizophrenia suggest that these patients are less likely to develop and maintain consistent and meaningful societal connections, including

occupational functioning, and thus are less likely to engage in social interactions to practice, apply, and validate ToM in real life.

Recent studies in cognitive neuroscience have revealed distinctive components of ToM related to its cognitive (i.e., knowledge about beliefs) and affective (i.e., knowledge about emotion that demands empathetic understanding) aspects (Baron-Cohen and Wheelwright, 2004; Kalbe et al., 2007, 2010; Shamay-Tsoory et al., 2007). However, a comparison of cognitive and affective ToM impairments has not been fully incorporated into analyses in schizophrenia research, even though various current ToM measures used in such research involve a combination of ToM components, including cognitive and affective aspects (Shamay-Tsoory et al., 2007). For example, the faux-pas recognition task includes affective mental state questions (e.g., “Why shouldn’t the individual in the story have said what they did?”) as well as cognitive mental state questions (e.g., “Did anyone say something they shouldn’t have said?”) (Stone et al., 1998, 2003; Abu-Akel and Abushualeh, 2004).

These various ToM components have led to somewhat mixed findings. Kim et al. (2008) reported comparable ToM impairments in individuals with schizophrenia and healthy individuals on both cognitive ( $d = -1.36$ ; hinting task and metaphor task) and affective ( $d = -1.36$ ; irony task) measures. In contrast, another study revealed larger impairments in the affective components of the faux-pas task ( $d = -2.20$ ) than in a cognitive task ( $d = -1.28$ ; false belief task; Shin, 2004, unpublished thesis).

As Bora et al. (2009a) have pointed out, different studies have modified individual ToM tasks; for example, the false belief task varies in terms of the number of stories and method of presentation (e.g., verbal vs. visual). Some studies have used story-based false belief tasks (Frith and Corcoran, 1996); others have used animation-based false belief tasks (Samson et al., 2007; Horan et al., 2009; Bell et al., 2010) or cartoon tasks (Brüne, 2003). Few studies have investigated the method of presentation (i.e., verbal vs. visual) of ToM tasks, which could affect task performance.

Sprong et al. (2007) reported that ToM impairments were modulated by types of psychiatric symptoms (disorganized symptoms vs. other psychiatric symptoms), types of tasks (i.e., first-order and second-order false belief tasks and deception task, comprehension of indirect speech, intention inference task), and methods of presentation (i.e., verbal or non-verbal). In another study, Bora et al. (2009b) replicated these modulations by task type (i.e., false belief task, hinting task, eyes test) and phase of illness (in remission, acute phase). Most recently, Chung et al. (2014) compared ToM impairments in schizophrenia between cognitive (strange stories, faux pas) and affective (eyes test) tasks and found a trend towards significant differences between the two domains.

Most recent meta-analytic studies on schizophrenia consistently reported no moderation effects of demographic characteristics (e.g., age, gender ratio, education) on ToM performances (Bora et al., 2009b; Chung et al., 2014). It is of interest whether the null effect of demographic characteristics on ToM in Western countries would be replicated in Korean patients with schizophrenia.

Thus, it is essential to investigate ToM impairments in Koreans with schizophrenia with reference to different ToM components (i.e., verbal vs. visual presentation and cognitive vs. affective components). In the current meta-analysis, we aimed to (1) investigate to what extent Koreans with schizophrenia show ToM impairments, (2) investigate the ToM impairments with reference to various factors (i.e., methods of presentation and affective vs. cognitive components), and (3) examine the role of potential moderators, such as demographic characteristics.

## 2. Method

### 2.1. Study selection

Potentially relevant articles were searched using PubMed and the Research Information Sharing Service (RISS) for the period between January 1980 and April 2014. The following search terms were used as key words in Korean and English: (“theory of mind,” “mentalizing,” or “ToM”) OR (“false belief,” “faux pas,” “eyes,” “hint,” “deception,” “desire,” “intention,” “cartoon,” “irony,” or “metaphor”) AND (“schizophrenia,” “psychosis,” or “schizo”). The reference sections of articles located from all searches were studied for relevant citations.

### 2.2. Inclusion criteria

Two hundred and forty-two reports were identified and examined according to the following criteria: (1) studies should include a Korean sample and be published in Korean or English; (2) studies should be composed of adults with diagnoses of schizophrenia or schizoaffective disorder according to standardized diagnostic criteria (DSM or ICD); (3) studies should include a comparison group with healthy controls; (4) tasks should include at least 3 items for minimum reliability (Bora et al., 2009b); and (5) studies should report means and standard deviations, or  $F$  and  $t$  values. These criteria excluded 229 studies, resulting in a final 13 studies (Fig. 1).

### 2.3. Coding of variables

Information on the following variables was extracted: (a) name of authors and year of publication; (b) number of participants and ratio of males; (c) demographic variables (age, duration of education), (d) clinical variables (age of onset, duration of illness, Positive and Negative Syndrome Scale [PANSS] score, dosage of medication) and IQ scores; (e) means, SDs, and calculated effect sizes (ES) of the subscales, as well as the component (i.e., cognitive, affective, verbal, and visual) and total scores of individual tasks; and (f) reported reliability of the Korean version of the ToM tasks. All study characteristics were coded independently by the authors for a subsample of 25% of studies, and cross-checked the rest of the studies by the Korean authors to ensure reliability of extraction of study characteristics; the results of this coding had high inter-rater reliability (100%) (Table 1).

### 2.4. Theory of mind tasks

The types of ToM task were divided into five categories based on Bora et al. (2009a). The first category was false belief and deception tasks (Frith and Corcoran, 1996; Mazza et al., 2001); a “first-order false belief task” demands the ability to appreciate that a character’s belief differs from one’s own belief in a short story, while a “second-order false belief task” requires the ability to infer false belief of one character about the false beliefs of another character. The second category consisted of stories or picture sequencing tasks that included the false belief task. The third category included character intention tasks, which require the inference of intention from information contained in a short story (Sarfati et al., 2000). The fourth category included indirect speech tasks, which require an understanding of indirect speech, such as irony or metaphor (Langdon et al., 2002; Corcoran and Frith, 2003). The final category of tasks comprised the eyes test measures, which test the ability to reason about others’ mental states from presented pictures of others’ eyes (Baron-Cohen et al., 1997; Kington et al., 2000), and the social animation tasks, such as the social attribution test, which demand attribution of a mental state to an interacting moving object (Klin and Jones, 2006; Bell et al., 2010). The ToM tasks listed above can also be divided into two components (cognitive vs. affective) according to the nature of the task (Shamay-Tsoory et al., 2007) (Table 2).

### 2.5. Statistical analyses

The effect size (ES) was calculated for this meta-analysis. For present study purposes, the  $d$  score was defined as the standard deviation of the differences between ToM task performances. The formulas from Glass (1977) were used to calculate  $d$ . The pooled standard deviation was calculated using Rosenthal’s formula (Rosenthal et al., 1994). To be consistent with previous meta-analytic studies conducted in Western countries (Sprong et al., 2007; Bora et al., 2009b; Chung et al., 2014), a pooled ES of each domain (e.g., cognitive vs. affective, verbal vs. visual) was calculated for studies that employed more than one ToM task. By expressing ES in standard deviation units, a direct comparison of outcomes can be made across studies. Effects were categorized as small ( $d = 0.2–0.4$ ), moderate ( $d = 0.5–0.8$ ), or large ( $d > 0.8$ ; Glass et al., 1981). All effect sizes were expressed in such a way that negative values indicated impairments. For the meta-analyses, a mixed-effects model was used (Lipsey and Wilson, 2001). A set of SPSS Version 18.0 (SPSS, Inc., Chicago) macros developed by David Wilson (Lipsey and Wilson, 2001) was used for categorical moderator analyses and weighted regression analyses. The

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