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A Quantitative Exploration of Gender Identity as a Potential Predictor for the Empathetic and Systematic Thought Processes of a Child

By Tonisha Hazledine

Supervised by: Jennifer McGahan   April 2019

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ABSTRACT

The sex differences amongst human beings have roused a vast scope of psychological research, evaluating their contribution to abilities, behaviour and cognition. Baron-Cohen (2002) offered a new context to these differences, suggesting that the female brain is driven by empathy, whilst the male brain is driven by systemising, even as a child. The present study looks to explore whether gender identity – masculinity or femininity – can be used to predict the empathetic and systematic thought process of children, more accurately than biological sex alone. The Combined Empathy and Systemising Quotient (Baron-Cohen et al., 2009) was administered to 121 parents of a 3 to 7-year-old child, alongside the Pre-School Activities Inventory (Golombok and Rust, 1993), establishing a score of empathy, systemising, masculinity and femininity. These variables, alongside age and biological sex, were subject to a series of analyses, each assessing their potential influence on the cognition of a child. Ultimately, the analysis highlighted an inability to significantly predict empathy scores using each of the variables presented. A similar pattern was revealed for systemising, with the presentation of age as the only significant predictor of systemising scores. The effectiveness of the research is discussed, alongside its place in informing future studies.

KEY WORDS:	EMPATHY	SYSTEMISING	GENDER	SEX	CHILDREN

Introduction

The expressions 'sex' and 'gender' are often used interchangeably, with an intensified confusion of their differentiation becoming apparent over recent decades (West and Zimmerman, 1987). Psychological practice has deemed the two distinct, defining 'sex' as a biological variable, built by the "chromosomes, genes and hormones" of an organism (Unger, 1979:1085), whilst 'gender' is interpreted as a social construction which reflects the attributes of one's sex in accordance to perceived normative behaviour (West and Zimmerman, 1987). The biological components of sex are determined by nature at the point of conception, however the title is classified by members of society strictly on the grounds of "procreative function" (Oakley, 1985:16) and is treated as oppositional categories: male or female (Eckert, 1989). According to Goffman (1976) gender identity is an interactional depiction of what society wishes to convey about the relevant sex, for example mannerisms, interests and behaviours – though, gender is said to not be something in which we have, more something that is performed (Butler, 1990). In harmony of sex, gender is typically presented as masculine or feminine. It has been proposed that though gender attributes may correspond to the binary depiction of sex, gender may in fact be the subject of individual development. Heilbrun (1976) discussed the possibility of people developing both masculine and feminine qualities regardless of their biological status, termed psychological androgyny (Bem, 1974). It is therefore suggested that confusion amongst the terms sex and gender, "may obscure analyses of the origins of sex-related differences and the processes which maintain them" (Unger and Crawford, 1993:123), hypothetically presenting gender as a more accurate contributor to supposed sex differences.

From an anthropological perspective, however, it is well established that there are physical differences between the sexes which contribute to a sexual division of society (Delphy, 1993), extending to the neuroanatomy and cognition of males and females even at an early age (Geary, 1995; Kimura, 1999). Further to this understanding, the newly found context of sex and gender has led to an increasing interest in their interaction with behaviour. Kimura (1999) stated that observations have informed research of higher aggression in males, shown as far back as childhood where rough-and-tumble play is more prominent compared to that of females. Similarly, boys appear to be more likely to endorse competitive behaviour, valuing social status with higher importance than intimacy and strong relationships (Knight and Chao, 1989). The sex differences continue into intellect, whereby major differences are said to be found in patterns of ability. Males appear to perform better on particular spatial tasks, including rotation or manipulation of objects, outperforming females in mathematical reasoning tasks and accuracy of target-directed motor skills (Kimura, 1999). On the other hand, Kimura continued with suggestions that females are more inclined to excel on tasks which include word recall, identifying matching items and tasks of fine motor precision, such as placing pegs into designated holes. Research has furthermore relayed this pattern to subject choice of A-Levels, by which science subjects were perceived by students to be masculine choices, whilst arts and languages were feminine. In turn, male students showed bias in their choices of subjects – those who chose masculine subjects exclusively, were more inclined to encourage traditional sex role behaviour (Whitehead, 1996).

Continuing on from sex differences in behaviour, Baron-Cohen (2002) offered a new dimension, proposing that in addition to differences in the conventional notions of

verbal and spatial ability, the elements of 'empathising' and 'systemising' may be of assistance to the understanding. He defined empathising as the "drive to identify another person's emotions and thoughts", responding to them "with an appropriate emotion", whereas systemising is the "drive to analyse the variables in a system, to derive the underlying rules that govern [its] behaviour" (Baron-Cohen, 2002:248). Systemising is said to be an inductive process, working with phenomena that is ultimately deterministic, lawful and finite, though Baron-Cohen (2002) states that it is of no use for the prediction of human behaviour, in which empathy is vital. He suggests that whilst empathy is our most influential method of comprehending the social world, systemising is the most powerful way to understand the "law-governed" universe that is inanimate. The two are similar in that they are processes which enable our understanding and prediction of events, though they are solely different types of practices, ultimately posing as opposite. Baron-Cohen (2002) associates the female brain entirely with an empathising cognitive profile, expressing that females, on average, spontaneously and instinctively empathise to a larger extent than do males. Conversely, he states that the male brain is typically pre-set to a systemising domain, of which is significantly stronger than any empathetic abilities.

The Empathy Quotient (EQ) and Systemising Quotient (SQ) were developed by Baron-Cohen et al. (2003) to assess trends of sex-typical behaviour in adults. The questionnaires were presented in a self-report Likert format, containing statements about experiences and interests of a real-life context, of which entailed empathising or systemising skills. The results reinstated the previous claims made by Baron-Cohen (2002), highlighting a significant sex difference between scores of empathy and systemising – females scored notably higher on the empathy quotient and males

scored notably higher on the systemising quotient. Following the previous mentioning of sex differences in A-Level choices, it is apparent that the EQ and SQ scores are more accurate in predicting career choice (Billington et al., 2007), therefore suggesting that differences in aptitudes and interests may reflect a person's cognitive form. Baron-Cohen et al. (2009) later adapted this research to establish whether the same pattern could be found amongst children. The two questionnaires were combined and adapted to create a child suitable scale (Combined EQ-C and SQ-C). Alike the adult measure, the questionnaire considered preferences and engagement in particular activities associated with empathising and systemising, typical to children – Baron-Cohen et al. (2009) importantly stated that some questions mentioned relatively rare behaviour, such as physical aggression or reaction to death of a television character, though this was fundamental in establishing either ends of the empathising and systemising spectrums. The new questionnaire was presented in a parent-report format and administered to 1,256 parents of 4 to 11-year-old children. The combined quotient showed to be successful in its aims, highlighting the same sex differences in empathy and systemising scores amongst children.

Findings from the Combined Empathy and Systemising have been supported by numerous accounts of research, all concluding that females show stronger skills of empathy, whilst males show stronger skills of systemising. This is said to be shown as far back as birth, whereby female babies have showed a stronger inclination for social stimuli, even at 24 hours old (Connellan et al., 2000), immediately making more eye contact after birth (Hittelman and Dickes, 1979), at 12 months (Lutchmaya et al., 2002), 2 years and at 4 years of age (Podrouzek and Furrow, 1988). Furtherly, McClure (2000) conducted a meta-analysis which revealed a higher interest or ability

in facial expressions than infant boys; even in toy preference, girls appear to typically favour toys with life-like features (Alexander and Hines, 2002). Furthermore, using the Children's Communication Checklist, a measurement of social relationships determined that girls show better quality relationships at just 48 months (Knickmeyer et al., 2005), which is additionally observed in adults, whom show a tendency of reporting more intimate relationships than do males (Baron-Cohen and Wheelwright, 2003). Adding to the findings of empathy in female children, girls have been said to be better at assessing the feelings and intentions of fictional characters (Bosacki and Antingston, 1999), distinguishing between the appearance and reality of emotion (Banjeree, 1997). Hoffman (1977) identified that when witnessing a distressed person, females tend to exhibit more comforting and sympathetic vocalisations. Research using the Embedded Figures Test (EFT) to measure attention to detail and field independence highlighted males to have higher scores (Nebot, 1988). Likewise, at 3 to 4 months old, boys showed a greater ability of mental rotation than girls (Quinn and Liben, 2008) and at 5 months old (Moore and Johnson, 2008), both considered to be features of systemising behaviour.

Whilst most research focuses on sex differences, Unger (1979:1086) considered that gender may in fact be a more beneficial predictor of behaviour than biological sex, as previously stated. It is for this reason that the present study aims to replicate previous findings, though using masculinity and femininity as predictor variables. To establish a score of femininity and masculinity for each child, the Pre-School Activities Inventory (PSAI) (Golombok and Rust, 1993) was administered alongside the Combined EQ-C and SQ-C (Baron-Cohen et al., 2009). According to Kohlberg (1966), infants are able to categorise sex at around 2 years of age and acknowledging their own gender at

around 3 years old, including the expression of sex role behaviour at only 4 and 5 years old (Mussen, 1969). The critical stage for development of gender appears to be around 2 to 5 years old, whereby labels become distinct and are almost fully rigid by 7 years old (Martin and Ruble, 2004). This includes adopting feelings towards gendered toys, activities and even professions, eventually shaping long-term interests and skills (Trepanier-Street and Romatowski, 1999). The PSAI was developed by (Golombok and Rust, 1993) to reliably assess gender role behaviour in young children, also presented as a parent-report Likert scale, aimed at parents of 1 to 5-year-old children. In consideration of the age in which gender development persists, alongside the target age of each questionnaire, it was decided that for the forthcoming study, a sample containing children aged 3 to 7 years of age would be most effective. The items contained various toys, activities and behaviours that are stereotypically associated with each sex, whereby parents were requested to state how often their child participated in such manners. A significant difference was found between scores of masculinity and femininity and biological sex, showing that males are typically masculine in their behaviour, whilst females are typically feminine. In the context of this study, sex and gender identity were analysed in relation to empathising and systemising to establish whether it is gender that informs stereotypical behaviour.

It has been noted, however, to consider the implications of the two measures. Hyde (2005) stressed the significance of context when assessing behaviour. Mothers are judging traits, skills, strengths and weaknesses over a long period of time, presenting a potential bias in responses (Baron-Cohen et al., 2009). Todd et al., (2016) reflected on the literature of gendered play differences, suggesting that most accounts involve interaction with or in proximity of the parent. A meta-analysis of research which

examined parents' socialisation of boys and girls, have also found signs of parental reinforcement of sex-typed activities (Lytton and Romney, 1991). Sex differences in preferences of toys have been discovered in 'play alone' conditions (Lamminmäki et al., 2012), yet the parents were often in the same room, occasionally sitting nearby.

Much research on gender in comparison to sex differences appears to be decades old, suggesting a large gap in literature regarding its importance. This study attempts to rediscover its potential influence on behaviour, using it to predict well established differences of cognition in males and females. In doing so, it may present the opportunity to explore gender identity and its development further, disregarding many assumptions that we are driven by our biological status.

Research Questions:

Does gender identity predict how empathetically or systematically inclined a child is? Does gender identity act as a more accurate predictor to empathetic or systematic thinking than biological sex in children?

Hypotheses:

In accordance of previous literature surrounding this area of study, it is supposed that the present research will find:

A) A significant positive correlation between both femininity and empathy, and masculinity and systemising.

B) Gender identity will significantly predict scores of empathising and systemising, showing a stronger significance than biological sex.

Method

Design

A non-experimental, within-subjects design was implemented. Each participant completed the Pre-School Activities Inventory (Golombok and Rust, 1993) and a combined version of the Empathy Quotient and Systemising Quotient (Baron-Cohen et al., 2009). Multiple conditions and the use of a control group was not necessary for this project.

Ethical Considerations

Prior to data collection, an outline of this project was reviewed by the ethics team at Manchester Metropolitan University Psychology Department, who later granted ethical approval (see appendix 3).

Informed consent was obtained (see appendix 4) before participation. Each participant was provided with a downloadable consent form and information sheet, which contained a full brief of the research and their consent (see appendix 5).

Anonymity was also maintained throughout, though participants were given the opportunity to create a unique code to identify their response if data withdrawal was necessary. This code included the date of the month in which they were born, the last two letters of their post code, and finally the last two digits of their phone number.

Upon completion of all questionnaires, participants were fully debriefed (see appendix 6).

Participants

The sample consisted of 121 parents, each with a child aged 3 to 7 years. As the focus of the study was the children, demographics of the parents were not recorded. Instead,

participants were asked to input their child's age and gender. The data was made up of 62 males and 59 females, ranging from 3 years and 1 month old to 7 years and 11 months (M = 5.25, SD = 1.31).

An opportunity sampling technique was executed, involving several participants carefully selected by the researcher through word of mouth. The questionnaire was also distributed using the research forums on Mumsnet, in which an anonymous Qualtrics link to the survey was posted. This allowed a wider range of responses, with participants of various demographics.

Measures

Pre-School Activities Inventory (Golombok and Rust, 1993) (See appendix 2):

Golombok and Rust (1993) designed the PSAI as a psychometric scale to assess the presence of gender roles in children. They aimed to develop both a valid and reliable measure of gender, which could discriminate between and within the sexes. In using this questionnaire, it was possible to obtain a score for each child's masculinity and femininity. The PSAI is a parent report questionnaire, which was deemed the most appropriate method by Golombok and Rust (1993) due to the age of the targeted sample (1 to 5 years) and their known unreliability in reporting.

In developing the PSAI, 27 mothers were asked to identify 10 aspects of their child's behaviour that they felt were typical of their sex and 10 ways in which the child showed behaviour that was more representative of the opposite sex. Following gaps in previous literature, the questionnaire focused on actual behaviour, as opposed to preferences of the child, measuring the frequency of play with a range of different toys and games, and the child's temperament. The initial item pool contained 153 items, though after numerous rounds of analyses, the final scale consisted of 24 items – 12

masculine and 12 feminine – presented in 3 categories: (a) Toys, (b) Activities, and (c) Characteristics.

The responses to each question took the form of a 5-item Likert scale, including Never (N), Hardly Ever (HE), Sometimes (S), Often (O) and Very Often (VO), reflecting a score of 1 to 5, with 'Never' corresponding to 1 and 'Very Often' scoring 5. Items were split into 'male' and 'female' categories for the purpose of scoring: questions 1, 3, 5, 6, 11, 12, 14, 15, 17, 19, 20 and 21 were regarded as 'male' and questions 2, 4, 7, 8, 9, 10, 13, 16, 18, 22, 23, 24 were named 'female' (see appendix 2 for all questions). Following this, the PSAI was scored by taking the sum of the 'male' items, subtracted by the sum of the 'female' items, multiplied by 1.1 and finally adding 48.25. According to Golombok and Rust (1993), the multiplication by 1.1 allowed the score to be transformed to a pseudo-T scale, rendering the standard deviation for boys and girls separately close to 10, and the addition of 48.25 was necessary to make the mean close to 50. For the purpose of this study, it was decided that the PSAI would be scored differently to create an individual score for both masculinity and femininity in each participant. Therefore, the overall score for each was devised by taking the sum of 'male' or 'female' items divided by 12.

Combined Empathy and Systemising Quotient (Baron-Cohen et al., 2009) (See appendix 1):

Following successful research of the Empathy Quotient (EQ) and Systemising Quotient (SQ), which highlighted sex differences within adult scores (Baron-Cohen et al. 2003; Baron-Cohen and Wheelwright, 2004), Baron-Cohen et al. (2009) developed the measure to assess whether the identified sex differences could be also be observed in children. The original questionnaires were adapted to create a child

appropriate measure – this included the rephrasing of questions to assess the engagement and preferences in activities in which would typically be associated with each sex (EQ-C and SQ-C) and combining the two separate questionnaires for ease of administration, named the Combined EQ-C and SQ-C. The EQ-C and SQ-C was also designed as a parent-report questionnaire, avoiding inaccuracies associated with children's comprehension and communication abilities. The questionnaire was aimed at parents of a 4 to 11-year-old child.

The combined questionnaire consisted of 55 items, with responses presented as a 4-item Likert scale. Parents were instructed to indicate how strongly they agreed with each statement, with choices of 'definitely agree', 'slightly agree', 'slightly disagree' or 'definitely disagree'. The combined measure contained 27 questions which were related to the EQ-C, whilst 28 were of the SQ-C.

The items were scored as follows: For the EQ-C, questions 1, 6, 14, 18, 26, 28, 30, 31, 37, 42, 43, 45, 48 and 52 scored one point for a 'slightly agree' response and two points for 'definitely agree', whilst questions 2, 4, 7, 9, 13, 17, 20, 23, 33, 36, 40, 53 and 55 received one point for 'slightly disagree' and two points for 'definitely disagree'. For the SQ-C, responses for items: 5, 8, 10, 12, 19, 21, 24, 25, 29, 34, 35, 38, 39, 41, 44, 46, 49 and 50 scored one point for 'slightly agree' and two points for 'definitely agree', whilst items 3, 11, 15, 16, 22, 27, 32, 47, 51 and 54 scored one point for 'slightly disagree' and two points for 'definitely disagree'. The sum of each EQ-C question provided a score of empathy for each child and the sum of each SQ-C question gave a score of systemising for each child.

Procedure

Participants which were opportunity sampled by the researcher were emailed an anonymous link directing them to the Qualtrics platform, in which they were able to find the information sheet, consent form and the two questionnaires. The same link was shared on the Mumsnet forum, allowing parents to voluntarily participate in the study. Upon opening the link, participants were initially presented with the information sheet and a requirement of informed consent. Participants were then asked to complete the PSAI (Golombok and Rust, 1993), followed by the EQ-C and SQ-C (Baron-Cohen et al., 2009). Once the questionnaires had been completed, participants received a debrief sheet and the option to complete a unique code to allow data withdrawal if necessary.

Results

Reliability analysis

Prior to the main analysis, an internal consistency analysis was performed on each questionnaire. It has previously been stated that in order to ensure internal consistency, the Cronbach's alpha level should ideally remain above .7 (Nunnally, 1978). Accordingly, the results showed satisfactory reliability for both the PSAI, α = .77, and the Combined EQ-C and SQ-C, α = .79.

Descriptive statistics

Pearson correlations were conducted for each variable (see Table 1).

As highlighted in Table 1, sex (r(119) = .09, p = .17) and age (r(119) = .05, p = .30) showed a slight positive correlation with scores of empathy, whilst masculinity (r(119) = .05, p = .29) and femininity (r(119) = .01, p = .47) showed a slight negative

correlation, though none of which proved to be significant. Conversely, systemising scores showed a significant positive correlation with age (r(119) = .26, p = .002) and masculinity (r(119) = .15, p = .05), alongside a significant negative correlation with femininity (r(119) = .21, p = .01). Sex (r(119) = .05, p = .29) showed a slight negative yet insignificant correlation with systemising scores.

As assumed, masculinity (r(119) = .45, p < .001) indicated a negative correlation to sex, whilst femininity (r(119) = .52, p < .001) correlated positively, both showing strong significance. Likewise, masculinity and femininity (r(119) = .24, p = .004) significantly correlated negatively with one another. Interestingly, age (r(119) = .26, p = .002) also correlated both negatively and significantly with femininity scores, with masculinity (r(119) = .07, p = .22) displayed a weak negative and insignificant correlation.

Table 1. Correlations amongst all study variables

Variable	Empathy	Systemising	Sex	Age	Masculinity	Femininity
Empathy			.09	.05	.05	.01
Systemising			.05	.26*	.15*	.21*
Sex				.03	.45**	.52**
Age					.07	.26*
Masculinity						.24*
Femininity						

Note. * indicates p < .05; ** indicates p < .001

Sex Differences

Following the research of Baron-Cohen et al. (2009), participant's sex was recorded and measured in relation to the participant's scores on the Combined Empathy and Systemising Quotient (empathy and systemising) and the Pre-School Activities Inventory (masculinity and femininity).

Table 2. Mean and standard deviation for male and female scores in each questionnaire

	Male		Female	
	M	SD	M	SD
Empathy	33.52	7.88	35.02	9.08
Systemising	22.66	6.85	21.97	6.70
Masculinity	3.59	.67	2.96	.61
Femininity	2.42	.70	3.30	.74

The data met assumptions of parametric testing, therefore an independent t test was carried out to assess the role of sex in participant's responses. Male participants appeared to have higher scores of systemising (M = 22.66, SD = 6.85) and masculinity (M = 3.59, SD = .67) than females (systemising, M = 21.97, SD = 6.70; masculinity, M = 2.96, SD .61). The standard deviation for both measures was also larger for males, showing a larger variation of scores. Accordingly, female participants showed to have higher scores of empathy (M = 35.02, SD = 9.08) and femininity (M = 3.30, SD = .74) than did males (empathy, M = 33.52, SD = 7.88; femininity, M = 2.42, SD = .70). The standard deviation for empathy and femininity were larger for females than males, again highlighting a larger variation.

No significant difference between males and females were found for both empathy (t(119) = .97 p = .33) and systemising (t(119) = .56, p = .57) scores. The 95% confidence intervals for the mean difference between the conditions for empathy were -4.56 to 1.56. For systemising, the confidence intervals were -1.74 to 3.13. As no significant difference was found for males and females, an effect size was not calculated. A significant difference was found for males and females in masculinity (t(119) = 5.42, p < .001, d = .44) and femininity (t(119) = 6.68 p < .001, d = .52). The 95% confidence intervals for masculinity were .40 to .86, and -1.13 to -.61 for femininity. Cohen's d was used to compute the effect size, showing a medium effect of the variables.

Regression analysis

Before conducting the regression analysis, particular assumptions were tested to confirm that a linear regression was a valid form of analysis for this data set. An absence of outliers, independent errors, multicollinearity, homoscedasticity and linearity were amongst the assumptions to be examined. The analysis of standard residuals showed a lack of outliers for empathy (Std. Residual Min = -2.55, Std. Residual Max = 2.01) and systemising questionnaires (Std. Residual Min = -2.32, Std. Residual Max = 2.82). The data met the assumption of independent errors for both empathy (Durbin-Watson = 2.05) and systemising (Durbin-Watson = 1.93) quotients. The assumption of no multicollinearity was also met as indicated by collinearity tests (sex, Tolerance = .60, VIF = 1.66; age, Tolerance = .89, VIF = 1.12; masculinity, Tolerance = .80, VIF = 1.25; femininity, Tolerance = .65, VIF = 1.54). Finally, the scatterplot of standard residuals specified that the data met the assumptions of homoscedasticity and linearity (see appendix 9 for all SPSS output).

A multiple regression analysis was conducted to assess the extent to which the variables 'sex', 'age', 'masculinity' and 'femininity' were predictive of empathising and systemising thought processes within a child sample.

Using the 'enter' method, the model showed not to be significant for scores of empathy ($F(4, 116) = .37$, $p = .83$). The relationship between the variables was weak ($R = .11$) and the model could only be used to explain approximately 1.2% ($R^2_{adj} = 2.2\%$) of the variance in empathy scores. All variables were displayed as insignificant predictors of empathy (sex, $\beta = .12$, t(116) = .97, $p = .34$; age, $\beta = .03$, $t(116) = .27$, $p = .79$; masculinity, $\beta = .01$, t(116) = .12, $p = .90$; femininity, $\beta = .06$, t(116) = .55, $p = .59$). The contribution of each predictor variable in accounting for the variance in empathy scores is shown in Table 3.

Table 3. Summary of regression analysis for predicting empathy scores

Variable	*B*	*SE B* (std. Error)	(beta score)
Constant	32.74	7.33	
Sex	1.94	2.01	.12
Age	.17	.64	.03
Masculinity	.15	1.24	.01
Femininity	.63	1.16	.06
Note: $R^2 = .01$			

Note. * indicates $p < .05$; ** indicates $p < .001$

On the other hand, a significant model was displayed for systemising scores ($F(4, 116) = .36$, $p = 0.01$). The relationship between the variables was slightly stronger ($R = .33$)

and the model could be used to explain 11% (R^2_{adj} = 8%) of the variance in systemising scores. out of all variables, age was the only significant predictor of systemising, β = .22, t(116) = 2.40, p = .02. Sex (β = .10, t(116) = .91, p = .36), masculinity (β = .17, t(116) = 1.76, p = .08) and femininity (β = .162, t(116) = 1.49, p = .14) all failed to significantly predict systemising scores. The contribution of each predictor variable in accounting for the variance in empathy scores is shown in Table 4.

Table 4. Summary of regression analysis for predicting systemising scores

Variable	*B*	*SE B* (std. Error)	(beta score)
Constant	12.52	5.54	
Sex	1.39	1.52	.10
Age	1.15	.48	.22*
Masculinity	1.65	.93	.17
Femininity	1.30	.87	.16

Note: R^2 = .11

Note. * indicates p < .05; ** indicates p < .001

Overall, the results presented a significant correlation between systemising scores and the variables age, femininity and masculinity. A significant correlation between systemising and sex was not found, likewise empathy failed to significantly correlate with each of the variables. Further to this, the regression analysis was unsuccessful in supporting the hypotheses, showing that apart from age, which was highlighted as a significant predictor of systemising scores, no other variable used in this study could

be used to predict empathising and systemising scores in children. As expected, a significant correlation between sex and gender was also found, supported by results of the t test, which highlighted a significant difference between sex and gender scores. However, the analysis failed to replicate Baron-Cohen's (2009) research of sex differences within scores of empathy and systemising, as no significant difference was found.

Discussion

The findings of the present research fail to support either one of the proposed hypotheses entirely. It was hypothesised that a significant positive correlation would be established between the variables femininity and empathy, alongside masculinity and systemising. The results concluded that neither femininity or masculinity correlated significantly with empathy scores, however, a significant positive correlation was present between masculinity and systemising. This was further supported by a significant negative correlation between femininity and systemising scores, thereby suggesting a potential link between gender identity and systematic thinking. To continue, the second hypothesis proposed that gender identity would significantly predict scores of empathising and systemising, furthermore showing to be a more significant predictor than sex. The analysis revealed that no variable, including biological sex, could be used to predict empathising scores within this study. Finally, age was the only variable presented as a significant predictor of systemising scores.

Though the proposed hypotheses appear unfounded, the analysis of each variable provides an individual insight into the effectors of empathising and systemising cognition within children. Firstly, unlike the findings of Baron-Cohen et al. (2009) which

saw sex differences between empathy and systemising scores, the present study was unable to determine any significant difference. Upon looking at the mean scores for both males and females, it appears that females on average did score higher on the EQ-C than did males, likewise males typically scored higher on the SQ-C than females. However, the use of independent t tests determined that these differences lacked significance, possibly being the result of chance. This matter was maintained by the lack of significant correlation and predictability when analysed further, therefore stating that in this sample, sex showed to be an irrelevant factor in empathy and systemising scores. These findings contest the numerous accounts of sex differences in cognition, of which previous research demonstrates, though it does present an opportunity for gender identity to stand the main influence, regardless of assigned sex. Initially, this theory is consistent with Unger and Crawford's (1993:123) statement that gender may create a misrepresentation of alleged sex differences, however, the analysis highlighted a significant correlation between each identity and biological sex, equally showing a significant difference of gender identity scores in accordance to sex. This contradicts ideas that gender identity may develop independent of sex (Heilbrun, 1976), ultimately disputing psychological androgyny (Bem, 1974).

The dependant variables, empathising and systemising, challenge each other in results. Systemising was found to correlate significantly with each variable, other than biological sex. Following the first hypothesis, the analysis showed a positive correlation with masculinity and a negative correlation with femininity, thus implying that systematic thinking may be a trait of masculinity. If following Baron-Cohen's (2002) domain of male and female brains being entirely associated with the corresponding cognitive profile, it would be theorised that femininity would reflect the

same pattern, correlating positively with femininity and negatively with masculinity. No significant correlation, difference or predictor was found in regard to empathy scores.

Given the mass research that has been undertaken in recent years, alongside the depth of their findings, it is questionable why a similar pattern was not established in the present research project. Though sex and gender failed to predict empathy and systemising overall, correlations were found between systemising and the other variables. With this in mind, it is possible to query the effectiveness of the EQ-C in establishing a score of empathy for children. As previously mentioned, acknowledging the context of behaviour analysis is extremely important when interpreting its findings (Hyde, 2005). Both the Pre-School Activities Inventory (Golombok and Rust, 1993) and the Combined Empathy and Systemising Quotient (Baron Cohen et al., 2009) were designed to be parent reporting, meaning that every answer was driven by the caregiver's perspective. Not only does this reveal the issue of subjectivity, it also ignites a large potential of bias towards how the caregiver wishes to portray their child by the questionnaire responses. The caregivers are able to draw upon traits, behaviours, strengths and weakness across the child's entire lifetime (Baron-Cohen et al., 2009), meaning they have the ability to determine which of these actions they wish to reflect in their responses, even if upon a subconscious level. This may not be applicable to questions on the SQ-C, however, the EQ-C may trigger an emotional response due to the sensitive nature of some of the items. As Baron-Cohen et al. (2009) importantly stated, some of the questions were designed to probe relatively rare behaviours that may have shocked respondents, for example using physical aggression, cutting up insects, or the child's reaction to the death of a fictional character. These were necessary in gaging an accurate scale of empathy, though

whether genuine or not, caregivers may be reluctant to recall a time in which their child displayed such behaviours. It is conceivable that the lack of significant findings in respect of the EQ-C, may be caused by a hesitancy to answer the questionnaire with accuracy, skewing empathising scores.

The points discussed above can also be applied to findings of the PSAI. As considered in the literature review, the concentration on sex and gender differences has increased over the decades, adding to a segregation of society (Delphy, 1993) and the importance of discovering the most appropriate identity for each individual. This fixation may be reflected in caregiver's responses of the PSAI, again attracting false or misunderstood answers. The gender context of the PSAI is fairly obvious, with participants reporting that they found the items particularly stereotypical and to an extent offensive due to what is considered to be 'girl-type' behaviour, such as playing with dolls, and 'boy-type' behaviour, displayed as pretending to be a soldier. Though the participants were informed in the brief that the questionnaire would contain stereotypical language in order to evaluate gender identity in relation to empathising and systemising, it was made apparent by comments made at completion, which suggested the same hesitancy that was previously mentioned. It is feasible that caregivers may have answered questions to display gender-neutral parenting as per social desirability. Conversely, some may not wish to convey their child in a way that challenges social stereotypes, again leaving the data with multiple biases and inaccuracy of generalisation. This reasoning may be held responsible for inconclusive findings of gender identity predicting the corresponding cognitive form.

Despite the limitations of the parent-report measures, the results presented an enlightening relationship which had not been previously considered. The analysis revealed a significant and positive correlation between age and systemising scores, alongside highlighting that the variable could significantly predict scores of systemising. This thereby suggests that as a child grows older, they are inclined to become more systemising, or at least begin to display systematic behaviour or preferences. The original study by Baron-Cohen et al. (2009) did not include the variable in the analysis, meaning that a background of the influence of age and development has not yet been contemplated in response to empathising and systemising. Nevertheless, if the findings of this research could represent a larger population accurately, it is plausible that empathetic qualities are developed at a very early stage, or even innate, whilst systematic qualities are the subject of lifetime development. Early displays of empathising are supported by research of female babies, which demonstrated the curiosity and attentiveness to social stimuli at just 24 hours of age (Connellan et al., 2000), whilst making more eye contact immediately after birth (Hittelman and Dickes, 1979). Critically, the presentation of systematic behaviour may be reduced simply to a matter of communication abilities which understandably grow stronger as a child grows older. Furthermore, interests in systematic activities may not be displayed until later childhood, where children have the opportunity to engage in activities of more complicated demands, such as games with strict rules like chess or dominoes and particular technologies such computers or gaming consoles.

Though not supporting the proposed hypotheses, the findings of the present study can be viewed as both supportive and contradicting of previous literature in regard to empathising and systemising cognition. In light of this statement, it is possible to

overcome many of the limitations presented above, allowing a more in-depth and thought-provoking piece of research. A method of observation by the researcher or member of an educational setting, may provide a more honest and exclusive account of behaviour, informing all measures of empathising, systemising, masculinity and femininity. Nonetheless, a brief insight into age and its accordance to the suggested sex differences of cognition, may inspire a new foundation of research. Though, it is ultimately concluded that neither sex or gender can be used to predict the empathising and systemising thought processes of a child.

References

Alexander, G. M. & Hines, M. (2002). 'Sex differences in response to children's toys in nonhuman primates (Cercopithecus aethiops sabaeus)'. *Evolution and Human Behavior*, 23(6), pp.467–479. DOI: 10.1016/S1090-5138(02)00107-1

Banerjee, M. (1997). 'Hidden emotions: Preschoolers' knowledge of appearance-reality and emotion display rules'. *Social Cognition*, 15, pp.107–132. DOI: 10.1521/soco.1997.15.2.107

Baron-Cohen, S. (2002). 'The extreme male brain theory of autism'. *Trends in Cognitive Sciences*, 6(6), pp.248-254. DOI: 10.1016/S1364-6613(02)01904-6

Baron-Cohen, S., & Wheelwright, S. (2003). 'The Friendship Ques-tionnaire: An investigation of adults with Asperger syndrome or high-functioning autism, and normal sex differences'. *Journal of Autism and Developmental Disorders*, 33, pp.509–517. DOI: 10.1023/A:1025879411971.

Baron-Cohen, S., & Wheelwright, S. (2004). 'The Empathy Quotient: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences'. *Journal of Autism and Developmental Disorders*, 34(2), pp.163–175. DOI: 10.1023/B:JADD.0000022607.19833.00

Baron-Cohen, S., Auyeung, B., Wheelwright, S., Allison, C., Atkinson, M. and Samarawickrema, N. (2009). 'The Children's Empathy Quotient and Systemizing Quotient: Sex Differences in Typical Development and in Autism Spectrum Conditions'. *Journal of Autism and Developmental Disorders*, 39(11), pp.1509-1521. DOI: 10.1007/s10803-009-0772-x

Baron-Cohen, S., Richler, J., Bisarya, D., Gurunathan, N., & Wheelwright, S. (2003). 'The systemizing quotient: An investigation of adults with Asperger syndrome

or high functioning autism, and normal sex differences'. *Philosophical Transactions of the Royal Society*, 358, 361–374. DOI: 10.1098/rstb.2002.1206

Bem, S. (1974). 'The measurement of psychological androgyny'. *Journal of Consulting and Clinical Psychology*, 42(2), pp.155-162. DOI: 10.1037/h0036215

Billington, J., Baron-Cohen, S. and Wheelwright, S. (2007). 'Cognitive style predicts entry into physical sciences and humanities: Questionnaire and performance tests of empathy and systemizing'. *Learning and Individual Differences*, 17(3), pp.260-268. DOI: 10.1016/j.lindif.2007.02.004

Bosacki, S., & Astington, J. W. (1999). 'Theory of mind in preadolescence: 'Relations between social understanding and social competence'. *Social Development*, 8, pp.237–255. DOI:10.1111/1467- 9507.00093.

Butler, J. (1990). *Gender Trouble*. 1st ed. Routledge, p.190.

Connellan, J., Baron-Cohen, S., Wheelwright, S., Batki, A., & Ahluwalia, J. (2000). 'Sex differences in human neonatal social perception'. *Infant Behavior and Development*, 23, pp.113–118. DOI: 10.1016/S0163-6383(00)00032-1

Delphy, C. (1993). 'Rethinking sex and gender'. *Women's Studies International Forum*, 16(1), pp.1-9. DOI: 10.1016/0277-5395(93)90076-L

Eckert, P. (1989). 'The whole woman: Sex and gender differences in variation'. *Language Variation and Change*, 1(03), p.245. DOI: 10.1017/S095439450000017X

Geary, D. (1995). 'Reflections of evolution and culture in children's cognition: Implications for mathematical development and instruction'. *American Psychologist*, 50(1), pp.24-37. DOI: 10.1037/0003-066X.50.1.24

Goffman, E. (1976). 'Gender Display'. *Gender Advertisements*, pp.1-9. DOI: 10.1007/978-1-349-16079-2_1

Golombok, S. and Rust, J. (1993). 'The Pre-School Activities Inventory: A standardized assessment of gender role in children'. *Psychological Assessment*, 5(2), pp.131-136. DOI: 10.1037/1040-3590.5.2.131

Heilbrun, A. (1976). 'Measurement of masculine and feminine sex role identities as independent dimensions'. *Journal of Consulting and Clinical Psychology*, 44(2), pp.183-190. DOI: 10.1037/0022-006X.44.2.183

Hittelman, J. H., & Dickes, R. (1979). 'Sex differences in neonatal eye contact time'. *Merrill-Palmer Quarterly*, 25, pp.171–184.

Hoffman, M. L. (1977). 'Sex differences in empathy and related behaviors'. *Psychological Bulletin*, 84, pp.712–722. DOI: 10.1037/ 0033-2909.84.4.712

Hyde, J. (2005). 'The gender similarities hypothesis'. *American Psychologist*, 60(6), pp.581-592. DOI: 10.1037/0003-066X.60.6.581

Kimura, D. (1999). *Sex and cognition*. Cambridge, MA: The MIT Press.

Knickmeyer, R., Baron-Cohen, S., Raggatt, P., & Taylor, K. (2005). 'Foetal testosterone, social relationships, and restricted interests in children'. *Journal of Child Psychology and Psychiatry*, 46, pp.198–210. DOI: 10.1111/j.1469-7610.2004.00349.x

Knight, G. and Chao, C. (1989). 'Gender differences in the cooperative, competitive, and individualistic social values of children'. *Motivation and Emotion*, 13(2), pp.125-141. DOI: 10.1007/BF00992958

Kohlberg, L. A. (1966). 'A cognitive–developmental analysis of children's sex role concepts and attitudes'. In E. E. Maccoby (Ed.), The development of sex differences (edn, pp. 82–173). Stanford, CA: Stanford University Press.

Lamminmäki, A., Hines, M., Kuiri-Hänninen, T., Kilpeläinen, L., Dunkel, L. & Sankilampi, U. (2012). 'Testosterone measured in infancy predicts subsequent

sex-typed behavior in boys and in girls'. *Hormones and Behavior*, 61, pp.611–616. DOI: 10.1016/j.yhbeh.2012.02.013

Lutchmaya, S., Baron-Cohen, S., & Raggatt, P. (2002). 'Foetal testosterone and eye contact in 12 month old infants'. *Infant Behavior and Development*, 25, pp.327–335. DOI: doi.org/10.1016/S0163-6383(02)00094-2

Lytton, H. & Romney, D. M. (1991). 'Parents' differential socialization of boys and girls: A meta-analysis'. *Psychological Bulletin*, 109, pp.267–296. DOI: 10.1037/0033-2909.109.2.267

Martin, C. and Ruble, D. (2004). Children's Search for Gender Cues. *Current Directions in Psychological Science*, 13(2), pp.67-70. DOI: 10.1111/j.0963-7214.2004.00276.x

McClure, E. (2000). 'A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents'. *Psychological Bulletin*, 126(3), pp.424-453. DOI: 10.1037/0033-2909.126.3.424

Moore, D. S. & Johnson, S. P. (2008). 'Mental rotation in human infants a sex difference'. *Psychological Science*, 19, pp.1063–1066. DOI: 10.1111/j.1467-9280.2008.02200.x

Mussen, P. H. (1969). 'Early sex-role development'. In D. A. Goslin (Ed.), Handbook of socialization theory and research. Chicago: Rand-McNally.

Nebot, T. K. (1988). 'Sex differences among children on embedded tasks'. *Perceptual and Motor Skills*, 67, pp.972–974. DOI: 10.2466/pms.1988.67.3.972

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Oakley, A. (1985). *Sex, Gender and Society*. London: Temple Smith, p.16.

Podrouzek, W., & Furrow, D. (1988). 'Preschoolers' use of eye contact while speaking: The influence of sex, age, and conversational partner'. *Journal of Psycholinguistic Research*, 17, pp.89–98. DOI: 10.1007/BF01067066

Quinn, P. C. & Liben, L. S. (2008). 'A sex difference in mental rotation in young infants'. *Psychological Science*, 19, pp.1067–1070. DOI: 10.1111/j.1467-9280.2008.02201.x

Todd, B., Barry, J. and Thommessen, S. (2016). 'Preferences for 'Gender-typed' Toys in Boys and Girls Aged 9 to 32 Months'. *Infant and Child Development*, 26(3). DOI: 10.1002/icd.1986

Trepanier-Street, M. and Romatowski, J. (1999). *Early Childhood Education Journal*, 26(3), pp.155-159. DOI: 10.1023/A:1022977317864

Unger, R. (1979). 'Toward a redefinition of sex and gender'. *American Psychologist*, 34(11), pp.1085-1094. DOI: 10.1037/0003-066X.34.11.1085

Unger, R. and Crawford, M. (1993). 'Sex and Gender—The Troubled Relationship Between Terms and Concepts;. *Psychological Science*, 4(2), pp.122-124. DOI: 10.1111/j.1467-9280.1993.tb00473.x

West, C. and Zimmerman, D. (1987). 'Doing Gender'. *Gender & Society*, 1(2), pp.125-151. DOI: 10.1177/0891243287001002002

Whitehead, J. (1996). 'Sex stereotypes, gender identity and subject choice at A-level'. *Educational Research*, 38(2), pp.147-160. DOI: 10.1080/0013188960380203