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This is the peer reviewed version of the following article:

Wood, L. A., Hutchison, J., Aitken, M., & Cunningham, S. J. (2021) 'Gender stereotypes in UK children and adolescents: changing patterns of knowledge and endorsement'. *British Journal of Social Psychology*.

which has been published in final form at:

<https://doi.org/10.1111/bjso.12510>

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Gender Stereotypes in UK Children and Adolescents: Changing Patterns of Knowledge and Endorsement

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How to cite this article: Wood, L. A., Hutchison, J., Aitken, M., & Cunningham, S. J. (2021). Gender stereotypes in UK children and adolescents: Changing patterns of knowledge and endorsement. *British Journal of Social Psychology*, 00, 1–22. <https://doi.org/10.1111/bjso.12510>

Data availability: The data are openly available in the Open Science Framework at <https://osf.io/njahd/>

Acknowledgements:

Thank you to C. Kimber-Bidlot, L. Morgan, C. Coyne, and E. Smith for assistance in collecting the data, and to the editor and two anonymous reviewers for their constructive comments on the manuscript.

KEYWORDS

adolescents, careers, children, development, gender, schools, stereotypes

Abstract

Across two studies, we investigated gender stereotype knowledge and endorsement in UK schoolchildren, and their impact on academic subject choice. In Study 1, children aged 9-11 ($N=68$) and 13-15 ($N=61$) completed a newly developed Gender Attribute scale assessing their knowledge and endorsement of gender stereotypes relating to academic subjects and occupations. Participants demonstrated gender stereotype knowledge and endorsement, although significantly higher knowledge than endorsement scores indicated a level of stereotype rejection. Stereotype knowledge was greater in the older age group, and older girls showed significantly higher levels of stereotype rejection than all other groups. In Study 2, children aged 13-15 ($N=165$) completed the Gender Attribute scale and provided information on their school subject choices. Patterns of stereotype knowledge and endorsement followed those of Study 1. Subject choice information showed that boys selected significantly more masculine than feminine subjects, while girls chose a similar proportion of each. Further, boys' level of gender stereotype endorsement predicted their subject choices, while girls' did not. We suggest that in contemporary UK some progress is being made in relation to girls challenging stereotypes that work against them but that more work is needed to encourage boys into female-dominated disciplines.

Gender stereotypes in UK children and adolescents: Changing patterns of knowledge and endorsement

There are significant gender differences in education and career opportunities internationally (Master & Meltzoff, 2016), with males being more likely than females to pursue maths and science pathways while females are more likely than males to focus on the arts and on caring roles (Department for Education, 2019; Francis, 2000; van der Vleuten et al., 2016). Research suggests that many of the gender differences in subject and career choice are driven by sociocultural stereotypes rather than any biological gender differences in ability (Halpern et al., 2007; Kurtz-Costes et al., 2008; Spelke, 2005). Stereotypes are networks of category-associated information whereby group membership is associated with the possession of particular attributes, and are activated by salient group-membership cues, of which gender is one of the most prominent (Martin et al., 2015). Given that stereotypes are a product of cultural evolution, they would be expected to be subject to some degree of change over time (Charlesworth & Banaji, 2021; Hutchison & Martin, 2015; Rowley et al., 2007). However, despite societal attitudes moving towards endorsement of equal opportunities for males and females (Ellemers, 2018), gender stereotyping remains pervasive, with male and female categorisation being highlighted to children in particular as a dominant social structure (e.g., gender-specific toys, activities and colour cues; see Cunningham & Macrae, 2011). This is likely to have the effect of maximising gender difference and stereotypes across childhood and into adolescence. However, the extent to which current UK cohorts of young people know and endorse these stereotypes is not clear.

Gauging young people's stereotype endorsement is particularly important because academic subject choices made in secondary school shape future career options, which then determine workplace gender balance. Understanding how gender stereotypes operate during late childhood (approximately ages 8 to 11) and adolescence (approximately ages 12 to 18) is therefore an important element of developing effective interventions to combat gender inequity within our culture. The influence of specific gender stereotypes in adolescence have been examined closely in an educational context, with policy makers attempting to increase female involvement in male-stereotypic STEM (science, technology, engineering and maths) subjects. However, interventions such as training for educators, involving women in visible leadership roles, and addressing social norms within the school environment have not been successful in eradicating significant gender differences in STEM subject choice, career objectives, or self-perceived competence (Department for Education, 2019; Kurtz-Cortes et al., 2008; Passolunghi et al., 2014; Steffens et al., 2010). Further, this STEM-focus neglects the fact that boys may need encouragement to participate in female-stereotypic subjects and occupations that may suit their particular interests and aptitudes. For example, in the UK only 2% of nursery staff and 12% of nurses are male (Children's Workforce Development Council Survey, 2018; Higher Education Statistics Agency, 2016), and less than 1% of eligible UK men took shared parental leave in 2016/17 (EMW Law, 2019). To support potential effective interventions for boys as well as girls, psychological research must begin with a clear starting point of understanding levels of gender stereotyping as children move from late childhood to adolescence when academic choices become pertinent. Providing this information is the first aim of the current study.

Stereotype Knowledge v. Endorsement

In order to assess the ways in which children's understanding and application of gender stereotypes develop, it is important to distinguish between two different levels of stereotyping: stereotype knowledge (i.e., awareness of the cultural stereotype) and stereotype endorsement (i.e., a personal belief that the stereotype is true; see Augoustinos & Rosewarne, 2001; Devine, 1989; Serbin et al., 1993; Signorella, Bigler, & Liben, 1993). Stereotype knowledge is built up by frequent co-activation of categories and their associated traits and behaviours. Delivery of these co-activations is ingrained in the fabric of society and is therefore almost impossible for individuals living in that society to escape (Cunningham & Macrae, 2011). However, stored associative knowledge does not necessarily translate into personal endorsement; individuals who report low-prejudice explicit attitudes can show high levels of knowledge of cultural stereotypes with which they personally disagree (Devine, 1989). For example, an individual might have knowledge of the stereotype that women are more caring than men, but hold a personal belief that is incongruent with this cultural stereotype. Differences between knowledge and endorsement are important when studying stereotyping, as these aspects impact on different types of behaviour. Associative stereotype knowledge has been shown to drive nonconscious and fast responses to stimuli, while personal beliefs are more aligned with controlled behaviours (e.g., Devine, 1989; Dovidio et al., 1997).

Importantly, younger children show more correspondence between these two levels of stereotyping than older children and adults. Illustrating this developmental trend, Augoustinos and Rosewarne (2001) measured five- to nine-year-old White Australian children's levels of racial stereotyping by asking two different questions in a trait-person matching task: 'what do *you* think?' (personal belief: stereotype endorsement), and 'what do *most Australians* think?' (stereotype knowledge). The five- to six-year-olds had knowledge and endorsement scores that were at similar level, while eight- to nine-year old children gave different answers to the two questions, showing higher levels of knowledge of negative race stereotypes than personal beliefs. Thus, while knowledge of gender stereotypes may increase across development with increased exposure to cultural associations (Bigler & Liben, 2007), older children may show higher personal rejection of some cultural stereotypes.

Complicating the interpretation of gender stereotyping in childhood is a methodological issue concerning binary responses that may mask a growing rejection of endorsing stereotype knowledge. Serbin et al. (1993) tested 5- to 12-year-olds' gender stereotyping on a task in which they were asked to match objects and personal attributes with gender categories. They found that stereotype knowledge increased across this age range, but so too did children's use of '*both*' genders as a response in the matching task. In a meta-analysis of studies exploring the attitudes of children aged four to 11 years, Signorella et al. (1993) found that there was a tendency for older children to give more answers that match gender stereotypes than did younger children when using binary choice scales (male v. female), but when non-binary choices were used there was a slight increase with age in the use of '*both*' as a response. The authors argue that binary-choice questions are an indirect measure of stereotype knowledge, while non-binary choices indirectly measure endorsement. However, it is also possible that specific items are not gender stereotyped in a particular society, meaning that a response of '*both*' could reflect accurate stereotypic knowledge. Thus, to get a clear picture of stereotyping it is important to replace binary choices ('male', 'female') with more flexible options (including '*both male and female*'), particularly with older children. In the current study, we therefore

explored gender stereotype knowledge and endorsement of older children and adolescents using more flexible response options.

Gender Stereotype Development

From infancy, children begin to identify gender as a category and attempt to understand the differences between males and females (Thompson, 1975). Children as young as five months can discriminate between male and female faces, and match voices with these faces within a few months (Powlishta et al., 1994). By 10 months, infants can form stereotypic associations between male and female faces and objects (Levy & Haaf, 1994). Discrimination of objects based on gender is observable in 18-month-olds (Serbin et al., 2001), knowledge of sex-typed roles emerges as early as two-years old (Thompson, 1975), and by three children have a basic understanding of roles, activities and toys associated with gender differences (Weinraub et al., 1984) with some evidence of increased play with toys congruent with gender stereotypes (Zosuls et al., 2009). By age five children have considerable sex-typing knowledge (Serbin et al., 1993) and some gender stereotype endorsement concerning preferences (e.g., colour: Cunningham & Macrae, 2011; toys: Banse et al., 2010; and personal-social attributes: Trautner et al., 2005). Interestingly, in earlier childhood an increasing knowledge of cultural gender stereotypes sometimes competes with strong in-group gender preferences. From as young as four, boys and girls show implicit and explicit own-gender preferences (USA; Dunham et al., 2016). This extends to a gender in-group association with academic brilliance at age five (USA; Bian et al., 2017), maths ability at age seven (Italy; Passolunghi et al., 2014) and nine (France; Martinot & Désert, 2007), and science abilities at age nine (USA; Kurtz-Costes et al., 2008).

However, during this stage of development children are also increasingly exposed to gender stereotypes relating to academic subjects, which can challenge beliefs of in-group brilliance. Indeed, across middle childhood, there is evidence that own-gender self-belief declines as knowledge of cultural stereotypes grows. Dunham et al., (2016), for example, found that by age six, the own-gender academic brilliance bias is already significantly smaller in girls compared to boys, indicating a trajectory towards the male academic brilliance stereotype. Similarly, while US five-year-olds associate academic brilliance with their own gender, this in-group bias then veers towards a gender stereotype that boys are more academically brilliant (Bian et al., 2017). Cvencek et al., (2011) found a clear implicit male-maths association in both US girls and boys as young as seven. This can impact on perceived personal ability, with girls underestimating and boys overestimating their mathematical ability by adolescence (Chatard et al., 2007). The same pattern emerges for boys and stereotypes relating to female academic abilities; Kurtz-Costes et al., (2014) measured both knowledge and endorsement of academic gender stereotypes in nine- to 14-year-olds. Younger children were shown to endorse in-group academic superiority rather than report traditional stereotypes, but adolescent boys knew and endorsed a stereotype of superior female verbal ability. However, some own-gender bias persists in stereotype endorsement, with studies of adolescents showing stronger implicit attitudes for the male-maths association in males than females, and high implicit attitudes for the female-language association in females than males (Steffens & Jelenec, 2011; see also Kurtz-Costes et al., 2014). Overall, by early adolescence children show a clear understanding of the academic stereotypes

associated with each gender, but an own-gender effect remains with a bias to endorse those that favour their own gender.

Awareness of cultural gender stereotypes can be particularly challenging for female in-group identity because of the prominence of the 'male brilliance' stereotype (Storage et al., 2020), and the stereotypic masculinity of high-status roles (Eagly & Karau, 2002). There is a persistent underrepresentation of women in high-pay and high-status leadership roles (see meta-analytic review by Badura et al., 2018), and more positive value associations with male-dominated agentic occupations than female-dominated caring roles (Block et al., 2018). Correspondingly, during middle childhood, children become aware that public regard for males is greater than for females (Neff et al., 2007) and perceive men to have greater power and status than women (Liben et al., 2001). Awareness of the cultural stereotypes that reflect negatively on females in a workplace context may produce a feeling of group threat in girls, which according to self-categorisation theory should increase the salience of the female identity (see Tajfel & Turner, 1979; Verkuyten & Nekuee, 1999). Indeed, research examining the effects of high status (male) and low status (female) groups on identity has demonstrated higher in-group identity in females than males (Cadinu et al., 2012; Verkuyten & Thijs, 2001). Females also have a greater perception of gender inequity than males (Spears Brown & Bigler, 2004) and adolescent girls show stronger implicit gender biases than boys (Steffens et al., 2010). Thus, any developmental analysis of level of gender stereotyping therefore needs to explore trajectories in the context of each gender separately.

The Current Study

There is a need for more detailed understanding of gender stereotype knowledge and endorsement in boys and girls living in contemporary UK culture, and how these constructs are associated with decision-making. This is particularly important in the developmental stage from late childhood to mid-adolescence when academic choices begin to shape career pathways. Updated stereotype knowledge and endorsement data is required not just for theoretical reasons but to inform interventions designed to reduce gender inequity in education and the workplace. Indeed, following national efforts to reduce girls' low participation in STEM subjects, but not boys' engagement in female-stereotypic subjects and occupations (e.g., drama, nursing), gender stereotypes for feminine items may now be stronger than for masculine items. To examine these issues, the current study developed a new Gender Attribute scale designed to measure both knowledge and endorsement of cultural stereotypes in male and female domains. The scale assesses knowledge and endorsement across a broad range of masculine and feminine stereotypes in relation to academic subjects and occupations. In Study 1, we used this scale to measure gender stereotype knowledge and endorsement in boys and girls in both late childhood and adolescence. In Study 2, we tested a different adolescent sample on the same stereotyping scale, and gathered academic subject choice data to examine relationships between stereotype endorsement and decision-making at this key stage.

Study 1: Gender stereotype knowledge and endorsement

Study 1 was designed to gauge levels of gender stereotype knowledge and endorsement across late childhood and adolescence. We aimed to examine contemporary UK gender stereotypes in two age

groups: 9-11-year olds (late childhood) and 13-15-year olds (mid-adolescence). Based on previous literature, we made the following predictions:

1. That children of all ages will demonstrate gender stereotype knowledge and endorsement.
2. Stereotype knowledge will be greater in the older than the younger age group (Serbin et al., 1993).
3. Stereotype endorsement will be higher in the younger age group relative to the older age group, leading to a larger gap between knowledge and endorsement (rejection) in the older than the younger age group (Augoustinos & Rosewarne; 2001; Kurtz-Costes et al., 2014; Trautner et al., 2005)
4. Stereotype endorsement will be moderated by in-group membership (Tajfel & Turner 1979), such that that both genders will endorse more stereotypes that claim their own gender is 'better' than the other gender.
5. Following efforts to increase female participation male-stereotypic (STEM) subjects, domains associated with masculine subjects/occupations will show lower levels of stereotyping than those associated with female stereotypes.

Method

Design

The study had a mixed design with two repeated measures ('Stereotype level': knowledge or endorsement, 'Stereotype direction': feminine or masculine) and two between-subjects factors ('Participant gender': male or female; 'Age group': 9-11 years or 13-15 years). This design was entered into MorePower 6.0.4 (Campbell & Thompson, 2012) with a medium effect size ($\eta^2_p = .06$; power = .8), which calculated an appropriate sample of 128 participants.

Participants

Participants were recruited from schools based in Angus, Dundee, and Perthshire in Eastern Scotland, which were contacted individually to request participation. In total 129 children were tested and there were no exclusions. This sample consisted of 68 9- to 11-year-olds (36 boys and 32 girls) and 61 13- to 15-year-olds (30 boys and 31 girls). Data collection occurred between October 2019 and March 2020. The research project and protocols were approved by the Research Ethics Committee at [Redacted] and all participating schools. Participation information was sent to parents and children, and consent was obtained from both.

Materials

Scale Items

The scale comprised academic subjects and occupations. Twelve academic subjects selected were common to most British secondary schools with five subjects associated with a male stereotype (science, maths (numeracy), IT (computers), Sport (PE), design and technology), five subjects associated with a female stereotype (art, English (literacy), music, drama, and languages) and two subjects that were assumed to be more neutral (history and geography). Occupations items were finalised using the following procedure; all occupations listed in Miller and Budd, (1999), De Caroli and Sagone (2007), and Bigler (1995)

were collated and included in the scale, except where the following exclusion criteria were applied: (1) Occupations that were not associated with a gender (e.g., artist, baker) were excluded. (2) Occupations that were not common were excluded, (i.e., those not listed in the Office for National Statistics Employment by Occupation April to June 2018 sourced from the Labour Force Survey, or having fewer than 1,000 employees nationwide; e.g., astronaut, spy). (3) Occupations that were synonymous with another included item were excluded (e.g., hair stylist was removed and hairdresser retained). This exclusion exercise resulted in 22 occupation items, which we supplemented with “stay-home parent” due to the notably low uptake of parental leave in the UK. “Firefighter” was erroneously not included in the experimental materials, leaving a final list of 22 items in the scale (Table 1).

Table 1: List of occupation items and assumed direction of stereotype. Number in parentheses indicates number of males/females as a percentage of the UK general population in that occupation (ONS, 2018).

Masculine	Feminine
Builder (99%)	Dancer (87%)
Scientist (52%)	Dressmaker (88%)
Police officer (65%)	Nurse (89%)
Engineer (88%)	Hairdresser (84%)
Journalist (53%)	Cleaner (81%)
Mechanic (99%)	Florist (89%)
Lorry Driver (99%)	Secretary (93%)
Pilot (100%)	Teacher (74%)
Farmer (89%)	Shop assistant (66%)
Plumber (100%)	Paid childcare (97%)
	Telephonist (66%)
	Stay home parent (N/A)

Scale delivery. The scale was constructed, delivered and controlled in PsychoPy (Pierce, 2007) running on a laptop. Written instructions were presented onscreen. The school subject items appeared in random order followed by the occupation items in random order. For each item presented the item was displayed at the top of the screen, then there was a question in relation to knowledge followed by a question related to endorsement. In both cases the same response was displayed on the laptop monitor (see Figure 1). These images were also printed onto small pieces of paper which were stuck onto four keys on the keyboard corresponding to a spatially similar configuration (Q=Men/Boys; T=Men or Women/Boys or Girls; O=Women/Girls; V=Don't know).

Figure 1; Screenshot of an example of an endorsement question from the job items.



Procedure

Children were given age-relevant participation information and asked if they consented to participation. Children were asked to sit at a desk with the laptop computer and the experimenter launched the scale. The instructions read, "We would like you to think about subjects at schools and what kinds of people might be better at these subjects. You will be presented with a school subject and then asked questions in relation to this subject. There is no right or wrong answer, we just want to know what you think. Press the Space bar to start". The 12 school subjects then appeared in a random order and questions for each item knowledge ("Who do most people think would be better?") and endorsement ("Who do you think would be better?") were asked on two separate screens. After this a new instruction sheet appeared with "job" replacing "school subjects" and the 22 occupations were randomly presented. The scale was self-paced and took approximately ten minutes. After completion children were thanked and given an opportunity to ask questions.

Results

The scale developed for the current study required verification before the data were analysed, so all items included were first checked to determine whether they were associated with the predicted male or female stereotype. All items to which responses differed significantly from zero (no gender association) were included in the subsequent analysis. The main analysis was categorical, with variance in stereotype knowledge and endorsement scores analysed by age group and participant gender.

Verifying Subject and Occupation Items

Each subject and occupation item was coded relative to the predicted direction of the gender stereotype. For example, for presumed positive female stereotype items such as "English", responses were scored -1 if "Boy" was selected, +1 if "Girl" was selected and 0 for "Both" and "Don't know" options. Conversely, for items that had a predicted male stereotype, such as Plumber, the responses were scored -1 if "Woman" was selected, +1 if "Man" was selected and 0 for "Both" and "Don't know" options. Inspection of responses indicated that the two 'neutral' items (History and Geography) were both associated with males, so these were reclassified as masculine items. To verify whether stereotype knowledge was extant in the sample, and aligned with the predicted direction, a one-way t-test was run for each item to see if

scores significantly differed from zero. Table 2 presents an overview of the items, with positive mean scores indicating a stereotype in the direction assumed. Every item except “Journalist” had a positive mean, and was significantly different from zero. Therefore, all items except “Journalist” were retained for the rest of the analyses.

Table 2: Summary of stereotype knowledge responses ordered by mean stereotypicality. Range of scores from +1 (stereotype consistent) to -1 (stereotype inconsistent). N = 129, df = 128. Note, Geography and History were predicted to be gender neutral but were associated with male superiority so were reclassified as masculine items.

Associated Stereotype	Item (subject/occupation)	Mean	SD	t	Sig	Lower CI	Upper CI
Neither	Journalist	-0.07	0.55	-1.45	0.15	-0.17	0.03
Masculine	Sport	0.72	0.47	17.52	<0.001	0.64	0.80
	Design & Technology	0.63	0.61	11.62	<0.001	0.52	0.73
	IT	0.43	0.60	8.25	<0.001	0.33	0.54
	Science	0.36	0.66	6.26	<0.001	0.25	0.48
	Geography	0.26	0.53	5.43	<0.001	0.16	0.35
	Maths	0.20	0.60	3.79	<0.001	0.10	0.31
	History	0.16	0.55	3.19	0.002	0.06	0.25
	Builder	0.85	0.38	25.68	<0.001	0.79	0.92
	Plumber	0.84	0.42	22.69	<0.001	0.77	0.92
	Lorry Driver	0.82	0.40	23.10	<0.001	0.75	0.89
	Mechanic	0.80	0.44	20.62	<0.001	0.72	0.88
	Engineer	0.79	0.43	21.03	<0.001	0.72	0.87
	Pilot	0.64	0.51	14.03	<0.001	0.55	0.73
	Farmer	0.64	0.53	13.64	<0.001	0.54	0.73
	Police Officer	0.59	0.51	13.13	<0.001	0.50	0.68
	Scientist	0.37	0.60	7.04	<0.001	0.27	0.48
Feminine	Art	0.60	0.55	12.28	<0.001	0.50	0.69
	Music	0.58	0.52	12.56	<0.001	0.49	0.67
	Drama	0.57	0.56	11.54	<0.001	0.47	0.66
	Languages	0.25	0.51	5.46	<0.001	0.16	0.34
	English	0.19	0.57	3.71	<0.001	0.09	0.29
	Nurse	0.79	0.43	21.03	<0.001	0.72	0.87
	Hairdresser	0.78	0.43	20.57	<0.001	0.71	0.86
	Dressmaker	0.78	0.45	19.76	<0.001	0.70	0.86
	Florist	0.71	0.50	16.10	<0.001	0.63	0.80
	Dancer	0.70	0.48	16.59	<0.001	0.61	0.78
	Paid Childcare	0.67	0.49	15.74	<0.001	0.59	0.76
	Stay at Home Parent	0.61	0.55	12.66	<0.001	0.52	0.71
	Cleaner	0.58	0.56	11.90	<0.001	0.48	0.68
	Secretary	0.33	0.69	5.39	<0.001	0.21	0.45
	Teacher	0.28	0.52	6.15	<0.001	0.19	0.37
	Shop Assistant	0.22	0.55	4.66	<0.001	0.13	0.32
	Telephonist	0.22	0.59	4.33	<0.001	0.12	0.33

Stereotype Knowledge and Endorsement Scores

Hypothesis 1 stated that children of all ages would demonstrate gender stereotype knowledge and endorsement. To examine this, the sum of scores for each item was calculated for each participant for both stereotype knowledge and endorsement, with a potential range of -33 to +33 for both. Knowledge scores ranged from 0 to 32 with a group mean of 17.98 ($SD = 6.66$) and endorsement scores ranged from -1 to 23 with a group mean of 8.33 ($SD = 6.46$), showing that children across the sample knew and endorsed gender stereotypes. Knowledge and Endorsement scores were not correlated, $r(129) = -0.14$, $p = .109$. As there was an unequal number of masculine ($N = 16$) and feminine items ($N = 17$), scores were transformed into ratio data relative to potential total scores. For example, if a participant scored 8 on the list of 16 masculine items, they were given a ratio score of 0.5. Table 3 summarises the mean ratio scores for masculine and feminine stereotype knowledge and endorsement relative to participant gender and age.

Table 3: Mean ratio scores for masculine and feminine stereotype knowledge and endorsement relative to participant gender and age

		Stereotype Knowledge		Stereotype Endorsement	
		Masculine	Feminine	Masculine	Feminine
9-11 years old	Boys	0.54	0.45	0.27	0.24
	Girls	0.51	0.47	0.23	0.29
13-15 years old	Boys	0.57	0.52	0.30	0.30
	Girls	0.65	0.66	0.18	0.21

A mixed general linear model was run with stereotype level (knowledge or endorsement) and stereotype direction (feminine or masculine) as repeated measures, and participant gender (male or female) and age group (9-11 years or 13-15 years) as between subject factors. This analysis revealed a significant main effect of stereotype level, $F(1,125) = 134.15$, $p < .001$; $\eta_p^2 = .52$, with higher summed ratio scores for stereotype knowledge (i.e., sum of the two ratio scores: $M = 1.09$, $SD = .40$) than endorsement ($M = 0.50$, $SD = .39$). There was no main effect of participant gender, $F(1,125) = 0.002$, $p = .963$, $\eta_p^2 = .00$. However, there was a significant main effect of age, $F(1,125) = 4.59$, $p = .034$, $\eta_p^2 = .04$; overall older children had higher summed stereotypic scores (i.e., sum of the four ratio scores: $M = 1.70$, $SD = .48$) than younger children ($M = 1.50$, $SD = .54$).

Stereotype Level: Knowledge versus endorsement

Hypothesis 2 stated that stereotype knowledge would be greater in the older than the younger age group. Hypothesis 3 stated that stereotype endorsement would be higher in the younger than older age groups, leading to a larger gap between knowledge and endorsement (rejection) in the older than the younger age group. In relation to these hypotheses, there were three significant interactions involving stereotype level. First, there was a significant two-way interaction with age-group, $F(1,125) = 4.60$, $p = .034$, $\eta_p^2 = .04$. Older children had higher total stereotype knowledge scores ($M = 1.20$, $SD = .40$) than younger children, ($M = 0.99$, $SD = .39$); $t(127) = 3.03$ $p = .003$, $d = 0.54$, 95% CI [.07, .35] while both age groups had

similar stereotype total endorsement scores (older: $M = 0.50$, $SD = .42$; younger: $M = 0.51$, $SD = .37$); $t(127) = -0.19$, $p = .852$, $d = 0.04$, 95% CI [-.15, .12]. Second, there was an interaction between stereotype level and gender, $F(1,125) = 4.19$, $p = .043$, $\eta_p^2 = .03$. There was a slight trend for girls to have higher stereotype knowledge scores than boys (girls $M = 1.15$, $SD = .44$; boys $M = 1.04$, $SD = .35$), and for boys to have higher endorsement scores than girls (boys: $M = 0.55$, $SD = .40$; girls: $M = 0.45$, $SD = .38$); however neither of these patterns reached significance, knowledge: $t(127) = -1.53$, $p = .128$, $d = 0.27$, 95% CI [-.25, .03]; endorsement: $t(127) = 1.41$, $p = .162$, $d = 0.26$, 95% CI [-.04, .23]. Importantly, these patterns were complicated by a significant stereotype level x age x gender interaction, $F(1,125) = 4.92$, $p = .028$, $\eta_p^2 = .04$.

To explore the three-way interaction, a difference score was calculated for each participant by subtracting the stereotype endorsement ratio from the stereotype knowledge ratio score. This difference constitutes the level of *rejection* of a known stereotype (i.e., knowledge that is not personally endorsed). Bonferroni comparisons revealed that the difference score of 13–15-year-old girls was significantly higher than all other groups (see Table 4; no other group differences were close to significance). This suggests that the patterns of age and gender differences in knowledge and endorsement are driven by older girls having a much higher difference between their knowledge and endorsement of gender stereotypes than any other group (see Figure 3).

Table 4: Bonferroni comparisons of stereotype rejection scores for 13-15 girls.

		Bonferroni		95% Confidence Interval	
		M	Sig.	Lower Bound	Upper Bound
13-15 Girl (M = 0.92)	9-11 Boy	0.49	0.018	0.48	0.81
	9-11 Girl	0.47	0.016	0.55	0.84
	13-15 Boy	0.48	0.023	0.04	0.83

Figure 2: Mean and 95% CI stereotype rejection scores relative to age and gender.

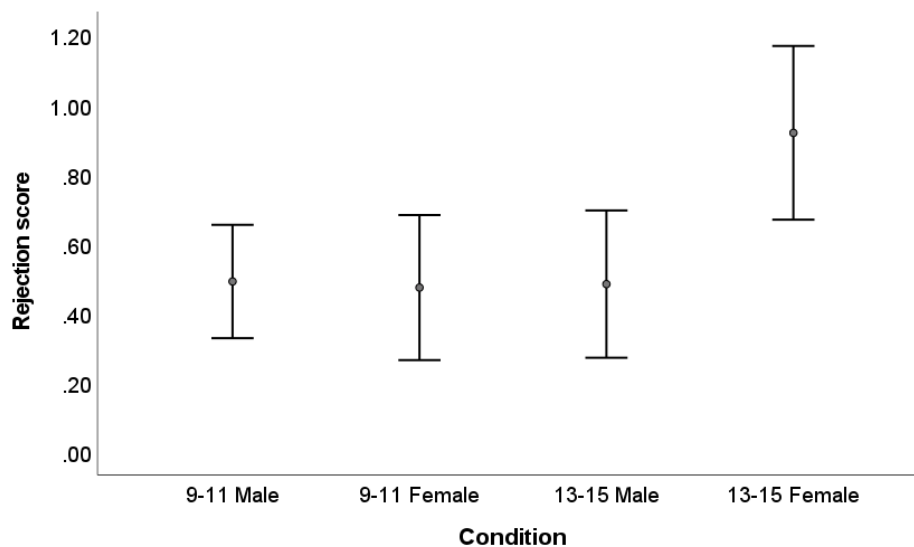
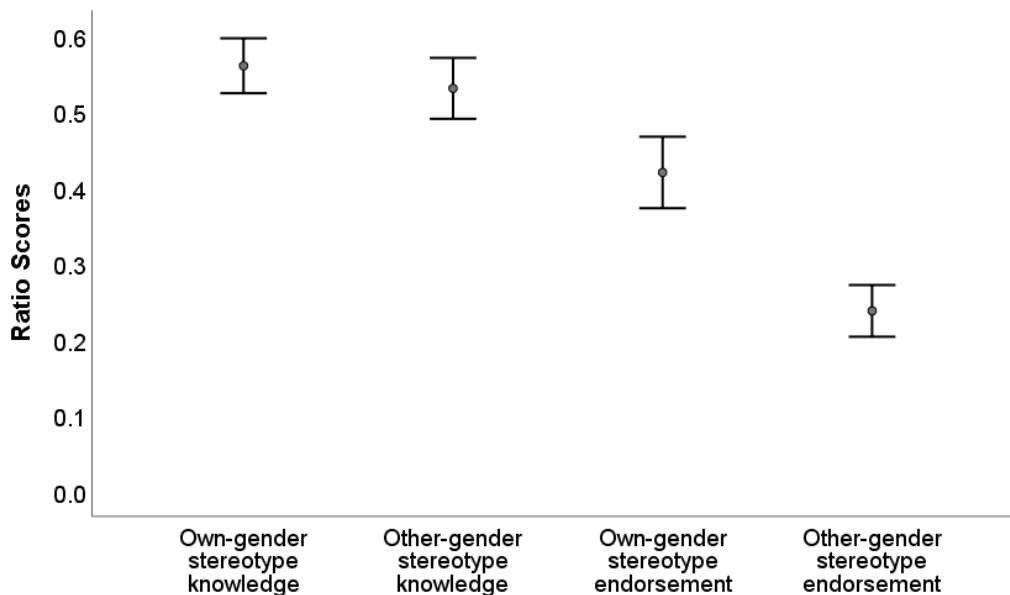


Figure 3: Knowledge and endorsement ratio score (mean and 95% CI) relative to own-gender and other-gender stereotypes.



Stereotype Direction: Masculine versus Feminine items

Hypothesis 4 stated that both genders would endorse more stereotypes that claim their gender is 'better' than the other gender, and accordingly there was a significant interaction between stereotype direction and gender, $F(1,125) = 5.96$, $p = .016$, $\eta_p^2 = .045$. To explore this interaction, items were coded as own-gender (child's gender matched item stereotype) or other-gender (mismatch; see Figure 3). Pair-wise T-tests showed that children knew more own-gender ($M = .56$, $SD = .21$) than other-gender ($M = .53$, $SD = .23$) items although this difference did not quite reach significance, $t(128) = 1.94$, $p = .054$, $d = 0.18$, 95% CI [.00, .06]. Children endorsed more own-gender ($M = .42$, $SD = .27$) than other-gender ($M = .24$, $SD = .20$) items and this difference was significant, $t(128) = 6.69$, $p < .001$, $d = 0.60$, 95% CI [.13, .24].

Hypothesis 5 stated that items associated with male-stereotypic subjects/occupations would show lower levels of stereotyping than those associated with female stereotypes. There was no main effect of stereotype direction, $F(1,125) = 1.57$, $p = .213$, $\eta_p^2 = .01$, but there was a significant interaction between stereotype direction and stereotype level, $F(1,125) = 15.353$, $p < .001$, $\eta_p^2 = .11$. Knowledge of masculine items ($M = 0.57$, $SD = .22$) was higher than knowledge of feminine items ($M = 0.52$, $SD = .22$), $t(128) = 3.19$, $p = .002$, $d = 0.29$, 95% CI [.02, .08]. In contrast, there was no significant difference in the endorsement of masculine items ($M = 0.24$, $SD = .22$) versus feminine ($M = 0.26$, $SD = .20$), $t(128) = -1.16$, $p = .25$, $d = 0.13$, 95% CI [-.04, .01]. Rejection scores (knowledge – endorsement) were calculated for masculine and feminine items separately; rejection of masculine stereotypes ($M = 0.33$, $SD = .32$) was significantly higher than rejection of feminine stereotypes ($M = 0.26$, $SD = .30$), $t(128) = -3.96$, $p < .001$, $d = .23$, 95% CI [-.09, -.03]. This pattern did not vary by gender (stereotype level x stereotype direction x gender interaction, $F(1,125) = 0.02$, $p = .963$, $\eta_p^2 < .01$).

Discussion

Study 1 sought to investigate contemporary UK developmental and gender differences in gender stereotype knowledge and endorsement. The results generally supported the hypotheses and showed that: (1) children demonstrated gender stereotype knowledge and endorsement, although endorsement scores were significantly lower than knowledge scores, indicating a level of stereotype rejection, (2) stereotype knowledge was greater in the older than the younger age group, (3) the gap between knowledge and endorsement (i.e., stereotype rejection) was significantly higher in adolescent girls as compared to all other groups (4) stereotype endorsement was moderated by in-group gender, such that both genders had higher gender stereotype endorsement scores for items that corresponded to own gender, and (5) tentative evidence that children demonstrated a greater rejection of male versus female stereotypes. The results here support previous research establishing persistent gender stereotyping in young people (Cunningham & Macrae, 2011; Martin & Ruble, 2004; Serbin et al., 1993) and demonstrate that in contemporary UK, children and adolescents continue to show high awareness of cultural gender stereotypes. With the exception of 'journalist', every subject and occupation included in the new Gender Attribute scale showed stereotype consistent scores, and every child showed some stereotype knowledge. This knowledge only increased between the two age groups, with children's awareness of cultural stereotypes growing with experience (Bigler & Liben, 2007).

In contrast to stereotype knowledge, there was no general developmental increase in stereotype endorsement. This suggests that children are not simply passively applying their increasing knowledge of cultural associations, but are more active in their personal judgement, choosing to reject some known gender stereotypes. Interestingly, both genders showed higher stereotype endorsement scores for items consistent with their own-gender stereotype. That is, boys had higher endorsement scores for masculine items than feminine items, whereas girls had a higher knowledge and endorsement scores for feminine items than masculine items. This may reflect own-gender social identity; social identity theory (Tajfel & Turner, 1979) asserts that individuals show a positive bias towards members of their in-group, resulting in endorsement of stereotypes that show in-group superiority and potential rejection of negative in-group stereotypes (Copping et al., 2013). This pattern is argued to reduce across childhood into adolescence as cultural stereotypes outweigh positive associations with the own-gender category (Kurtz-Costes et al., 2014), but was measurable in our current sample of nine- to fifteen-year-olds.

Notwithstanding this own-gender bias, there was clear evidence of stereotype rejection across the items. This was particularly strong in adolescent girls, whose very high awareness of gender stereotypes contrasted sharply with their low personal endorsement. This pattern may be driven by teenaged girls' awareness that masculine subjects and occupations (e.g., pilot) tend to have more positive associations than feminine items (e.g., cleaner), providing a clear motivation for rejection. Masculine domains have also been subject to significant educational interventions designed to attract women to STEM subjects and occupations (Prieto-Rodriguez et al., 2020), whereas feminine domains (such as care related jobs) are less explicitly advertised to boys as attractive career options. While there is some optimism in relation to females challenging male stereotypes, the current study suggests that not enough is being done to encourage boys to challenge female stereotypes, rejecting perceptions of female superiority in certain academic subjects and domains. This issue is critical in adolescence, when potentially career-defining subject choices are

being made. A second study was therefore designed to explore the relationship between levels of gender stereotype endorsement and adolescents' real-life school subject choices.

Study 2: Gender stereotypes and educational choices

The patterns of stereotype rejection identified in Study 1 give rise to clear predictions about potential links between adolescent gender stereotypes and school subject choices. In adolescent boys, the level of stereotype rejection was relatively low, indistinguishable from that of a younger cohort. This could translate to adolescent boys demonstrating a bias to select male-stereotypic over female-stereotypic subjects (i.e., an own-gender subject bias). Further, male-stereotypic items were associated with higher stereotype rejection than female-stereotypic items, so boys' own-gender subject bias may be increased by a failure to reject the belief that specific subjects are 'just for girls'. Compared to adolescent boys, girls at this stage showed significantly higher levels of stereotype rejection in Study 1, and levels of rejection of masculine associations were high across the sample, suggesting girls may reject the stereotype that some subjects are 'just for boys'. Together, these trends may lead to lower own-gender subject bias for girls than boys. Additionally, previous research suggests that personal attitudes (e.g., levels of explicit prejudice) are strongly predictive of conscious behavioural choices (Devine, 1989; Dovidio et al., 1997) so personal endorsement of gender stereotypes is likely to be statistically associated with the level of own-gender bias in subject choices in both boys and girls. Interestingly, previous research suggests that the relationship between gender stereotypical beliefs and subject or occupation choice is stronger for boys than girls (Van der Vleuten et al., 2016, Whitehead, 1996), and boys who hold strong gender stereotyped beliefs are more likely to choose masculine over feminine subjects whereas this link is not established in girls (Whitehead, 1996). To explore these issues in a contemporary UK sample, in Study 2, we examined gender stereotype knowledge and endorsement, and academic subject choices in 13-15-year old school pupils. Based on Study 1 findings and the reasoning above, we made the following predictions:

1. Stereotype rejection will be higher in girls than boys.
2. There will be higher levels of stereotype rejection for domains associated with masculine than feminine stereotypes.
3. Boys will show higher levels of own-gender congruent academic subject choices than girls.
4. The bias to select own-gender stereotype congruent academic subjects will be related to levels of personal gender stereotype endorsement, particularly in boys (van der Vleuten et al., 2016, Whitehead, 1996).

Method

Design

The study was a mixed design with three repeated measures ('Stereotype level': knowledge or endorsement, 'Stereotype direction': feminine or masculine. 'Subject choice': own-gender congruent or other-gender congruent) and one between-subjects factors ('Participant gender': male or female). This design was entered into MorePower 6.0.4 (Campbell & Thomas, 2012) with a medium effect size ($\eta^2p = .06$; power = .8), which calculated an appropriate sample of 128 participants.

Participants

Participants were recruited from a school in Angus in Eastern Scotland, and inclusion criteria were pupils in year groups S2, S3 or S4, aged 13 to 15-years-old. In the Scottish education system, S2, S3 and S4 refer to the secondary school year groups during which the children can be aged 12 to 16 years. At the end of S2 or S3, pupils choose the academic subjects in which they will sit their first national exams at the end of S4 (aged 15-16 years). In total, 233 individuals accessed the survey. Of these, 47 participants did not progress beyond the start of the survey or did not consent to their data being used, eight pupils were not aged 13-15, and a further 13 participants who selected 'prefer not to say' or 'other' as their gender were not included in the analysis. This left a sample of 165 (79 boys; mean age 13.97 years; 86 girls; mean age 13.97 years), slightly above the recommended sample required to detect effects. Data collection took place online in pupils' homes via a link emailed by their school, between December 2020 and February 2021.

Materials

Gender Attribute Scale

The scale was moved from PsychoPy to Qualtrics to allow online completion. The survey was identical to the Study 1 scale with the exception that option selection was via a mouse or touchscreen (rather than keyboard keys), with the position of the response options counterbalanced. The "boys or girls/ men or women" option was amended to "either".

Subject Choice Questionnaire

This questionnaire included a list of 16 gender-stereotyped subjects. The list of subjects was developed after researching the subject choices available at the participating school (excluding mandatory core subjects such as Maths and English), and matching these where possible with corresponding subjects listed in the Gender Attribute scale. One subject that did not have an equivalent in the Gender Attribute scale was 'Hospitality: Practical Cookery', but this was included as a gender stereotyped subject because it is taken by far more girls than boys (e.g., more than two-thirds of candidates were female in 2019). The final list of subjects comprised eight masculine subjects (Physics, Biology, Chemistry, PE, Practical woodworking, Computing science, Graphic communication, IT), and eight feminine subjects (French, German, Spanish, Italian, Music, Drama, Art, Hospitality: practical cookery). Participants could select up to five subjects that they had chosen or planned to choose to study at school. If the subjects they intended to choose were not listed, they could select fewer or none of the options.

Procedure

Researchers sent a Qualtrics link for the online task, along with instructions, to the Head Teacher, who then passed this on to designated school staff/teacher. The online link was then forwarded on to all eligible pupils to complete while home-schooling due to the national Covid-19 lockdown. When participants accessed the Qualtrics link, they were taken to a page showing participation information and a brief

description of the task. They were then shown a consent statement at the end of the information. The Gender Attribute scale was presented first, followed by the subject choice selection.

Results

In Study 2, stereotype knowledge scores ranged from -1 to 31 with a group mean of 18.59 ($SD = 7.72$) and stereotype endorsement scores ranged from -2 to 25 with a group mean of 5.87 ($SD = 6.87$), showing that children across the sample knew and endorsed gender stereotypes. As in Study 1, ratio scores for knowledge and endorsement were calculated for masculine and feminine stereotypes. A mixed general linear model was run with stereotype level (knowledge or endorsement) and stereotype direction (feminine or masculine) as repeated measures, and participant gender (male or female) as a between subject factor. As with Study 1, this analysis revealed a significant main effect of stereotype level, $F(1,163) = 363.23$, $p < .001$; $\eta_p^2 = .69$, with higher summed ratio scores for stereotype knowledge, ($M = 1.15$, $SD = .44$), than endorsement, ($M = .36$, $SD = .42$), indicating a reliable level of stereotype rejection.

Stereotype Rejection

Hypothesis 1 stated that stereotype rejection would be higher in girls than boys, indicated by a greater difference between stereotype levels (i.e., knowledge and endorsement) in the girls. There was a main effect of Gender, $F(1,163) = 4.38$, $p = .038$, $\eta_p^2 = .03$ with boys having higher summed stereotype ratio scores ($M = 1.62$, $SD = .67$) than girls ($M = 1.41$, $SD = .60$), $t(163) = 2.09$, $p = .038$, $d = 0.33$, 95% CI [.01, .40]. However, as expected there was an interaction between stereotype level and gender $F(1,163) = 31.71$, $p < .001$, $\eta_p^2 = .16$; boys had significantly higher endorsement scores than girls ($M = .53$, $SD = .46$ and $M = .20$, $SD = .30$ respectively), $t(163) = 5.56$, $p < .001$, $d = .39$, 95% CI [.22, .46], while there was a non-significant trend for their knowledge scores to be lower than girls' ($M = 1.09$, $SD = .38$ and $M = 1.22$, $SD = .48$ respectively), $t(163) = -1.90$, $p = .060$, $d = .44$, 95% CI [-.26, .01]. A rejection score (knowledge-endorsement) was calculated for each participant and showed that once again girls of this age rejected an endorsement of known stereotypes significantly more than boys (Girls: $M = 1.02$, $SD = .54$, Boys: $M = 0.55$, $SD = .52$), $t(163) = 5.63$, $p < .001$, $d = 0.86$, 95% CI [.30, .63].

Hypothesis 2 stated there would be higher levels of stereotype rejection for domains associated with masculine than feminine stereotypes. Accordingly, there was no main effect of stereotype direction, $F(1,163) = 0.31$, $p = .576$, $\eta_p^2 = .00$, but there was a significant interaction between stereotype direction and stereotype level, $F(1,163) = 6.35$, $p = .013$, $\eta_p^2 = .04$. As with Study 1, there was no significant difference in the endorsement of feminine items, ($M = 0.17$, $SD = .23$) versus masculine items ($M = 0.18$, $SD = .24$), $t(165) = 0.54$, $p = .59$, $d = .04$, 95% CI [-.02, .04] but in contrast to Study 1, there was also no significant difference between the knowledge of feminine items ($M = 0.59$, $SD = .26$) versus masculine items ($M = 0.56$, $SD = .23$); $t(165) = -1.60$, $p = .112$, $d = .12$, 95% CI [-.06, .01]. Rejection scores (knowledge – endorsement) were calculated for masculine and feminine items separately; rejection of feminine stereotypes ($M = 0.42$, $SD = .31$) was significantly higher than rejection of masculine stereotypes ($M = 0.38$, $SD = .30$); $t(164) = -2.55$, $p = .012$, $d = 0.20$, 95% CI [-.06, -.01]. This pattern did not vary by gender; stereotype level x stereotype direction x gender interaction, $F(1,163) = 0.43$, $p = .514$, $\eta_p^2 = .00$. There was also no significant interaction

between stereotype direction and gender, $F(1,163) = 2.07$, $p = .153$, $\eta_p^2 = .01$, ergo, there was no indication of a bias towards own-gender items.

School subject choice

Hypotheses 3 and 4 related to school subject choices. Participants' subject scores were calculated by assigning an own-gender congruent score of 1 for each subject choice that aligned with participants' own gender, and an other-gender congruent score of 1 for each subject choice aligned with the opposite gender, giving a potential score between 0 and 5 for both own and other-gender congruent subject choices. Four participants did not indicate subject choice and are excluded from this analysis. Hypothesis 3 stated that boys would show higher levels of own-gender congruence in their academic subject choices than girls. A mixed general linear model was run with subject choice (own- or other-gender congruent) and participant gender (male or female) as a between subject factor. There was no main effect of gender, $F(1,159) = 0.06$, $p = .807$, $\eta_p^2 = .00$. There was a main effect of subject choice, $F(1,159) = 50.27$, $p < .001$, $\eta_p^2 = .24$ with own-gender congruent subjects ($M = 2.28$, $SD = 1.18$) more likely to be chosen than outgroup subjects ($M = 1.37$, $SD = .95$), but this was complicated by a significant interaction between gender and subject choice, $F(1,159) = 41.65$, $p < .001$, $\eta_p^2 = .21$, see Figure 4. For girls, the number of own-gender congruent subjects selected ($M = 1.86$, $SD = .98$) versus other-gender congruent subjects selected ($M = 1.77$, $SD = .92$) was not significantly different, $t(82) = 0.49$, $p = .63$, $d = 0.05$, 95% CI [-.26, .43]. Conversely, boys selected significantly more own-gender congruent subjects ($M = 2.73$, $SD = 1.22$) than other-gender congruent subjects ($M = 0.94$, $SD = .80$), $t(77) = 8.86$, $p < .001$, $d = 1.00$, 95% CI [1.39, 2.20].

Hypothesis 4 stated that the bias to select own-gender over other-gender academic subjects will be related to levels of personal gender stereotype endorsement, particularly in boys. An own-gender subject congruence score was determined by dividing the number of own-gender congruent subjects selected by the total number of subjects selected. As can be seen in Figure 5, girls showed no correlation between their stereotype endorsement score and own-gender subject congruence score, $r(80) = .004$, $p = .970$. Conversely boys demonstrated a significant positive correlation between stereotype endorsement and own-gender subject congruence score, $r(76) = .40$, $p < .001$. There was no correlation between the stereotype knowledge score and own-gender subject score for girls, $r(80) = -.03$, $p = .793$ or boys, $r(76) = .01$, $p = .912$.

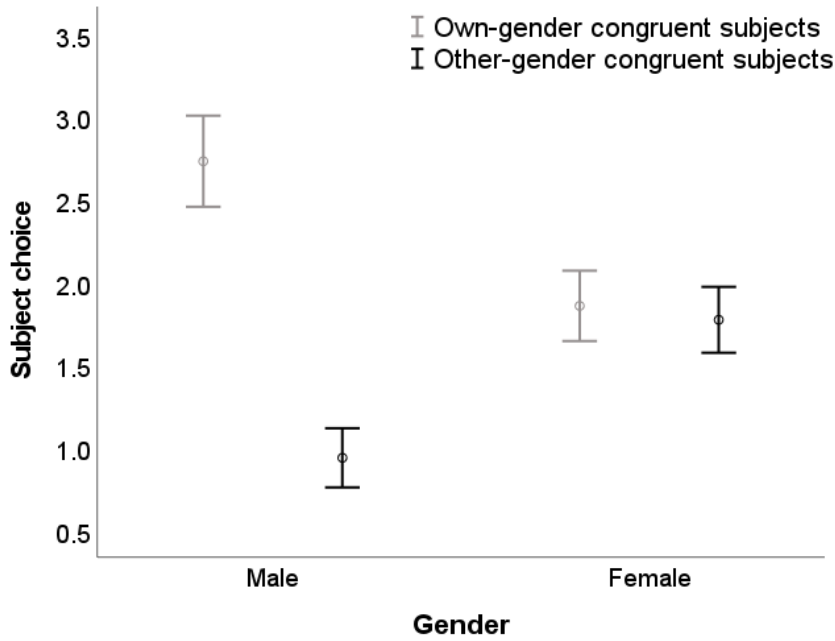


Figure 4: Subject choice scores (mean and 95% CI) for boys and girls.

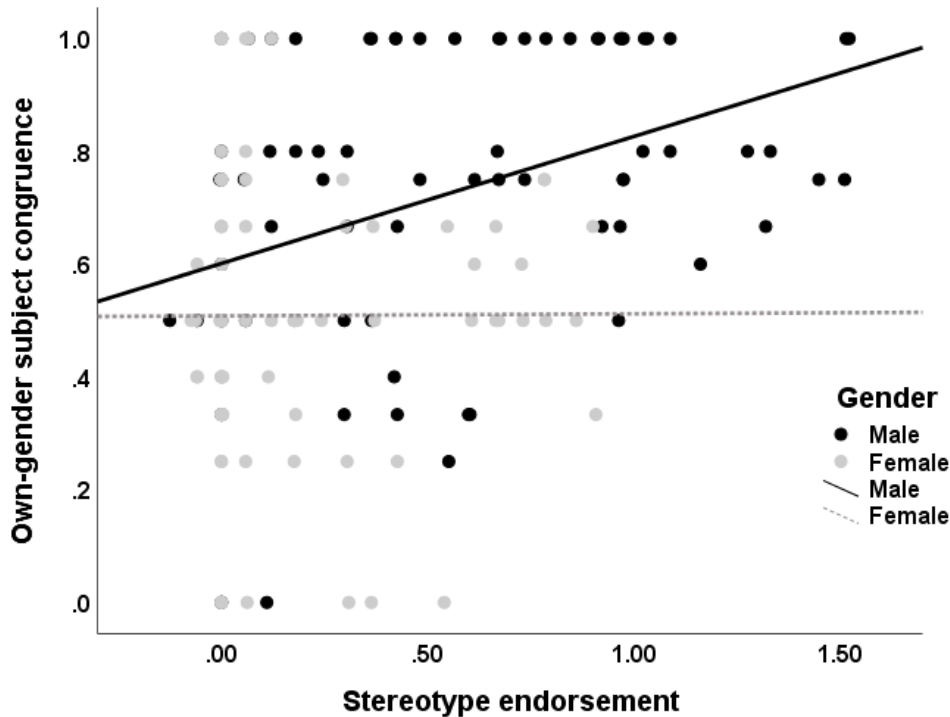


Figure 5: Scatterplot with linear fit line showing correlation between Own-Gender Subject Congruence Score and Stereotype Endorsement for Boys and Girls.

Discussion

Study 2 was designed to replicate the pattern of gender stereotype knowledge and endorsement reported by adolescents in Study 1, and to assess the relationship between gender stereotypes and school

subject choices. Findings were generally in line with predictions, showing that: (1) as in Study 1, stereotype rejection was significantly higher in adolescent girls than boys, although unlike Study 1 there was higher rejection of feminine than masculine stereotypic associations, (2) boys showed higher levels of own-gender congruence bias in their subject choices than boys, and (3) own-gender subject congruence was positively associated with stereotype endorsement for boys.

The findings of Study 2 replicated the key patterns of adolescent gender stereotype knowledge and endorsement identified in Study 1. Knowledge was significantly higher than endorsement across the sample, showing a level of personal rejection of the cultural stereotype (Augoustinos & Rosewarne, 2001). As in Study 1, this was particularly high in adolescent girls, who are generally very aware of gender stereotypes but do not endorse them. In Study 1 we speculated that this may be partly due to the educational focus of interventions designed to encourage rejection of masculine subject associations (i.e., in STEM). However, in contrast with Study 1, the Study 2 sample of adolescents showed higher rejection of feminine than masculine stereotypes. While there were no statistical comparisons between the two studies, the mean scores indicate the difference stems from a much higher rejection rate of female stereotypes in the second school.

Additionally, Study 2 provided no evidence of adolescents endorsing more stereotypes relating to own-gender than other-gender superiority. In Study 1 where this pattern was found, it was argued that endorsement of stereotypes that show own-gender superiority may reflect social identity biases designed to preserve ingroup status (Copping et al., 2013). However, this pattern has been shown elsewhere to dissipate with age (Kurtz-Costes et al., 2014), so the lack of strong positive associations with the own-gender items shown in Study 2 may reflect the older sample tested here. The inconsistency in results between the two studies may be a result of different cohorts (i.e., with exposure to potentially different educational cultures and interventions) but indicates that future research is required to understand the patterns of rejection in relation to masculine versus feminine stereotypes. However, the key findings that adolescent girls are particularly high in their levels of stereotype rejection continues to support the argument that while gender-equality messages targeted at girls are getting through, there is little evidence of an equivalent message reducing boys' stereotype endorsement.

Importantly, Study 2 extended the findings of Study 1 by establishing a connection between the measurable differences in boys' and girls' level of stereotype endorsement, and their behavioural choices. This was predicted because knowledge of stereotypes may underpin unconscious and fast responses to stimuli, but personal endorsement of stereotypes is aligned with more controlled behaviours (e.g., Devine, 1989; Dovidio et al., 1997). Boys showed higher levels of gender stereotype endorsement, and correspondingly higher levels of gender-biased subject choice, selecting to study significantly more masculine-congruent than feminine-congruent subjects. This gender-congruence bias was not shown in girls. Further, within the adolescent boys, there was a significant positive association between stereotype endorsement and the tendency to choose more masculine than feminine subjects. Such correlations are of course difficult to interpret with certainty; the association may have arisen because strong endorsement of gender stereotypes produced a gender-biased subject choice, because choosing more masculine subjects created cognitive dissonance with weak stereotype endorsement, or because endorsement of gender stereotypes and gender-biased subject choice share a common basis (e.g., parental or peer influence).

However, the pattern does replicate older reports from the UK (Whitehead, 1996) as well as more recent Dutch data (Van der Vleuten et al., 2016) suggesting there is a widespread and intractable issue of gender stereotyping in adolescent boys that is linked to educational choices. While additional research is required to establish causal relationships, it is clear that failing to challenge adolescent boys' gender stereotype endorsement is strongly associated with the failure to redress gender imbalances in academic subject choice.

General Discussion

Across two studies, we employed a new Gender Attribute scale to measure young people's knowledge and endorsement of stereotypes, as well as examining how stereotype endorsement related to academic choices. In both studies, the same key patterns emerged: gender stereotype knowledge was higher than personal endorsement of these stereotypes, indicating levels of rejection. There was higher stereotype knowledge in adolescence than late childhood, but no corresponding difference in stereotype endorsement between the two age groups (Study 1). Stereotype rejection was significantly higher in adolescent girls relative to boys of the same age (Study 1, Study 2), as well as to younger boys and girls (Study 1). Finally, stereotype endorsement in boys was associated with decision-making, with endorsement being significantly correlated with their tendency to choose more male-stereotypic than female-stereotypic subjects in school (Study 2).

These findings show that despite an increasing motivation for egalitarian gender beliefs and opportunities (Ellemers, 2018), gender stereotypes remain pervasive in young people in the UK. Stereotypes are formed by associations between group members (e.g., boys or girls) and experiences within one's social world. Children can acquire these associations through personal experience with group members (e.g., all their nursery staff being female), and through the information provided to them by others (e.g., being told that women are more caring). Across childhood there is increasing exposure to these societal associations (Bigler & Liben, 2007), leading to the higher knowledge of gender stereotypes shown in the older participants in Study 1.

While gender stereotype knowledge may be widespread and persistent, our data show that endorsement of such stereotypes is not an inevitable consequence in late childhood and adolescence. The overall pattern was that children endorsed fewer stereotypes than they knew, with an average of about ten fewer gender-item associations endorsed than known per participant. Additionally, unlike Kurtz-Costes et al. (2014), knowledge and endorsement scores were not correlated. Thus, knowledge does not necessarily translate into personal endorsement and individuals in both Study 1 and Study 2 showed knowledge of cultural stereotypes with which they explicitly disagreed (Devine, 1989). This contrasts with the pattern previously reported in five- to six-year-olds, who show more correspondence between these two levels of stereotyping (Augoustinos & Rosewarne, 2001). Thus, from early to later childhood there appears to be a developmental increase in stereotype knowledge but a relative decrease in endorsement. One possibility is that young children initially endorse stereotypes they come to know, but with development they start to reject these, (i.e., they change their minds). Another possibility is that across middle and late childhood, children become more critical about endorsing the new stereotypes that they are learning about. The current cross-sectional research cannot detail the developmental change directly, but this could be investigated through

longitudinal studies of the acquisition, endorsement and then rejection of different gender stereotypes. Our research has shown that it is imperative that research acknowledges the theoretical importance of differences between knowledge and endorsement and ensure that measurement can differentiate between these two levels.

This difference between a child's knowledge and endorsement of gender stereotypes also demonstrated a nuanced developmental trajectory. In Study 1, while both age groups had similar endorsement scores, the higher knowledge scores in older children meant that older versus younger children endorsed proportionally less of the stereotypes than they knew. In other words, older children rejected more known stereotypes. Further analyses revealed an unpredicted finding that this age difference was driven by significantly higher rejection rates (differences in knowledge and endorsement) in 13-15-year-old girls as compared to all other groups. Study 2 also found high levels of stereotype rejection in adolescent girls, relative to boys at the same stage. Kurtz-Costes et al (2014) found that adolescent American girls rejected a male maths and science stereotype in favour of an in-group preference, but our results appear to be the first evidence that this stereotype rejection at a key time may extend to a wide range of academic subjects and career choices. Thus, older girls, at an age where they are making key decisions about school subjects and career choices, are rejecting an endorsement of gender stereotype barriers that they know exist.

Importantly, Study 2 showed that girls' rejection of gender stereotypes was echoed in their academic subject choices, which were evenly split between stereotypically male and female subjects. This movement towards unbiased choice in girls maps onto data published by the Department of Education in 2019 for England, that shows that since 2010, the number of girls taking STEM subjects has increased by 26%, and 25% more women were accepted onto full-time STEM undergraduate courses. This increase is encouraging but does not present the full picture, and our Study 2 choice data do not control for that fact that some male-stereotypic subjects may be more popular or have a different level of perceived difficulty or status than others, masking a low prevalence of girls that continues to pervade some specific masculine subjects. For example, boys are still more likely to pursue STEM subjects at A-Level than girls, and are twice as likely as girls to say STEM is their best subject although both agree that STEM subjects lead to the highest paid jobs. Overall, these data demonstrate an encouraging upward trend in girls taking STEM subjects, but clearly there is still progress to be made.

Relative to their female peers, adolescent boys in both Study 1 and Study 2 showed lower rejection of gender stereotypes. Study 2 showed that this low stereotype rejection rate was reflected in boys' academic subject choices, which showed a strong own-gender congruent bias not seen in the girls' choices. Further, the tendency to choose masculine over feminine subjects was statistically associated with boys' personal endorsement of gender stereotypes, a pattern also not found in the girls. This suggests that there is much more work needed to address boys gender stereotyping. Most schools and universities continue to have high gender imbalance in a number of subjects, with consequences for gender equity in the workplace. Our study found that children clearly understood that occupations such as nursing and dressmaking are stereotypically female, as borne out by national occupation statistics (only 11% of nurses and 12% of dressmakers in the UK are male; ONS, 2018). If children are not encouraged to challenge and reject these female stereotypes then such endorsement will likely discourage boys from participating in such occupations

since perceived self-efficacy, rather than actual ability, is the dominant determinant of children's education and career choices (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001). Clearly, there is a need to design effective interventions for boys that can drive stereotype rejection and less biased subject choices.

Further avenues for future research include the influence of family and culture on children's gender stereotype knowledge and endorsement. In particular, there may be different cultural values assigned to gender-stereotyped occupations among families from different socio-economic backgrounds and ethnicities (e.g., see Lent et al., 2018; McGraw et al., 2006), an understanding of which could help to inform future intervention design. An additional focus of future research should be the longitudinal examination of the development of gender stereotype knowledge and endorsement. Any cross-sectional approach is limited by potential cohort effects, but this is particularly important when assessing stereotypes that can be influenced by fast-changing cultural values. Gender attitudes have changed significantly in recent years (Charlesworth & Banaji, 2021) so it is critical that research takes this into account, especially if wider age ranges are to be explored.

In conclusion, the current study provides a detailed overview on the gender stereotype knowledge and beliefs of older children and adolescents in a UK sample, following high-profile national interventions designed to reduce the impact of gender stereotypes on children's subject and career choices. We found increasing levels of gender stereotype knowledge across 9-15-year-old participants, but also a level of stereotype rejection, particularly among older girls. For this group in particular, knowledge of stereotypes was high, and endorsement of the same stereotype was low. The equivalent pattern of stereotype rejection was not evident in boys at this stage, and endorsement of stereotypes in teenage boys correlates with subject choices. Overall, the findings demonstrate a persistence of gender stereotyping in young people, and the potential implications of important life choices, but also highlight the importance of distinguishing between knowledge and endorsement when exploring gender stereotypes, and of encouraging boys as well as girls to challenge pervasive gender stereotypes.

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