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Testing the Empathizing-Systemizing theory in the general population: Occupations, vocational interests, grades, hobbies, friendship quality, social intelligence, and sex role identity

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ABSTRACT

The Empathizing–Systemizing (E–S) theory holds that our ability to understand people and to understand lawful systems account for individual differences in a host of cognitive, social and personality factors. However, evidence concerning variation within the nonclinical population is scarce. The present study tested the theory's central predictions concerning occupations, vocational interests, grades in mathematics and physics, hobbies, friendship quality, social intelligence, and sex role identity in a large sample (N = 3084). For most factors, the results were in line with the E–S theory, and empathizing and systemizing accounted for sex differences almost completely. However, there were also important differences between those who were strong on both empathizing and systemizing, and those who were weak on both. The High–High group shared many of the strengths of those in whom one dimension dominated. The present results provide strong support for the explanatory power of the E–S theory in explaining individual differences in cognition, personality, and social characteristics in the normal population, but highlight the importance of studying different combinations of empathizing and systemizing.

1. Introduction

What unites individual differences in our sensitivity to recognize people's moods, to imagine what an object looks like from a different angle, and our interest towards mathematics? According to the Empathizing–Systemizing (E–S) theory, these characteristics, and many more, are expressions of two fundamental dimensions of thought: empathizing and systemizing (Baron-Cohen, 2002; Baron-Cohen, Richler, Bisarya, Gurunathan, & Wheelwright, 2003). Empathizing is the interest and ability to understand the mental states of others and to react to them appropriately (Baron-Cohen et al., 2003). According to E–S theory, this dimension accounts for traits such as sensitivity to facial expressions and the ability to maintain altruistic reciprocal relationships. Systemizing, in turn, is cognition specialized for analyzing, constructing, and predicting the actions of systems that reliably follow rules (Baron-Cohen, 2002, 2008). It has been suggested that systemizing involves talent in mathematics and physics, spatial skill, and a general interest towards how things work (Baron-Cohen, 2002, 2008).

While E–S theory assumes that empathizing and systemizing are normally distributed, few studies have tested its predictions in the normal population. The theory originates as an explanation for autism spectrum disorders (ASD), arguing that ASD are the result of extremely poor empathizing combined with extremely strong systemizing. This idea is well supported by research (Baron-Cohen & Wheelwright, 2004; Baron-Cohen et al., 2003; Wheelwright et al., 2006). However, to assess E–S theory, it is crucial to test whether it also accounts for cognitive and personality differences in the normal population. Here, we examined the relationships between empathizing, systemizing and a host of their proposed correlates, including occupations, vocational interests, grades, hobbies, friendships, social intelligence, and sex-role identity. For some of these predictions, evidence has started to accumulate, and the obtained results have predominantly been in line with the theory, but many questions remain.

For instance, a link between E–S variables and occupations has been demonstrated, with people working in the physical sciences or with technology showing strong systemizing and weak empathizing, and people in the humanities showing weak systemizing and strong empathizing (Wakabayashi et al., 2006; Wheelwright et al., 2006). However, it is not clear that the humanities should be the fields most favored by high empathizers, as these fields may involve more working with literary sources than with people. Instead, fields such as education and psychology may involve more human contact. Likewise, it is not clear that physical and technical occupations should be the only ones favored by high systemizers, as E–S theory posits that systemizing may be directed towards a range of domains, including also natural systems (tides, weather etc.), abstract systems such as mathematics, and legal and other social systems (Baron-Cohen, 2002). Thus, we investigated a

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broader range of occupations and also vocational interests for working with people and with things.

Regarding interests and hobbies, a positive relationship has been found between self-assessed systemizing, and technical and other "nerdy" interests (Caldwell-Harris & Jordan, 2014; Nettle, 2007). However, the relationship between empathizing and interests is not known.

Nettle (2007) reported that empathizing is positively related to having a larger number of friends, but whether empathizing is also related to the quality of friendships is currently not known. Thus, we investigated whether high empathizing is related to greater satisfaction with friendships, and to greater social intelligence, as the theory predicts.

1.1. Overspecialized or multitalented?

Much of the E–S literature has looked at the difference in empathizing and systemizing scores and classified people as having a more empathizing, more systemizing, or balanced "brain type" (Baron-Cohen, 2002; Goldenfield, Baron-Cohen, & Wheelwright, 2005). Baron-Cohen et al. (2003) assert that there is a trade-off, whereby empathizing and systemizing compete in the brain, implying a negative correlation between E and S scores. However, it seems that this only applies to the clinical population and their relatives (Wheelwright et al., 2006). In the normal population, the two dimensions tend to be independent and high empathizing and systemizing may not exclude each other (Morsanyi, Primi, Handley, Chiesi, & Galli, 2012; Nettle, 2007; Voracek & Dressler, 2006). Thus, it may be fruitful to investigate the two dimensions separately.

The possibility that there is no trade-off opens up the question of variation within the "balanced brain type". The balanced group ranges from people with high interest and talent for both systemizing and empathizing, to people low on both factors, but the meaning of this variation has so far been left unexplored. Goldenfield et al. (2005) calculated people's positions on this continuum, but limited their analysis to noting that there were no sex differences in its distribution. Similarly, Wright and Skagerberg (2012) noted that empathizing and systemizing occur in a range of combinations. However, neither of these studies analyzed whether different combinations of empathizing and systemizing were related to any other characteristics. The E–S theory predicts that the highest achievements in, for example, mathematics, should be found among those with high systemizing combined with low empathizing. Conversely, the warmest social relationships should be found among those with high empathizing but low systemizing. However, might these characteristics not also be found among those who are strong on multiple dimensions? To test for inter-group variation within the balanced brain group, we compared the Low–Low, High–High, and two low–high combinations.

Finally, we investigated the role of empathizing and systemizing for sex differences. E–S theory holds that empathizing and systemizing are biologically determined (Baron-Cohen, 2008) and that different distributions of empathizing and systemizing among men and women largely account for any population level cognitive sex differences (Baron-Cohen, Knickmeyer, & Belmonte, 2005). In line with this assertion, the profile in which systemizing is relatively stronger than empathizing, is called the "male brain type", and the opposite is called the female brain type. The profiles with more marked asymmetries between the dimensions are called the "extreme" male and female brain. Sex differences in self-rated empathizing and systemizing have been reliably demonstrated (Wakabayashi et al., 2006; Wheelwright et al., 2006), but more evidence is needed to show that they mediate other sex differences as the theory suggests.

In addition, how empathizing and systemizing relate to identifying with traditionally gendered attributes is not known. If one is more strongly geared towards empathizing than systemizing, we can easily set the hypothesis that one will identify more with traditionally feminine traits, such as being caring and considerate. Whether traditionally masculine attributes, such as being confident and strong, are related to a "male brain" profile, is also an interesting question.

2. Method

2.1. Participants and procedure

The participants were 3084 Finnish volunteers (65% females; mean age 28 years, $SD = 8.87$, range 15–69). Twenty-seven percent were working, 64% were students, and 9% were otherwise occupied. Recruitment was via open internet discussion forums, student mailing lists, and from a volunteer participant pool. No exclusion criteria were applied. The participants were told that the study concerned thinking and personality, given three weeks to fill in the online questionnaire, and received a thinking style profile as compensation.

2.2. Measures

2.2.1. Empathizing and systemizing

We used the short, 15-item version of the Empathy Quotient (EQ) scale (Muncer & Ling, 2006) and the short, 18-item version of the Systemizing Quotient (SQ) scale (Ling, Burton, Salt, & Muncer, 2009). The reliabilities (Cronbach's α) were .81 and .85. We used the original scoring whereby the 4-point response scale is converted into scores of 0, 0, 1, and 2. This scoring method yielded variables that were nearly identical (EQ: $r = 98$, SQ: $r = .96$)) to variables formed using traditional scoring (1–4). Following Wakabayashi et al. (2006), we calculated "brain type" scores by subtracting standardized EQ scores from standardized SQ scores. Combined scores were calculated by adding standardized EQ scores to standardized SQ scores.

2.2.2. Proposed correlates

Participants selected the field that they were occupied in or studying from a list of 22 options. The following eight fields were chosen to test our hypotheses: education, psychology, social sciences (including in Finland social work, sociology etc.), law, humanities, the exact sciences (pooled from physics, chemistry, astronomy, mathematics), other natural sciences (pooled from biology, earth sciences, environment), and IT and technology. For vocational interests, we developed a scale based on Su, Rounds, and Armstrong (2009). The participants were asked to rate how important the following themes are in their work or study: 1) Data, 2) Ideas, 3) People (interpersonal processes, for example helping, educating, informing, service, entertaining, sales, or motivating), or 4) Things (e.g., machines, materials, or tools as the focus of the job, not only as instruments). Only information about people and thing orientation were used. Next, the participants rated whether they were interested in 24 hobbies. Based on Rubinstein and Lansisky (2013) and Statistics Finland (http://www.stat.fi/til/akay/kat.html), we evenly selected hobbies that are preferred more by men (e.g., cars, TV sports, computers), more by women (e.g., fashion, romantic movies, theater), and gender-neutral (e. g., museums and exhibitions). We calculated the proportions of a participant's feminine and masculine hobbies out of that participant's total number of reported hobbies. In addition, we used the 6-item ($\alpha = .82$) Friendship Scale (Hawthorne, 2006), the 21-item ($\alpha = .90$) Tromsø Social Intelligence Scale (Silvera, Martinussen, & Dahl, 2001), the 20-item Bem Sex Role Inventory (SRI; Bem, 1981) with subscales on traditionally masculine ($\alpha = .84$) and feminine characteristics ($\alpha = .89$), and the participants indicated their last school grades in mathematics and physics.

3. Results

3.1. Exploratory analyses

The EQ and SQ were independent of each other (for women: $r = -.05$, $p = .04$; men: $r = .03$, $p = .40$). Table 1 shows the partial