

What's stopping you? The contribution of gender essentialism to sex differences in subject choice

Japinder Dhesi

London School of Economics

Abstract

The present study considered the impact of gender essentialism on sex differences in subject choice. Secondary school children, aged 11-12 years ($N = 30$) and 15-16 years ($N = 26$), were randomly assigned to one of three experimental conditions, and completed a thought experiment requiring them to make inferences about two gendered attributes; academic subject ability and gender-stereotyped properties, of a hypothetical male and female; (a) raised in an opposite sex environment; (b) following a brain transplant from a member of the opposite sex and (c) a 'normal' male or female, acting as a baseline response. Results from the experiment indicated that children do hold essentialist beliefs about gender. However, such beliefs vary as a function of both the age of participants, and the gendered attribute considered. We conclude that gender essentialism may account for the persistence of sex differences in subject choice.

Key words: gender, essentialism, academic ability, subject choice

Introduction

In Britain, up to and including much of the twentieth century, differentiation by sex was used both formally and informally in schools for curricular and disciplinary purposes (Radford, 1996). Significant inroads were made following feminist interventions including, the passing of the Sex Discrimination Act in 1975, and the introduction of a National Curriculum in 1988, making it obligatory for all students to study science, mathematics and English up to the age of 16. However, despite such changes there remain significant sex differences in educational subject choice. While the examination entries of boys and girls are broadly even in compulsory subjects at GCSE level, there are significant sex differences in the take-up of optional

subjects such as I.T and social studies. There are also significant sex differences in subject choice at A level; girls are more likely to study art & design, English, textiles and social studies, whereas boys are more likely to study design and technology, mathematics, I.T and physics (DFES, 2007).

The fact that boys and girls tend to choose different pathways through the education system may not be considered problematic given that they have access to all subjects. However, this is an important area of study as it has been found that the gender stereotyping of subjects is one of the major factors guiding subject choice. This, I will come to argue, renders the notion of 'free choice' largely redundant (Kelly, 1981). Furthermore, the fact that boys and girls continue to make different subject choices has direct consequences for higher education and occupational opportunities (EOC, 2005), for example, entering stereotypically masculine or feminine occupations. The present study considers whether psychological essentialism, a theory of category representation, can offer an insight into the persistence of sex segregation in subject choices.

Sex differences in subject choice

The issue of sex differences in subject choice was placed on the research agenda by feminists in the 1970s. Research on gender and education highlighted a number of factors as influencing subject choice, including family background, school environment and inherent sex differences in cognitive abilities (Radford, 1996). Foremost among these was the gender stereotyping of subjects amongst students (Stanworth, 1981). Numerous studies have documented how school children distinguish between 'masculine' subjects such as physics, I.T and mathematics, known collectively as the 'sciences', and 'feminine' subjects such as art, languages, and textiles, known as the 'arts' (Archer & Macrae, 1991). There is evidence that boys show more of a bias in their subject choices than girls (Whitehead, 1996). It has also been found that the beliefs and behaviour of teachers in relation to gender can moderate gender stereotyping among children (Colley, 1998).

In a more recent study Francis (2000) has suggested that there has been a decline in the gender-stereotyping of subjects such as mathematics and English. However, in this study children were asked to rate their favourite subjects which may not correlate with their actual subject choices. Furthermore statistics for examination entries, discussed above, show no evidence of a decline in sex segregation in subject choice. Accordingly, Colley (1998) has argued that the gender stereotyping of academic subjects remains one of the most fundamental factors guiding subject choice. In order to explain the origin of the gender stereotyping of subjects Colley

argued that perceptions of male and female social roles and the abilities which are considered typical of these social roles leads to the assignment of subjects as masculine or feminine. Hence, the binary gender dichotomy presented below appears to be central to our gender-role concepts:

Male	Female
Rationality	Emotion
Aggressive	Nurturing
Objectivity	Subjectivity
Science	Arts

The acquisition of gender-role concepts

Psychological essentialism

Medin & Ortony (1989) proposed that humans approach the categorization of certain entities with an essentialist heuristic, known as psychological essentialism. This heuristic leads people to believe that members of a category share a deep underlying causal essence which confers their identity, and is responsible for many of their observable features, both perceptual and behavioural features. A distinction is made between metaphysical essentialism, the view that things have essences, and psychological essentialism, the view that people's representations of these things might reflect such a belief (as erroneous as it may be) (ibid).

Furthermore, Medin and Ortony (1989) propose that peoples concepts contain an 'essence placeholder' as while people believe that a category has an underlying essence they may not know what it is, or which observable features of category members are linked to this essence. Hence although it is difficult to obtain direct evidence of essentialism there is support for a varied set of early developing, essentialist-like beliefs about natural kind categories, including (1) the expectation that category members share non-obvious similarities in the face of conflicting perceptual information (Gelman, Collman & Maccoby, 1986); (2) category membership is believed to remain stable over time and transformations (Keil, 1994) and (3) properties of category members are considered to have innate origins and are impervious to environmental influences (Gelman & Wellman, 1991). While early formulations of psychological essentialism characterised the representation of natural kinds (e.g. plants and animals), in recent years evidence has emerged which suggests that humans also essentialise social kind categories such as race (Hirschfeld, 1996), caste (Mahalingham, 2001) and, of interest here, gender (Taylor, 1996).

Gender and essentialism

Gender essentialism has been characterized in several different ways in the literature. Following Medin & Ortony's (1989) articulation of psychological essentialism, an essentialist construal of gender would entail the belief that females have an inner essence that distinguishes them from males, and is responsible for differences in appearance and behaviour between the sexes. There are several converging lines of research that support the view that an essentialist bias shapes children's and adult's representations of gender.

One of the manifestations of essentialism is that categories are endowed with rich inductive potential (Haslam, Rothschild and Ernst, 2000). Several studies have demonstrated how the category of gender promotes rich inferences. For example, Martin (1989) found adults readily infer a number of properties including role behaviours, traits and occupations on the basis of knowledge of sex group membership alone. A second manifestation of essentialism is 'boundary intensification', which entails the treatment of category membership as mutually exclusive and an exaggeration of differences between category members (Gelman, 2003). In a review of studies exploring children's memory errors, Signorella and Liben (1987), have shown that children often misremember or deny gender anomalies such as a female firefighter. Finally, a third manifestation of essentialism is the belief in nativism; the assumption that properties of category members are the result of an innate potential, and will develop in spite of powerful environmental influences. In one of the first studies of gender essentialism from this perspective, Taylor (1996) found that four-year old children predicted that a hypothetical infant raised on an island with only members of the opposite sex would nonetheless grow up to display gender-stereotyped properties. Taylor (1996) also found that older children (10 years of age) and adults were more likely to recognise the potential impact of the environment on gender-role development than younger children. This is consistent with previous research, which has indicated that children initially attribute gender differences to biological causes, and only later recognise the role of environmental factors. However, there is disagreement about at which age this shift occurs, Ullian (1976), for example, reported that by age 12, children recognise that gender roles are a function of social conventions, whereas Smith and Russell (1984) found that even by age 15 only 61% of girls and 25% of boys explained gender differences in terms of social factors. Furthermore, adults have also been found to hold essentialist beliefs about gender, for example Mahalingham and Rodriguez (2003) found that American adults believed that a brain transplant from a member of the opposite sex would lead to a change in the gender specific behaviour of the recipient.

While most of the research reviewed has focused on beliefs about gender, there is some evidence which indicates that these beliefs may have an impact on behaviour. Martin, Ruble, & Szkrybalo (1995) found that children use knowledge of whether a toy is "for girls" or "for boys" to guide both their inferences about the toy preferences of other children and their own toy preferences. In a more recent study, Prentice and Miller (2006) found that participants who believed that they differed from a member of the opposite sex on a novel attribute (perceptual style) were significantly less likely to make corrections to their performance on a dot estimation test given the opportunity, than those who were told they were similar to a member of the opposite sex. This research suggests that cross-category differences trigger essentialist thinking about social categories.

In order to account for why social categories such as gender are essentialised it has been suggested that children perceive phenomenal variation in humans, and in order to make sense of this they resort to the essentialist heuristic from the natural kinds module (Atran, 1998). However, a crucial difference between animal and social categories is the role of culture in categorisation, while children and adults from various cultures seem to hold similar beliefs about animal categories, cultures differ in terms of how they conceive of the same social categories and which categories they essentialise (Astuti, Solomon, & Carey, 2004). It is important, therefore, to consider the cultural factors which may contribute to the essentialisation of social categories. In relation to gender, Gelman (2003) has noted how cultural factors such as stereotyping and gender-typed practices can serve to heighten (or indeed dampen) an essentialising tendency.

Present research

While most of the existing literature concerning sex differences in subject choice is mainly devoted to describing or decrying them, it suggests that gender stereotyping plays an important part in guiding children's subject choices. There is evidence to suggest that psychological essentialism is crucial to our representations of social categories such as gender, and therefore may be one of the central cognitive biases underlying stereotyping (Haslam et al., 2002). Although most of the research reviewed above focused on beliefs about gender, it was seen that there some evidence to suggest that essentialist beliefs have an impact on behaviour (Prentice & Miller, 2006). The present study considers the possibility that children hold essentialist beliefs about gender, specifically, about sex differences in academic subject ability, which may help to explain sex differences in subject choices. Hence, the central research question addressed is: Do children hold gender essentialist beliefs about academic subject ability?

A thought experiment was conducted to examine the representations of gender held by 11-12 year old and 15-16 year old children. Specifically, children were asked to make inferences about two types of gendered attributes of a hypothetical male and female; (i) academic ability in stereotypically masculine and feminine subjects and (ii) gendered properties such as occupational preferences. There were three experimental conditions; an island condition to assess whether these attributes are considered to be open to environmental influence, a transplant condition to assess whether these attributes are believed to have a biological basis in the brain and a control condition to assess whether children are willing to make inferences about these attributes based on knowledge of sex group membership alone, as a baseline response.

These age-groups were chosen for two reasons. Firstly, 11-12 year olds are just beginning at secondary school and will be required to choose their GCSE subjects at age 14, while 15-16 year olds are at the end of compulsory schooling and will be making important decisions about A-level subjects and/or careers. Secondly, previous research has indicated that there are important age-related changes in representations of social categories with older children moving away from essentialist beliefs and taking into account the role of environmental factors (Taylor, 1996). A sub-question that is addressed is whether there are age differences in essentialist beliefs. However, in their discussion of psychological essentialism Medin and Ortony (1989) propose that the people's concepts contain an essence placeholder, therefore, the present study also examines the possibility that older children reject an essentialist account because of their belief about the kind of attribute being considered, as opposed to a rejection of an essentialist account per se (Gelman, 2003).

Method

Thought experiment

In order to examine whether children hold gender essentialist beliefs about academic subject ability, a thought experiment was designed as this research method is most conducive to uncovering people's implicit mental representations (Gelman, 2003).

Participants

Fifty-four children, thirty 11-12 year olds and twenty four 15-16 year olds, attending a mixed sex comprehensive school in West London.

Experimental design

A 3 (experimental condition: island, transplant and control) x 2 (age; 11-12 and 15-16 year olds) x 2 (gendered attributes: academic ability in subjects and gendered properties) X 2 (sex of participant: male or female) X 2 (sex of character: male or female) design was used. Where experimental condition, age and sex of participants were between-subjects factors and gendered attributes and sex of character were within-subjects factors.

Experiment materials

Island condition

One of the manifestations of essentialism is a belief that properties of category members are immutable and impervious to environmental influences (Gelman & Wellman, 1991). In order to obtain evidence of this the Island paradigm used by Taylor (1996) was adapted and forms the basis for the Island condition.

Participants read two stories one about a 16 year old boy, Mark, who was raised from birth by his aunt on an island populated entirely by girls and women, and the second about a 16 year old girl, Sarah, raised from birth by her uncle on an island containing only boys and men. The task was divided into two sections; in the first section participants were required to predict Mark and Sarah's GCSE examinations grades in stereotypically feminine subjects (art, English and textiles) and stereotypically masculine subjects (mathematics, physics and I.T) on a scale from A* to G. The subjects selected are those that have been highlighted by previous research and show the greatest discrepancy in take-up between the sexes in post-compulsory education. The scale of A* to G was used as it is the official GCSE examination mark scheme, and therefore one that school children are familiar with.

In the second section participants were asked to indicate their degree of agreement or disagreement about the likelihood of Mark and Sarah acquiring 8 gendered properties; 4 stereotypically feminine properties (cries a lot, wears dresses, wants to be a ballet dancer and wants to be a nurse), and 4 stereotypically masculine properties (gets into fights, has short hair, wants to be a soldier and wants to be a fire-fighter) from Taylor's (1996) study. The properties were presented in a random order and the rating scale ranged from 1 (very strong agreement) to 7 (very strong disagreement), with 4 representing neither agreement nor disagreement. At the end of both sections participants were provided with a blank box and were asked to write down why they had chosen these answers. The task took them on average 20 minutes to complete.

Transplant condition

Another manifestation of essentialism noted above is a belief in nativism. In a later study using the island paradigm, Taylor and Gelman (unpublished) found that in some cases children were suggesting that while children raised on the island would acquire gendered properties they may be less likely to display them (cf. Taylor, 1996). Therefore Mahalingham and Rodriguez's brain transplant paradigm was used as a more direct test of essentialist beliefs. Participants in this condition read a story about a 16 year old boy called Mark and a 16 year old girl called Sarah whose brains had been switched. The remaining procedure was identical to that in the island condition.

Control condition

In the control condition participants were required to make inferences about the two gendered attributes on the basis of sex group membership alone i.e. the names of the boy and girl. This condition also provides a baseline level of responses to ensure that the attributes used were ones that children found to be stereotypically feminine and masculine. If children are prepared to make inferences about gendered properties based on category membership this may also provide evidence of essentialism given that one of its manifestations is that social categories are infused with inductive potential.

Procedure

An equal number of participants were randomly assigned to the 3 experimental conditions (ten 11-12 year olds and eight 15-16 year olds in each condition). The participants were tested in their form group by one of the researchers in their own classrooms during a free study period. The researcher introduced the research as a thought experiment about school children. Participants were informed the study would take 30 minutes to complete and they were given a consent form to sign. Consent was also obtained from the students' parents prior to the experiment. The researcher emphasised that there are no right or wrong answers and the need to answer the questions independently, and in silence. The students were given the opportunity to withdraw from the experiment if they did not want to take part. Both the researcher and the class teacher ensured that no communication took place between the students during the procedure. Each participant read two short stories, one with a female character and one with a male character, and answered a series of questions. The order of presentation of the stories was counter-balanced across participants to minimise order effects. Upon completion of the task participants were debriefed, thanked for partaking in the study, and the researcher offered to answer any questions.

Results

An analysis of variance (ANOVA) was used to examine whether children hold essentialist beliefs about the two gendered attributes. Preliminary ANOVAs revealed no significant main effect or interactions involving sex of participant, and thus data were pooled across this variable. For all subsequent analyses 3 (experimental condition: control, transplant and island) X 2 (age: 11-12, 15-16) between- subjects ANOVAs were used. The alpha level was set at 0.05. All comparisons among means following significant ANOVAs were conducted using the Tukey-D test and r was calculated as the effect size.

Sex differences in academic ability

The main dependent variable, mean predicted GCSE grades, were aggregated across stereotypically feminine (art, English and textiles) and masculine subjects (mathematics and physics). If children hold essentialist beliefs about sex differences in academic ability they would predict a higher grade in stereotypically feminine subjects for the male in the transplant condition (male with female brain) than a male in either the island condition (opposite sex environment) or control condition ('normal' male) and vice versa for the female. The predicted grades were reverse coded such that higher numbers represent higher grades, thus 8 = A* and 1 = G in order for the presentation of the results to be clearer and more intuitive.

Feminine subjects

A two-way ANOVA for the female character's predicted grade in stereotypically feminine subjects revealed significant main effects for experimental condition $F(2, 48) = 16.739, p < .001, r = 0.68$, and age $F(1, 48) = 4.755, p < .05, r = 0.52$. However, the interaction between experimental condition and age failed to reach statistical significance, $F(2, 48) = 1.499, p = .234$. Post-hoc comparisons indicated that the predicted grade for the female character was significantly lower in the transplant condition ($M = 5.2, SD = .96$) than in the island condition ($M = 6.1, SD = .98, p < 0.05$) and control condition ($M = 6.8, SD = .59, p < .001$).

The analysis of the male characters predicted grade revealed a significant main effect for experimental condition, $F(2, 48) = 13.821, p < .001, r = 0.65$. However, neither the main effect of age [$F(1, 48) = 1.132, p = .293$] nor the interaction effect [$F(2, 48) = 2.105, p = .133$] reached statistical significance. Post-hoc comparisons revealed that the predicted grade for the male in the transplant condition ($M = 6.8, SD = .66$) was significantly higher than in the island condition ($M = 5.1, SD = 1.2, p < .001$) and the control condition ($M = 5.4, SD = .54, p < .001$).

Masculine subjects

A two-way ANOVA for the female and male character's mean GCSE grade in stereotypically masculine subjects revealed that neither the main effects of experimental condition [$F(2, 48) = 1.206, p=.308, F(2, 48) = 2.732, p=.075$, for female and male character respectively] and age [$F(1, 48) = 1.410, p=.241, F(1, 48) = .306, p= .583$] nor the interaction effect [$F(2, 48) = 2.384, p=.103, F(2, 48) = 2.915, p = .064$] reached statistical significance. In order to explore why none of the effects reached statistical significance ANOVAs were performed for individual masculine subjects.

Mathematics: An analysis of a two-way ANOVA for the female and male character's mean GCSE grade in mathematics revealed that neither the main effects for experimental condition [$F(2, 48) = .548, p=.582, F(2, 48) = .965, p = .388$, for the female and male character respectively] and age [$F(1, 48) = 1.420, p=.239, F(1, 48) = .024, p = .878$] nor the interaction effect [$F(2, 48) = .709, p=.497, F(2, 48) = .860, p = .430$] reached statistical significance.

Physics: A two-way ANOVA for the female character's grade in physics revealed a significant main effect for experimental condition, $F(2, 48) = 3.169, p < .05, r = 0.33$. The main effect for age [$F(1, 48) = 1.534, p=.222$], did not reach statistical significance. The interaction effect was statistically significant, $F(2, 48) = 4.611, p < .05, r = 0.58$. Post-hoc comparisons following a one-way ANOVA, for 11-12 year olds indicated that the predicted physics grade for the female character was significantly higher in the transplant ($M = 6.6, SD = 1.3$) condition than in the island condition ($M = 5.2, SD = 1.2, p < .05$) and the control condition ($M = 5.0, SD = .61, p < .05$). In contrast a one-way ANOVA for 15-16 year olds revealed that there were no statistically significant differences in the predicted physics grade for the female character between the 3 experimental conditions, $F(2, 21) = 3.089, p = .067$.

A two-way ANOVA for the male character's grade in physics revealed a significant main effect for experimental condition, $F(2, 48) = 5.309, p < .05, r = 0.44$. The main effect for age did not reach statistical significance, $F(1, 48) = .725, p=.399$. However, the interaction effect was statistically significant, $F(2, 48) = 4.958, p < .05, r = 0.53$. A one-way ANOVA for 11-12 year olds revealed a statistically significant difference in the physics grade for the male character between the three experimental conditions, $F(2, 27) = 9.809, p < .001$. Post-hoc comparisons indicated that the physics grade for the male character was significantly lower in the transplant condition ($M = 4.6, SD = 1.7$) compared to the island condition ($M = 6.2, SD = .63, p < .05$) and the control condition ($M = 6.8, SD = .79, p < .001$). This indicates that 11-12 year olds believe that a male with a female brain would do worse in GCSE physics than a male raised in an opposite sex environment and a 'normal' male. In contrast

there were no statistically significant differences in the physics grade for the male character between the 3 experimental conditions for 15-16 year olds, $F(2, 21) = 1.961$, $p = .166$.

The acquisition of gender stereotypical properties

The main dependent variable, mean predicted likelihood of acquiring gendered properties, were aggregated across stereotypically feminine (cries a lot, wears dresses, wants to be a nurse and wants to be a ballet dancer), and masculine properties (gets into fights a lot, has short hair, wants to be a fire-fighter and wants to be a soldier). If children hold essentialist beliefs about the acquisition of gender stereotyped properties they would be expected to predict that the male in the transplant condition (male with a female brain) is more likely to acquire feminine properties than the male in either the island condition (opposite sex environment) or control condition ('normal' male). Similarly, they would be expected to predict that the female character in the transplant condition (female with male brain) is more likely to acquire masculine properties than the female in either the island (opposite-sex environment) or control conditions ('normal' female). The scores were coded such that lower numbers indicate higher likelihood as 1 = Very strongly agree, 4 = neither agree nor disagree and 7 = Very strongly disagree.

Feminine properties

A two-way ANOVA for the female character's predicted likelihood of acquiring feminine properties revealed a significant main effect for experimental condition, $F(2, 48) = 11.947$, $p < .001$, $r = 0.62$. The main effect for age failed to reach statistical significance, $F(1, 48) = .948$, $p = .335$. The interaction effect was statistically significant, $F(2, 48) = 3.660$, $p < .05$, $r = 0.46$. Post-hoc comparisons indicated that for 11-12 year olds the predicted likelihood of the female character acquiring feminine properties was significantly lower in the transplant condition ($M = 5.0$, $SD = 1.1$) compared to the island condition ($M = 3.2$, $SD = 1.1$, $p < .001$) and the control condition ($M = 2.9$, $SD = .70$, $p < .001$). In contrast there was no statistically significant difference between the 3 experimental conditions for 15-16 year olds ($p = .08$). It is noteworthy that the means for the transplant and island condition are 4.3 and 4 respectively, which represents neither agree nor disagree suggesting that they are uncertain as to whether biological or social factors influence the acquisition of gendered properties.

A two-way ANOVA for the male character's predicted likelihood of acquiring stereotypically feminine properties revealed significant main effect for experimental condition, $F(2, 48) = 10.931$, $p < .001$, $r = 0.60$. The main effect for age did not reach statistical significance, $F(1, 48) = 1.343$, $p = .252$. The interaction effect was statistically

significant, $F(2, 48) = 4.418, p < 0.05, r = 0.50$. Post-hoc comparisons for 11-12 year olds indicated that the likelihood of a male acquiring feminine properties was significantly higher in the transplant condition ($M = 3.8, SD = 1.1$) compared to both the island condition ($M = 5.8, SD = 1.1, p < .001$) and the control condition ($M = 6.0, SD = .86, p < .001$). For 15-16 year olds the post-hoc comparisons indicated that the likelihood of the male acquiring feminine properties is significantly higher in the island condition ($M = 4.0, SD = 1.8$) compared to the control condition ($M = 6.1, SD = 1.0, p < .05$). The transplant condition did not differ significantly from the other 2 conditions. However, as above the means for the transplant and the island conditions were 4 and 4.4 respectively which again suggests they are uncertain about whether the acquisition of feminine properties is influenced by biological or social factors.

Masculine properties

A two-way ANOVA for the female character's predicted likelihood of acquiring stereotypically masculine properties revealed significant main effect for experimental condition $F(2, 48) = 7.496, p < .001, r = 0.52$. The main effect for age did not reach statistical significance $F(1, 48) = 3.243, p = .078$. The interaction effect was statistically significant, $F(2, 48) = 3.600, p < .05, r = 0.49$. Post-hoc comparisons for 11-12 year olds indicated that the likelihood of the female acquiring masculine properties was significantly higher in the transplant condition ($M = 3.7, SD = 1.0$) compared to the island condition ($M = 5.2, SD = 1.0, p < .001$) and the control condition ($M = 5.3, SD = 4.3, p < .001$). In contrast there was not a statistically significant difference between the 3 experimental conditions for 15-16 year olds, ($p = .133$).

The analysis for the male character's predicted likelihood of acquiring stereotypically masculine properties revealed a significant main effect for experimental condition $F(2, 48) = 22.349, p < .001, r = 0.73$. The main effect for age did not reach statistical significance, $F(1, 48) = .910, p = .345$. The interaction effect was statistically significant, $F(2, 48) = 7.139, p < .05, r = 0.62272$. For 11-12 year olds post-hoc comparisons indicated that the predicted likelihood of a male acquiring masculine characteristics was significantly lower in the transplant condition ($M = 4.9, SD = .62$) compared to the island condition ($M = 3.0, SD = .62, p = .001$) and the control condition ($M = 2.7, SD = .59, p < .001$). For 15-16 year olds the likelihood of the male possessing masculine properties characteristics was significantly higher in the control condition ($M = 2.7, SD = 1.2$) compared to both transplant condition ($M = 4.2, SD = .85, p < .05$) and the island condition ($M = 4.3, SD = .97, p < .05$). As above, the means for the transplant and island conditions fall in the neither agree nor disagree category (4), again indicating uncertainty about the factors influencing the acquisition of gendered properties.

Summary of results

Overall, results from the experiment showed that both 11-12 year olds and 15-16 year olds appear to hold essentialist beliefs about sex differences in academic ability in stereotypically feminine subjects. Only 11-12 year olds were found to hold essentialist beliefs about sex differences in stereotypically masculine subjects. Furthermore, 11-12 year olds were found to be more likely to hold essentialist beliefs about gender-stereotyped properties; masculine and feminine than 15-16 year olds who appear to be ambivalent as to the factors influencing the acquisition of these properties.

Discussion

Gender essentialism is the theoretical position that the categories of male and female have an inner essence that it is this inner essence that is responsible for observable sex differences. The present study explored whether this mode of category representation is indicative of the persistence of sex segregation in educational subject choice.

The thought experiment results indicate that school children hold essentialist beliefs about gender. Although such beliefs vary as a function of both the age of participants and the gendered attributes considered, both 11-12 and 15-16 year olds were found to hold essentialist beliefs about academic ability in stereotypically feminine subjects, predicting, for instance, that a following a brain transplant from a female, a male would achieve higher grades in art, English and textiles than a male raised by women or a 'normal' male. In relation to stereotypically masculine subjects no significant differences were found in the grades for mathematics across the experimental conditions for both age-groups. While only 11-12 year olds were found to hold essentialist beliefs about academic ability in physics. Although these findings do not provide direct evidence of essentialism, this is the first study to provide converging evidence for three manifestations of psychological essentialism; (1) inductive potential; children made inductive inferences about academic subject ability on the basis of knowledge of sex group membership alone, (2) a belief in nativism; children believe that academic subject ability has a biological basis in the brain and (3) immutability; academic subject ability is not seen perceived as open to environmental influence.

Whilst acknowledging that gender stereotyping is not the only factor guiding subject choice, the fact that children hold essentialist beliefs about academic subject ability may deter them from choosing subjects that are not stereotypically aligned with their own gender for further study. There is some evidence to suggest that holding essentialist beliefs has an impact on behaviour (Martin et al, 1995) so these

essentialist beliefs about sex differences in academic ability in stereotypically masculine and feminine studies may well influence children's subject choices. Children were found to hold less essentialist beliefs about masculine subjects which may help to explain why boys show more of a bias in subject choice than girls (Whitehead, 1996). Furthermore, Leaper (2000) has argued that boys have more at stake than girls in maintaining group boundaries due to males' higher status in society. The role of power and status in relation to essentialist representations of social categories remains relatively unexplored (although see Mahalingham, 2001), and is an important area for future research.

In the second part of the experiment children were required to make inferences about the gendered properties from Taylor's (1996) study. It was found that 11-12 year olds appear to hold essentialist beliefs about gender-stereotyped properties predicting, for instance, that a male with a female brain is more likely to acquire feminine properties than a male raised by only women and a 'normal' male, yet the 15-16 year old participants were found to be ambivalent as to the factors influencing the acquisition of these properties. Previous research has suggested that as children get older they move away from an essentialist construal of gender, an important finding in this study is that even 15-16 year olds appear to view certain, but not all, gendered attributes in essentialist terms. Based on the present findings it is plausible that what previous researchers uncovered was not that the older children and adults were no longer essentialist per se but just that they did not construe the specific gendered attributes participants were asked to make inferences about in essentialist terms. In other words, they may still believe there are innate sex differences in certain skills and attributes but not about others. Another possibility leading on from this is that some of the older participants may not perceive the brain to be central to gender identity, one of the 15-16 year old participants in the transplant condition for instance stated: 'Some things would change but there are differences in the body too – like hormones'.

Overall, the present data suggest that gender essentialism may be ongoing in development and future research needs to uncover which attributes people believe are linked to the gender essence, as well as where the essence is believed to be located.

Although the extent to which these results can be generalized needs to be considered. Previous studies on essentialism have been conducted with mainly white, middle-class samples, the present study was conducted at school where a significant majority (70%) of the students come from an ethnic minority and it is possible that gender attitudes are relatively less liberal in this sample. Future research

should broaden the range of samples and consider the intersection of gender, class and ethnicity.

Another issue that needs to be considered is that of individual differences between the participants, based on the explanations they provided for their answers some appear to have an essentialist orientation stating 'girls are better than boys in some subjects like textiles but boys are better at science', while others refused to make gender-category based inferences stating that 'the information provided was too vague'. Of relevance to educational subject choice is the possibility that the gender stereotyping of subject areas is more of an attraction/deterrent to some pupils than others.

A further nother issue that needs to be addressed concerns the use of thought experiments as a way of uncovering gender representations. There is evidence to suggest that some of the 15-16 year olds over-interpreted the task, for instance 3 of the participants in the island condition mentioned that there were no computers on the island and therefore they could not predict grades for I.T. It is for this reason that predicted grades for I.T were excluded from the analysis. This illustrates the need for future research to utilise a more sensitive measure of older children's knowledge. Finally, the role of culture in relation to essentialist representations of social categories remains relatively underspecified. Although psychological essentialism is a cognitive heuristic which categories people essentialize varies both across and within cultures. More research is required which explores the role of culture in essentialism, specifically the cultural conditions including the nature of cultural discourse that serve to heighten or inhibit children's essentialist beliefs about social categories such as gender.

Conclusion

If an attempt is to be made to design policies or campaigns that counteract prevailing gender stereotypes and their influence upon subject choice it needs to be based on an understanding of both the acquisition, and nature of gender-role concepts. While the present study is only the first step in this direction, the current findings suggest that psychological essentialism as a theory of category representation may underlie the gender stereotyping of subjects amongst children, and may explain why sex differences in subject choice persist despite 30 years of gender reform policies.

Acknowledgements

We would like extend our gratitude to all the students who took part in our experiments for their generous cooperation. A special thanks to Debbie Prentice for reading an earlier draft of this paper.

References

- Archer, J., & Macrae, M. (1991). Gender Perceptions of School Subjects among 10-11 year olds. *British Journal of Educational Psychology*, 61, 99-103.
- Astuti, R., Solomon, G.A & Carey, S. (2004). Constraints on conceptual development: a case study of the acquisition of folkbiological and folksociological knowledge in Madagascar [online]. London: LSE Research Online.
- Atran, S. (1998). Folk biology and the anthropology of science. *Behavioral and Brain Sciences*, 21, 547—611.
- Baron, A.S., & Banaji, M, (2006). The Development of Implicit Attitudes. *Psychological Science*, 17 (1), 53 – 58.
- Colley, A. (1998). Gender and Subject Choice in Secondary Education. In J. Radford (Ed.), *Gender and Choice in Education and Occupation*. London: Routledge.
- Department for Education and Skills. (2007). *Gender and Education: the evidence on pupils in England*. London: DFES.
- Equal Opportunities Commission (2005). *Women and Men in Britain: Sex Stereotyping from school to work*. Manchester: EOC.
- Francis, B. (2000). The Gendered Subject: students' subject preferences and discussions of gender and subject ability. *Oxford Review of Education*, 26 (1), 1-17.
- Gelman, S.A. (2003). *The Essential Child: Origins of Essentialism in Everyday Thought*. New York: Oxford University Press.
- Gelman, S., Collman, P., Maccoby., E. (1986). Inferring Properties from Categories versus Inferring Categories from Properties: The Case of Gender. *Child Development*, 57(2), 396 – 404.

Gelman, S. A., & Wellman, H.M. (1991). Insides and essences: Early understandings of the nonobvious. *Cognition*, 38, 213-244.

Haslam, N., Rothschild, L., & Ernst, D. (2000). Essentialist beliefs about social categories. *British Journal of Social Psychology*, 39, 112-127.

Hirschfeld, L.A. (1996). *Race in the making: Cognition, Culture, and the Child's Construction of Human Kinds*. London: MIT Press.

Keil, F.C. (1994). The birth and nurturance of concepts by domains: The origins of living things. In L.A. Hirschfeld, & S.A. Gelman (Ed.), *Mapping the Mind: Domain-Specificity in Cognition and Culture*. Cambridge University Press.

Kelly, A. (1981). Choosing or Channelling? In A. Kelly (Ed.), *The Missing Half: Girls and Science Education*. Manchester: Manchester University Press.

Leaper (2000) The social construction and socialization of gender during development. In P.H. Miller, & E. Kofsky Scholnick (Ed.), *Toward a feminist developmental psychology*. Florence: Taylor & Francis/Routledge.

Mahalingam, R. (2001). Essentialism, Culture and Power: Representations of Social Class. *Journal of Social Issues*, 59 (2), 733-749.

Mahalingham & Rodriguez (2003) Essentialism, Power and Cultural Psychology of Gender. *Journal of Cognition and Culture*, 3 (2), 157-174.

Martin, C.L. (1989). Children's use of gender-related information in making social judgements. *Developmental Psychology*, 25, 80-88.

Martin, C.L, Ruble, D.N., & Szkrybalo, J. (2002). Cognitive theories of early gender development. *Psychological Bulletin*, 128, 903 – 933.

Medin, D. & Orton, A. (1989). Psychological Essentialism. In S. Vosniadou & A. Ortony (Ed.), *Similarity and Analogical Mapping*. Cambridge: Cambridge University Press.

Prentice, D.A and Miller, D.T (2006). Essentializing Differences Between Women and Men. *Psychological Science*, 17 (2), 129 – 135.

Pickering, J. (1997). *Raising Boys' Achievement*. London: Network Educational Press.

Radford, J. (1996). Gender and Subject Choice in Secondary Education. In J. Radford (Ed.), *Gender and Choice in Education and Occupation*. London: Routledge.

Signorella, M.L & Liben, L.S. (1984). Recall and reconstruction of gender-related pictures. *Child Development*, 55, 393-405.

Smith, J. & Russell, G. (1984). Why do males and females differ? Children's beliefs about sex differences. *Sex Roles*, 11, 1111-1120.

Stanworth, M. (1981). *Gender and Schooling: a study of gender divisions in the classroom*. London: Women's Researches and Resources Centre.

Taylor, M.G. (1996). The Development of Children's Beliefs about Social and Biological Aspects of Gender Differences. *Child Development*, 67(4), 1555-1571.

Ullian, D. (1976). The development of concepts of social structure: Social convention. In B. Lloyd & J. Archer (Ed.), *Exploring sex differences*. London: Academic Press.

Whitehead, J.M. (1996). Sex stereotypes, gender identity and subject choice at A-level. *Educational Research*, 38 (2), 147-160.

About the author:

Japinder Dhesi was awarded a PhD from the Institute of Social Psychology at the LSE, UK. Her doctoral thesis brings together social psychological, evolutionary and anthropological ideas as a means of generating new insights into the cognitive foundations of social group stereotyping.

Address for correspondence: Japinder Dhesi, Institute of Social Psychology, London School of Economics, St Clements Building, Houghton Street, London, WC2A 2AE
E-mail: jap.dhesi@gmail.com