6 Sex Differences in Early Life

A Cross-Cultural Perspective

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Sex[1] is a dimension along which considerable variations in behavioral patterns are observed. Through tremendous effort, researchers have quantified hundreds of psychological sex differences (Ellis et al., 2013). A large part of this effort has included identifying sex differences at their earliest point of emergence, which may illuminate the origins of sex differences that are present later in life and inform interventions that could influence the development of important competences (Moore, 2012).

A cross-cultural analysis can provide unique insights regarding the emergence of sex differences. To the extent that early-life sex differences remain consistent across cultures, factors that remain relatively constant across those cultures represent good candidates to account for why such differences exist. In contrast, when the observed patterns vary across cultures, this suggests a role for cultural factors that are dissimilar among the cultures in question. As such, by adopting a cross-cultural perspective, one can home in on mechanisms that explain why certain behavioral patterns, at least in certain cultures, vary by sex.

Differences can be described as averages between groups of males and females (between-sex differences: e.g., men are taller than women on average) or as individual variations within each sex (within-sex differences: e.g., some women are taller than other women). Across many domains, within-sex variations are large, and sometimes larger than the corresponding between-sex differences (Hyde, 2014). Nevertheless, between-sex differences are usually the subject of studies, perhaps reflecting the social reality that, in many instances in life, differential treatment is made on the basis of categorical sex membership.

[1] Although gender and sex are often defined as the former being social and the latter being biological, this theoretical distinction cannot be applied unambiguously because of the complexity of development. We use the term "sex differences" as it is a more inclusive term that applies to characteristics that may be socialized as well as those that are more biological in nature. In other instances, our use of "sex" and "gender" reflects what seems more common in the field.

Although there are numerous sex differences worthy of discussion, to illustrate the value of a cross-cultural approach most effectively this chapter focuses on phenomena that (1) are important to the emergence of sex-differentiated behavior in early life, (2) have been subjected to a large amount of research, and (3) have been studied in multiple cultures. With these considerations, we focus primarily on sex differences in play, gender identity, and gender expression. We also consider instances in which individuals' behavior and identity do not conform to gender stereotypes, a phenomenon often referred to as gender nonconformity (Adelson, 2012). It is important to note that while most individuals identify as either male or female, and most of the literature on sex differences compares males to females, neither gender nor sex is entirely binary (Fausto-Sterling, 2000). Therefore, although we focus mainly on male–female differences, we also consider available cross-cultural and clinical studies that give insight into sex differences beyond the binaries.

DESCRIBING PATTERNS OF EARLY-LIFE SEX DIFFERENCES ACROSS CULTURES

Sex-Typed Play

Play is indispensible to development and is recognized by the United Nations as a universal right of children. Apart from being an enjoyable activity, play is an avenue for children to learn through active exploration. However, not all toys afford the same learning opportunities. Play with boy-typical toys such as blocks relates to some spatial skills including mental rotation (Liben, Schroeder, Borriello, & Weisgram, 2018). Other boy-typical toys such as toy weapons have been associated with more aggression, while girl-typical toys such as baby dolls elicit more caretaking behavior (Murnen, 2018) and are associated with the ability to generate strategies to comfort a crying infant (Li & Wong, 2016). When coupled with gender stereotypes regarding toys, the implication that different toys promote

different abilities is profound because of the possibility for small differences in early life to turn into concerning gender gaps later in life (Eliot, 2009). As a result, interest in gender-typed play has surged recently, with research on gender-typed play surging in academia, the Obama administration hosting a conference in the White House on the topic in 2016, and toy manufacturers such as LEGO adapting their products and marketing to be more gender-sensitive (though whether they are making them more or less gender stereotyped is debatable). Thus, in North America, western Europe, and some other countries such as Australia, gender-typed play has aroused the interest not only of academics but of politicians and the general public as well.

Sex-typed play warrants such attention because, across a range of assessment methods, boys and girls have been found to prefer different toys (Hines & Davis, 2018). By 2 years of age, boys' and girls' play preferences already differ substantially (Zosuls & Ruble, 2018). A meta-analysis has shown that this sex difference is larger than most behavioral differences (Hines & Davis, 2018). The magnitude of the sex difference, called the effect size and often quantified roughly as the difference between two means in terms of standard deviations (d), is $d = 1.83$ for boys' greater preference than girls for boy-typical toys, and $d = 1.60$ for girls' greater preference than boys for girl-typical toys. Within-sex comparisons suggest effect sizes of $d = 3.48$ and $d = 1.21$ for the preference for sex-typical over sex-atypical toys in boys and girls, respectively. Effect sizes this large are rare in the psychological literature and are equivalent to very little overlap between the score distributions of boys and girls. A meta-analysis of observations of free play reported that these sex differences have been stable for several decades and are not affected by the presence of an adult (Todd et al., 2018).

As with most psychological research, studies on sex-typed play were conducted primarily in the USA. Given that the nature and degree of gender stereotypes vary somewhat across cultures (Lonner & Malpass, 1994), it is important to test whether children from other cultures show similar sex differences in play. Cross-cultural comparisons are limited, but the available evidence suggests that sex differences in toy preferences are widespread across cultures. For example, there are sex differences in play in various locations, including the USA, the UK, Canada, Hong Kong, mainland China, Israel, etc. (Todd et al., 2018; Yu, Winter, & Xie, 2010). Studies on play often employ similar sets of toys as masculine toys and feminine toys, increasing the comparability of the results. The magnitude of the sex differences seems to be consistent across cultures in the meta-analysis of observational studies (Todd et al., 2018). However, this meta-analysis did not include many studies from non-Western cultures. More studies on non-Western cultures are required before one can draw firm conclusions about the cross-cultural generalizability of sex differences in toy preferences.

Gender Identity and Gender Nonconformity

From a developmental perspective, gender identity develops in three stages (Kohlberg, 1966). By age 2 years, many children have acquired gender identity, the ability to identify the gender of themselves and others; then, by age 5, they acquire gender stability, the knowledge that gender is stable over time, while through to age 7, they continue to acquire consistency, the knowledge that gender does not change upon superficial changes in gender expression (Ruble et al., 2007). The age of acquisition varies, possibly due to cultural influences as well as imperfect comparability of interview protocols. For example, gender constancy has been reported to be attained as late as age 8 years in children in four preindustrial societies and as early as age 5 years in middle-class Canadian children; apart from procedural and reporting differences, knowledge about anatomical genital differences may be one cause for these cross-cultural differences (Gibbons, 2000). However, the sequence of these stages seems to be very consistent across cultures as diverse as North America, India, Australia, American Samoa, Nepal, and South Africa (Gibbons, 2000).

Gender identity can also be conceptualized as multidimensional. For example, it can consist of the feelings of compatibility with one's gender, contentedness about being a certain gender, felt pressure to conform to gender stereotypes, and the sentiment that one's own gender is superior to the other (Egan & Perry, 2001). While measures like this have rarely been applied to young children and outside the West, there is some evidence of similar sex differences (e.g., boys feel greater pressure to conform) and correlates (e.g., one's sense of gender-typicality correlates positively with the sense of self-worth) across the East and the West, though there are also cultural differences in factor structure (Yu, Xie, & Shek, 2012).

In many domains, between-sex differences, even when large, are characterized by large variation along continuous spectrums (Carother & Reis, 2013; Hyde, 2014). Gender identity seems to exhibit a rather polarized pattern. The large majority of males identify with a male identity and the large majority of females identify with a female identity. The effect size in this core gender identity in adolescents and adults in some studies is as large as $d = 11–13$ (Hines, 2010), which signifies close to 0 percent overlap in the two groups' distributions.

However, recent evidence suggests that variation from typical gender identity may be more common than expected and increasing (Meerwijk & Sevelius, 2017). Zucker (2017) provides a review of 44 studies from western Europe, North America, and Scandinavia, including epidemiological, clinic-based, self-report, parent-report, and expert-diagnosed data. In the review, the prevalence of a self-reported transgender identity in children, adolescents, and adults ranges from 0.5 to 1.3 percent. Although gender dysphoria, a condition partially characterized by identifying with a gender different from one's

birth-assigned gender, is more common in birth-assigned males than females in childhood, in adolescents there has been a recent inversion in the sex ratio from one favoring birth-assigned males to one favoring birth-assigned females, regardless of whether the samples were representative or clinic-referred (Zucker, 2017). In Japan also, using several items assessing cross-gender identification and feelings of dysphoria, the prevalence of traits of gender identity disorder (the former diagnostic term for gender dysphoria used in earlier versions of the DSM), was estimated to be 1.6, 10, and 12 percent among Japanese female children, adolescents, and women, and 0.5, 2, and 3 percent among Japanese male children, adolescents, and adults, respectively (Sasaki et al., 2016). It remains unclear whether the increase in prevalence in gender dysphoria and transgender identity reflects a bona fide change, greater visibility due to decreasing stigmatization, or a greater awareness of therapeutic options (Zucker, 2017).

While most individuals identify with their birth-assigned gender and behave in a gender-conforming manner, variations from gender norms have recently received a lot of attention in the West. An atypical gender identity is highly correlated with gender-nonconforming behavior in domains such as toy, activity, gender of playmate, and clothing and hairstyle preferences (Drummond, Bradley, Peterson-Badali, & Zucker, 2008; Wallien & Cohen-Kettenis, 2008). Across cultures, gender-nonconforming behavior is relatively rare, but is also more common in girls and young children (Yu & Winter, 2011). Although a minority, the percentage of children showing gender-nonconforming behavior is substantial. A Canadian study showed that levels of gender nonconformity comparable to those seen among children referred to clinics for gender dysphoria is present in 16.3 percent of girls and 7.8 percent of boys aged 6–12 years old in the community based on a normed cut-off score on the parent-reported Gender Identity Questionnaire for Children (van der Miesen, Nabbijohn, Santarossa, & VanderLaan, 2018). Even in China, a more conservative culture, many children aged 6–12 years old reportedly exhibit more than 10 different gender-nonconforming behaviors; girls may have more room to exhibit gender-nonconforming behavior than boys, with the percentage being 17.9 percent in boys and 40.8 percent in girls (Yu & Winter, 2011). Because older children are more likely to shun gender-nonconforming behavior (Johnson et al., 2004; Yu & Winter, 2011), the prevalence of gender nonconformity is likely higher in even younger children.

In sum, children across cultures acquire an understanding of gender labels and gender invariance in a similar sequence, although the age of acquisition varies (Gibbons, 2000). Alternative conceptualization of gender identity has not been studied as much outside the West, but there is some evidence of similar sex differences and correlates across the East and the West, with some cultural differences in factor structure (Yu et al., 2012). The normative sex differences in gender identity are substantial and most people identify with either a female or a male identity that is consistent with their birth sex (Hines, 2010; Sasaki et al., 2016; Zucker, 2017). However, as will be illustrated in the next section, there is increasing acceptance that the binary is not a hard-and-fast rule (Diamond, Pardo, & Butterworth, 2011; Fausto-Sterling, 2000).

EXPLAINING PSYCHOLOGICAL SEX DIFFERENCES: EVIDENCE ACROSS CULTURES

Evolutionary Perspectives

Evolutionary mechanisms have been proposed as distal explanations for many sex differences. The underlying premise is that differences in the strategies that best serve males and females, respectively, in survival and reproduction have contributed to human psychological sex differences (Geary, 2010). Sex differences in toy preferences are one example that has been related to this theory.

Cross-species comparative studies that test toy preferences in animals have potential for providing evidence that sociocultural influences are unlikely to provide a full account of sex differences. Two such studies showed that monkeys that had not been exposed to human toys previously showed some sex differences typical of children (Alexander & Hines, 2002; Hassett, Siebert, & Wallen, 2008). For example, male monkeys played more with a car and female monkeys played more with a doll than did their opposite-sex counterparts. The exact causes of these sex differences were not tested, but the authors reasoned that the cross-species consistency suggests toy preferences do not simply result from socialization but also reflect evolved preferences for different object features (e.g., movement of cars and faces of dolls), preferences that may be transmitted through genes and hormones, and moderated by sociocognitive factors.

Studies of human sex-typed play suggest cross-cultural ubiquity. However, almost all the studies on human sex-typed play were conducted in developed societies, raising the possibility that the consistency in results could merely reflect Western cultural influence. Studies in remote cultures that have been touched little by Western culture would strengthen this conclusion.

Biodevelopmental Mechanisms

Greater effort has been allocated to identifying biological mechanisms that influence the development of psychological sex differences. Of particular interest are mechanisms either known or thought to be involved in sexual differentiation of the brain and behavior. These include genetic, hormonal, and immunological factors that are hypothesized to channel brain development in a male- or female-typical direction during the pre/perinatal period (Bogaert & Skorska, 2011; Ngun, Ghahramani, Sánchez, Bocklandt, & Vilain, 2011).

To explore the relevance of these mechanisms to sex differences in early life, researchers have tended to use two methodological approaches. First, longitudinal research has examined associations between prenatal factors and childhood sex-typed behavior; however, relatively few studies employed this method due to the challenges inherent to long-term research of this sort. A second more common approach has been to compare individuals who vary in gender expression on measures that indirectly provide a window on early-life exposure to genetic, hormonal, and/or immunological mechanisms. Studies using this approach have focused on gender variation among typically developing children, children who have been seen in specialty gender clinics for gender dysphoria, individuals who exhibit disorders of sex development with known biological causes, and studies of adults reporting on recalled childhood behavior.

Cross-culturally, the most relevant data bearing on the role of biological mechanisms come from studies comparing adults of varying sexual orientations as well as studies of non-Western "third" gender individuals. Research on the former is relevant because same-sex sexual orientation has been associated with elevated childhood gender nonconformity in both retrospective and prospective longitudinal studies in the West (Bailey & Zucker, 1995; Li, Kung, & Hines, 2017) and retrospective studies in non-Western countries such as Turkey, Thailand, and Japan (Cardoso, 2009; Petterson, Wrightson, & Vasey, 2017). Of particular note regarding research on non-Western "third" gender individuals is a series of studies on the Samoan *fa'afafine* (translated literally as "in the manner of a woman"). *Fa'afafine* are birth-assigned males who take on feminine social roles and are sexually attracted to masculine men. In Samoan culture, they are recognized as being distinct from the categories "boy/man" and "girl/woman." Their identity as *fa'afafine* is typically recognized in childhood based on recognition of their feminine gender expression (Vasey & Bartlett, 2007), which is supported by research showing that adult *fa'afafine* recall more childhood female-typical behaviors and preferences than Samoan men (Bartlett & Vasey, 2006; VanderLaan, Petterson, & Vasey, 2017).

Given cross-cultural consistencies in childhood gender nonconformity among same-sex attracted and third gender individuals, cross-cultural evidence linking sexual orientation and third gender identity to biological mechanisms has important implications. Such evidence supports the notion that biological mechanisms influence early-life expression of psychological sex differences in similar ways across different populations. Below, we detail research that supports the existence of genetic, hormonal, and/or immunological influences on early-life sexual differentiation, and highlight important cross-cultural work in this area.

Genetics

In the West, twin studies provided the key empirical data bearing on the possible genetic bases of early-life gender expression. A study of typically developing children 3–4 years of age reported greater concordance in gender expression among monozygotic, compared to dizygotic, twin boys and girls, respectively (Knafo, Iervolino, & Plomin, 2005). The authors reported that approximately 18–29 and 21–75 percent of the variance in boys' and girls' gender expression, respectively, was attributable to genetics. Also, the more cross-gender behavior reported, the higher the proportion of variance accounted for by genetics, especially for girls. Similarly, a twin study on children seen in specialty gender identity services reported that concordance for diagnosis of gender identity disorder (now termed gender dysphoria) was 39.1 percent among monozygotic twins and 0 percent among dizygotic twins, suggesting a genetic influence (Heylens et al., 2012). Twin research on adult male and female sexual orientation has indicated some genetic influence on both sexual orientation (Långström, Rahman, Carlström, & Lichtenstein, 2010) and recalled childhood gender nonconformity (Bailey, Dunne, & Martin, 2000). It is important to note, however, that although these studies support the role of genetics in early-life gender expression, the data indicate only partial genetic heritability, leaving open the possibility for other biological as well as non-biological mechanisms.

Research exploring the familiality of Samoan *fa'afafine* has been in line with the Western data. The logic of this research was that if there is a genetic component influencing gender expression, then one should observe that *fa'afafine* tend to be more common within particular families. This logic has similarly been applied to sexual orientation in the West and indicated it has a familial component (e.g., Schwartz, Kim, Kolundziji, Rieger, & Sanders, 2010). In two studies examining the extended male relatives (i.e., uncles, male cousins) of *fa'afafine* and comparison groups of Samoan men, *fa'afafine* participants had greater preponderances of *fa'afafine* relatives in both their maternal and paternal lines (Semenyna, Petterson, VanderLaan, & Vasey, 2017; VanderLaan, Forrester, Petterson, & Vasey, 2013). Among the Istmo Zapotec of Mexico, this same familial pattern was recently reported in a similar third gender group of feminine birth-assigned males known locally as *muxes* (Gómez, Semenyna, Court, & Vasey, 2018). Thus, this Samoan and Istmo Zapotec research provides cross-cultural data to support the hypothesis that genetic factors influence early-life gender expression.

Sex Hormones

The action of sex hormones during pre/perinatal brain development is thought to be of profound importance to the organization of the brain and psychological sex differences. Androgens are hypothesized to be important to masculinizing the brain, whereas low androgen exposure is associated with a more female-typical pattern (Hines, 2011). In the West, there have been several relevant lines of inquiry. Longitudinally, variations of prenatal testosterone exposure, assessed via maternal blood serum or amniotic fluid during gestation, has been used to

predict parent-reported sex-typed behavior in preschoolers, but the findings were largely inconsistent and have yet to be independently replicated (Hines, Constantinescu, & Spencer, 2015). Findings from individuals exposed to unusual levels of prenatal androgens provide the strongest evidence of a role of androgens on sex differentiation. In particular, over a dozen studies conducted in the USA, Britain, Sweden, and Germany found increased male-typical toy, playmate, and activity preferences in girls with congenital adrenal hyperplasia (CAH) – a condition characterized by elevated prenatal androgen levels via the adrenal glands (Hines, 2011). Other aspects of sex differentiation, such as gender identification and aggression, have also been found to be masculinized in females with CAH, whereas the childhood play behaviors of individuals with complete androgen insensitivity syndrome (CAIS) are feminized (Hines et al., 2015). Together, such findings support the hypothesis that pre/perinatal sex hormones influence early-life gender expression.

Other work from the West has relied on indirect measures of pre/perinatal sex hormone exposure. For example, the finger length ratio of the second-to-fourth digit (i.e., 2D:4D) is a putative marker of prenatal androgen exposure, with lower ratios being male-typical and higher ratios being female-typical (Hönekopp & Watson, 2010). Preschoolers' 2D:4D has shown only modest and inconsistent associations with their degree of male- or female-typical gender expression (Wong & Hines, 2016) and 2D:4D does not appear to distinguish children who experience gender dysphoria from same-sex control children (Wallien, Zucker, Steensma, & Cohen-Kettenis, 2008). That said, 2D:4D appears to differ in the expected directions among adult transgender individuals (Kraemer et al., 2009; Schneider, Pickel, & Stalla, 2006). Also, lesbians show masculinized 2D:4D, though the findings on gay men are mixed (Grimbos, Dawood, Burriss, Zucker, & Puts, 2010). Handedness can also be an informative biomarker to consider. It is known to be related to prenatal brain lateralization (Gutwinski et al., 2011; Sun & Walsh, 2006) and although its development remains somewhat unclear – possibly owing to complex interactions of genetic, hormonal, and immunological factors (Arning et al., 2015; Geschwind & Behan, 1982) – longitudinal research has linked prenatal testosterone levels to childhood nonright-handedness (Lust et al., 2011). Nonright-handedness has been associated with relative increases in gender nonconformity among typically developing 6–12 year olds (Coome, Skorska, van der Miesen, Peragine, & VanderLaan, 2018) and with gender dysphoria in birth-assigned male children (Zucker, Beaulieu, Bradley, Grimshaw, & Wilcox, 2001). In adults, it has also been associated with same-sex sexual orientation in men and women (Lalumière, Blanchard, & Zucker, 2000) as well as transgender identity (Green & Young, 2001). Thus, the Western 2D:4D and handedness literatures also provide some support for a prenatal hormone perspective on the development of psychological sex differences.

Relatively few non-Western studies link pre/perinatal sex hormones to early emergence of psychological sex differences. To our knowledge, no studies measured sex hormones directly. Using indirect measures, a meta-analysis of 2D:4D in Chinese samples ranging in age from 7 to 63 years old found the expected overall sex differences in finger ratios and reported no effect of age on the magnitudes of effects (Xu & Zheng, 2015). Using data from online samples of Chinese adults, gay men reported feminized self-measured 2D:4D (Xu & Zheng, 2016) and nonright-handedness was associated with same-sex attraction in men and women (Xu & Zheng, 2017). Also, a large internet study of more than a quarter of a million participants from various Western and non-Western countries found that ambidexterity in writing hand preference was associated with sexual orientation, particularly bisexuality, in men and women (Peters, Reimers, & Manning, 2006). As such, there are some cross-cultural consistencies in the findings of studies employing indirect measures of pre/perinatal sex hormone action.

Immune Factors

Immune factors may also exert influence on brain sexual differentiation and have implications for early gender expression; however, available evidence supports a role for these mechanisms only in birth-assigned males, not females. The maternal immune hypothesis (Blanchard, 2018; Bogaert & Skorska, 2011) proposes that with every successive male fetus gestated, mothers experience an increased probability of exposure to male-specific fetal proteins produced by the fetus' Y-chromosome. If, through such exposure, mothers develop antibodies to male-specific proteins involved in prenatal brain masculinization, then these antibodies might bind to these proteins and neutralize their impact on brain development. Consequently, later-born male offspring would have an increased probability of showing a more female-typical pattern of brain development. Yet, there should be no similar effect in relation to female offspring, because female fetuses do not produce Y-linked, male-specific proteins.

The hypothesis has been most consistently supported by research examining birth order. A recent meta-analysis demonstrated that same-sex attracted males have preponderances of older brothers, and this effect is especially pronounced in more feminine same-sex attracted males (Blanchard, 2018). This finding, termed the *fraternal birth order effect*, has been replicated in relation to sexual orientation in Hong Kong (Li & Wong, 2018) and among Samoan *fa'afafine* (VanderLaan & Vasey, 2011).[2] A recent

[2] Some anthropological literature has suggested that Samoan *fa'afafine* are "assigned" as such when parents have several sons and few or no daughters; however, *fa'afafine* have more older brothers *and* more older sisters than do Samoan men, and Samoans, including *fa'afafine*, generally do not endorse this notion (see VanderLaan & Vasey, 2011).

Canadian parent-report study using a large online sample also found that relatively later fraternal birth order predicted increased gender nonconformity among boys ages 6–12 years (Coome et al., 2018). In addition, the fraternal birth order effect has been identified in Canadian and Dutch birth-assigned male children and youth who experienced childhood onset of gender dysphoria (Schagen, Delemarre-van de Waal, Blanchard, & Cohen-Kettenis, 2012; VanderLaan, Blanchard, Wood, & Zucker, 2014).

Importantly, there is evidence to support the major tenets of the maternal immune hypothesis. First, the fraternal birth order effect appears to be prenatal in origin. It is specific to older biological brothers, regardless of whether males were reared with those brothers (Bogaert, 2006). Second, fetuses exposed to maternal immune responses during gestation exhibit relatively lower birth weights (Kiefte-de Jong et al., 2013); in the West, having one or more older brothers is associated with increased odds of having been of relatively lower birth weight among gay men (Blanchard & Ellis, 2001) and children and youth who experienced childhood onset of gender dysphoria (VanderLaan, Blanchard, Wood, Garzon, & Zucker, 2015). Third, mothers of gay men and birth-assigned male children who experienced gender dysphoria, particularly mothers of those gay men and children who had older brothers, exhibited elevated blood serum levels of antibodies to a Y-linked, male-specific protein involved in male fetal brain development (Bogaert et al., 2018). Thus, the maternal immune hypothesis appears to be viable and the existing cross-cultural evidence on the fraternal birth order effect suggests these immune processes could be relevant to gender expression development among birth-assigned males across diverse populations.

In contrast to this work on males, there is little to suggest immune processes influence gender expression or sexual orientation in birth-assigned females. The fraternal birth order effect appears to be specific to males (Blanchard, 1997). Two clinic-based studies of birth-assigned females with childhood onset of gender dysphoria found they were more likely to be only children and had fewer older brothers than expected (Schagen et al., 2012; VanderLaan et al., 2014). However, a similar proportion of clinical control girls were only children, suggesting the earlier findings had less to do with gender dysphoria and more with the clinical nature of the samples (Hughes et al., 2017). Similarly, a large online parent-report study found no birth order effects in relation to gender expression in girls ages 6–12 years (Coome et al., 2018).

Sociocultural Mechanisms

Socialization Influences

Studies of sociocultural and cognitive mechanisms on the micro-level focus on both external forces of socialization and children's own internal ability and drive to conform to gender norms. Through a variety of ways, socialization agents send overt or subtle messages about gender (Blakemore, Berenbaum, & Liben, 2009). For example, parents engage in "channeling or shaping" by providing sex-typed materials and creating sex-typed environments; they engage in differential treatment during parent–child interactions, such as smiling more when boys play with boy-typical toys; they may give direct instructions about gender, such as by saying who can do what; and they serve as models, such that parents' gender disparities in domestic labor predict children's visions for their future roles. These patterns seem at odds with the finding from some meta-analyses that there is little evidence that parents treat boys and girls differently (e.g., parental control: Endendijk, Groeneveld, Bakermans-Kranenburg, & Mesman, 2016; eight broad areas of socialization: Lytton & Romney, 1991). It may be that differential parental socialization is more observable in specific aspects of parenting (e.g., parents use more total words and supportive speech with girls than boys, but there is no difference by child gender in talk duration or use of directive speech; Leaper, Anderson, & Sanders, 1998).

Few studies provided systematic comparison of adult gender socialization across cultures. Those that did suggest that cultures show similarities in the general pattern of parental gender socialization and differences are seen in nuances. For example, Lytton and Romney (1991) compared North American versus other Western samples on a range of socialization areas (e.g., interaction, warmth, discipline) and found that both showed very few areas of parental gender socialization, but cultural difference was found for a specific aspect of parenting (use of physical punishment). Individual studies assessing parental gender attitudes toward childrearing also suggest similarity between cultures such as the UK and Hungary (Turner & Gervai, 1995), and USA and Hong Kong (Wong & Yeung, 2019) in how parents socialize boys and girls differently.

Given the centrality of school life in childhood, teachers' influence cannot be neglected. Across the West and the East, even kindergarten teachers engage in extensive gender-role stereotyping and channeling. For example, teachers frequently use gender labels and arrangement of routines that segregate boys and girls (Chen & Rao, 2011).

Differences in adult treatment toward boys and girls are often interpreted as reflecting an effect of the adults to the children. However, much of the literature on adult socialization is correlational and does not allow causal conclusion. In fact, children may affect adults too. For example, parents' gender-role attitudes become more traditional following the birth of a child (Katz-Wise, Preiss, & Hyde, 2010).

Peer influence grows when children start to form social circles outside the home. Children all over the world voluntarily sex-segregate from a young age, though cultural differences in the availability of same-sex companions and autonomy in peer selection affect the timing of this behavior (Edwards, de Guzman, Brown, & Kumru, 2006). Boys' and girls' groups differ in many ways; for example, boys' groups are larger and more constricting (Maccoby, 1990).

Also, peers punish gender-norm violations by evaluating gender-nonconforming peers more negatively than conforming peers (Blakemore, 2003). Thus, the more children play with same-sex peers, the more sex-typed they become (Martin & Fabes, 2001). However, children's responses to gender-norm violations and the effects of these responses have not been tested in a non-Western culture.

Apart from significant others, gendered messages come from media as well. In many regions including the USA, Hong Kong, and Indonesia, gender portrayals are prevalent in textbook materials and TV ads, perhaps more so in Asia (Furnham, Mak, & Tanidjojo, 2000; Lee & Colins, 2008). Gender marketing is also infused into toys, such as by using explicit gender labels, gendered colors, and names that convey gender-role expectations (e.g., "Fashion Miss" versus "Adventurer") (Pennell, 1994).

Importantly, many child-driven factors affect whether and how the above external socialization forces are internalized. For example, as children acquire gender identity and gender stability, their gender-role stereotyping increases, but as their understanding of gender becomes more flexible, they become less strict about adhering to gender norms (Ruble et al., 2007). The interaction between different factors of sex-typing may be even more sophisticated. Specifically, girls exposed to high concentrations of androgens prenatally show reduced responsiveness than other girls to information about gender-appropriateness and reduced imitation of female models, suggesting that physiological factors may affect sociocognitive processes of gender development (Hines et al., 2016).

A seminal Dutch study that longitudinally examined (trans)gender identity development among children seen clinically for gender dysphoria provides an example of the potential for social reinforcement to impact gender identity development (Steensma, McGuire, Kreukels, Beekman, & Cohen-Kettenis, 2013). The researchers coded several variables at the time of the initial clinical assessment, when the children were 8–10 years of age. These included parent-reported gender expression and a gender identity interview that asked the children about their gender affect (e.g., "I *feel like* a boy/girl") and gender identity cognition (e.g., "I *am* a boy/girl). A key variable related to social reinforcement was whether the child had undergone a social gender transition prior to assessment, which would have been supported to some extent by the parents and involved steps such as altering the child's name and gender presentation to others (e.g., through clothing, hairstyle, pronouns). When the children had become adolescents, now an average of 16 years of age, the researchers coded for persistence of gender dysphoria and/or a transgender identity. The sample of 48 birth-assigned females was relatively small, but in the larger group of 79 birth-assigned males, older age at assessment, parent-reported gender nonconformity, cross-gender cognition (but not affect), and having undergone social gender transition prior to the initial childhood assessment were all unique predictors of persistence. This latter finding in particular provides valuable insight to support the possibility that social reinforcement can influence gender identity.

As a cultural parallel to this Dutch clinical research, somewhat similar social reinforcement processes might apply in the context of certain non-Western third gender identities. For example, Samoan *fa'afafine* often report that they were first recognized by others as *fa'afafine* on the basis of their early-life feminine gender presentation (Vasey & Bartlett, 2007). Categorizing or labeling children in this way might then reinforce their gender-role behavior and self-concept, increasingly bringing them into alignment with the social norms and expectations associated with that particular gender category over the course of development.

Interestingly, similar to Samoa – where *fa'afafine* are publicly visible and socially tolerated, and represent a sizable minority at approximately 0.6–3.5 percent of the birth-assigned male population (Semenyna et al., 2017; Vasey & Bartlett, 2007) – in recent years there has been a marked increase in the prevalence and visibility of individuals identifying as transgender in the West (Meerwijk & Sevelius, 2017; Zucker, 2017). On the surface, this greater visibility and acceptance could give the impression that the West is becoming increasingly similar to Samoa in terms of its overall acceptance of non-binary individuals. An important caveat, however, is that these recent increases in the West are being driven primarily by the growing number of birth-assigned females identifying as transgender boys/men (Aitken et al., 2015; Zucker, 2017). Greater stigmatization of male femininity, relative to female masculinity, in Western culture has been raised as one possible reason for this asymmetry (Aitken et al., 2015), and may explain the departure from what is seen in Samoa.

Macro-Cultural Factors

In light of the potential for gender stereotypes and gender-labeling to reinforce gender expression and identity, the gender categories available within a given sociocultural context and the norms associated with those categories are key macro-level variables to consider. Indeed, the range of gender identity categories available within a culture is a fundamental constraint on the self-concepts and gender-related behaviors that can be reinforced. For example, if a culture does not have a concept of a "third" gender, then members of that culture will be less likely to take on or be socialized according to a third gender identity. Rather, unless one forges a novel identity category, one's self-concept and social roles will likely correspond, more or less, with one of the identity categories available within a given cultural context. Thus, cultural variation in the number of gender identity categories available and/or the norms associated with each of those categories might produce divergent patterns of gender expression.

As an example, both Western gay men and Samoan *fa'afafine* exhibit elevated childhood female-typical behavior (Bailey & Zucker, 1995; Bartlett & Vasey, 2006). Yet, the *fa'afafine* remain markedly feminine into adulthood,

whereas Western gay men – who develop within a cultural context that conceptualizes gender identity more so in terms of the boys/men–girls/women binary *and* is relatively less tolerant of male femininity – tend to show a significant reduction in female-typed gender expression between childhood and adulthood (VanderLaan, Petterson, & Vasey, 2016).

Sources of variability in the conceptualization of gender are, therefore, distal factors that can have repercussions on early-life gender development. These sources can often be found at the macro-level as well. For example, a study of 192 indigenous, nonindustrialized cultures showed that the presence of a third gender category was more common among those societies possessing traditional characteristics (i.e., animistic beliefs, less complex political systems, smaller groups, greater subsistence dependence on hunting and gathering; VanderLaan, Ren, & Vasey, 2013). Animistic beliefs may be particularly important. If members of a culture believe certain individuals are "animated" by both masculine and feminine spiritual essences, they may be more inclined to view some individuals as having a mixture of masculine and feminine essences, thus making them "third" gender (Totman, 2003).

Distal cultural factors can also give insight regarding cultural differences in gender roles and stereotypes. For example, it has been hypothesized that a culture's historical agricultural practices impacted modern-day gender inequality via cultural transmission over time. Specifically, Boserup (1970) proposed that men's physiques would have allowed them to operate heavy ploughs, thus making men's labor a more limiting factor on economic productivity. In theory, such circumstances would have led to cultures characterized by greater gender inequality and female economic dependence on men. One would predict, therefore, that these characteristics should be more evident in cultures with a history of heavy plough use. In line with this prediction, when examining contemporary samples, individuals from such cultural backgrounds held less gender-egalitarian attitudes, and these populations also showed lower rates of female participation in economic and political spheres (Alesina, Giuliano, & Nunn, 2011). As such, distal cultural factors may differentially shape gender-related attitudes within local cultures and, therefore, lead to cultural differences in the norms that become socialized and reinforced in boys and girls.

Researchers have also looked into variations in sex differences with broad-level structural indices such as wealth. For children, some research measuring district-level characteristics within the USA have implied a positive relation between socioeconomic status and sex differences in spatial abilities (Levine, Vasilyeva, Lourenco, Newcombe, & Huttonlocher, 2005) and mathematics (Reardon, Fahle, Kalogrides, Podolsky, & Zárate, 2018). However, these relations may be confounded by differences in ethnicity and level of urbanization across districts. Other studies covering the USA and/or other countries report no significant or consistent relation between socioeconomic status and sex differences in spatial abilities (Wai, Lubinski, & Benbow, 2009), cognitive skills (van Langen, Bosker, & Dekkers, 2006), leisure activity (Leversen, Torsheim, & Samdal, 2012) or toy collection (Nelson, 2005). Therefore, socioeconomic indicators that reliably predict childhood sex differences have not been identified.

CONCLUSIONS

In this chapter, we focused on play, gender identity, and gender expression to illustrate evidence and principles relating to early-life sex differences. We highlighted findings from outside of North America to shed light on underlying processes. While available evidence suggests general resemblance and specific differences, much of what we know about sex differences has not been adequately tested in non-White, non-North American populations. Apart from informing the generalizability of existing knowledge, cross-cultural studies may also help identify innovative strategies to encourage certain kinds of skills and abilities (Gibbons, 2000; Henrich, Heine, & Norenzayan, 2010). Considering other cultures may also increase sensitivity to alternative discourse, given that the topics studied and the dominant discourse surrounding them may reflect prevailing philosophy and values of developed Western countries.

We conclude with some caveats and suggestions for future research. First, studying early sex differences remains challenging, especially across cultures. For older samples, there exist many large multinational studies of academic achievement, cognitive abilities, and personality. However, young children do not directly participate in surveys and many outcomes concerning them are absent in large data sets containing representative samples. Those available (e.g., the British Avon longitudinal study) may be costly and their measurement methods may be restricted. Multiple individual studies sampling different cultures that use comparable procedures may circumvent this challenge.

Another challenge is that measures are mostly developed in the West and reflect Western notions (Smiler & Epstein, 2010). Cultural appropriateness is an important consideration, especially with instruments that entail linguistic presentations or cultural judgments, such as scales of gender socialization and measures of preferences for stereotypically feminine and masculine items. Adapting measures is thus often necessary when conducting research outside the West. However, psychometrically validated measures for non-Western samples are difficult to come by. Cross-cultural studies on sex differences are needed because many questions that interest researchers in the field of gender and sexuality (e.g., whether the gender gap in spatial abilities is attributable to sex-typed play; what testosterone exposure predicts) require the premise that certain variables are sex-differentiated.

More studies using and comparing measures in different locations will facilitate research in more diverse cultures.

Accompanying an increasing interest in sex development in non-mainstream cultures is an increasingly sophisticated conceptualization of sex differences and alternative statistical approaches to quantifying them. For example, recent research shows that sex differences in many psychological constructs are dimensional and not categorical, that individuals often display different degrees of sex-typing on different domains, and that, apart from average group differences based on the means and standard deviations, alternative statistical approaches to quantifying sex differences can offer different views about whether and how the genders are different or similar (Hyde, 2014). With these developments, coupled with greater emphasis on gaining cross-cultural perspectives, significant advances in the study of early-life psychological sex differences are foreseeable.

SUGGESTED READINGS

Blakemore, J. E. O., Berenbaum, S. A., & Liben, L. S. (2009). *Gender development*. New York: Psychology Press.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*, 61–83. doi:10.1017/S0140525X0999152

Hines, M., Constantinescu, M., & Spencer, D. (2015). Early androgen exposure and human gender development. *Biology of Sex Differences*, *6*, 3. doi:10.1186/s13293–015-0022-1

Hyde, J. S., Bigler, R. S., Joel, D., Tate, C. C., & van Anders, S. M. (2019). The future of sex and gender in psychology: Five challenges to the gender binary. *American Psychologist*, *74*, 842–844. doi:10.1037/amp0000307

Smiler, A. P., & Epstein, M. (2010). Measuring gender: Options and issues. In J. C. Chrisler & D. R. McCreary (Eds.), *Handbook of gender research in psychology* (pp. 133–157). New York: Springer. doi:10.1007/978-1-4419-1465-1_7

Stoet, G., & Geary, D. C. (2015). Sex differences in academic achievement are not related to political, economic, or social equality. *Intelligence*, *48*, 137–151. doi:10.1016/j.intell.2014.11.006

Zell, E., Krizan, Z., & Teeter, S. R. (2015). Evaluating gender similarities and differences using metasynthesis. *American Psychologist*, *70*, 10–20. doi:10.1037/a0038208

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REFERENCES

Adelson, S. L. (2012). Practice parameter on gay, lesbian, or bisexual sexual orientation, gender nonconformity, and gender discordance in children and adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*, 957–974. doi:10.1016/j.jaac.2012.07.004

Aitken, M., Steensma, T. D., Blanchard, R., VanderLaan, D. P., Wood, H., Fuentes, A., … Zucker, K. J. (2015). Evidence for an altered sex ratio in clinic-referred adolescents with gender dysphoria. *Journal of Sexual Medicine*, *12*, 756–763. doi:10.1111/jsm.12817

Alesina, A., Giuliano, P., & Nunn, N. (2011). The origins of gender roles: Women and the plough. Working paper, Harvard University. doi:10.3386/w17098 doi:10.2139/ssrn.1856152

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

Arning, L., Ocklenburg, S., Schulz, S., Ness, V., Gerding, W. M., Hengstler, J. G., … Beste, C. (2015). Handedness and the

X chromosome: The role of androgen receptor CAG-repeat length. *Scientific Reports*, *5*, 8325. doi:10.1038/srep08325

Bailey, J. M., Dunne, M. P., & Martin, N. G. (2000). Genetic and environmental influences on sexual orientation and its correlates in an Australian twin sample. *Journal of Personality and Social Psychology*, *78*, 524–536. doi:10.1037/0022-3514.78.3.524

Bailey, J. M., & Zucker, K. J. (1995). Childhood sex-typed behavior and sexual orientation: A conceptual analysis and quantitative review. *Developmental Psychology*, *31*, 43–55. doi:10.1037/0012-1649.31.1.43

Bartlett, N. H., & Vasey, P. L. (2006). A retrospective study of childhood gender-atypical behavior in Samoan fa'afafine. *Archives of Sexual Behavior*, *35*, 559–566. doi:10.1007/s10508–006-9055-1

Blakemore, J. E. O. (2003). Children's beliefs about violating gender norms: Boys shouldn't look like girls, and girls shouldn't act like boys. *Sex Roles*, *48*, 411–419. doi:10.1023/A:1023574427720

Blakemore, J. E. O., Berenbaum, S. A., & Liben, L. S. (2009). The family as an agent of gender development. In J. E. O. Blakemore, S. A. Berenbaum, & L. S. Liben (Eds.), *Gender development* (pp. 271–304). New York: Psychology Press.

Blanchard, R. (1997). Birth order and sibling sex ratio in homosexual versus heterosexual males and females. *Annual Review of Sex Research*, *8*, 27–67.

(2018). Fraternal birth order, family size, and male homosexuality: Meta-analysis of studies spanning 25 years. *Archives of Sexual Behavior*, *47*, 1–15. doi:10.1007/s10508–017-1007-4

Blanchard R., & Ellis, L. (2001). Birth weight, sexual orientation and the sex of preceding siblings. *Journal of Biosocial Science*, *33*, 451–467. doi:10.1017/S0021932001004515

Bogaert, A. F. (2006). Biological versus nonbiological older brothers and men's sexual orientation. *Proceedings of the National Academy of Sciences of the United States of America*, *103*, 10,771–10,774. doi:10.1073/pnas.0511152103

Bogaert, A. F., & Skorska, M. (2011). Sexual orientation, fraternal birth order, and the maternal immune hypothesis: A review. *Frontiers in Neuroendocrinology*, *32*, 247–254. doi:10.1016/j.yfrne.2011.02.004

Bogaert, A. F., Skorska, M. N., Wang, C., Gabrie, J., MacNeil, A. J., Hoffarth, M., VanderLaan, D. P., … Blanchard, R. (2018). Male homosexuality and maternal immune responsivity to the Y-linked protein NLGN4Y. *Proceedings of the National Academy of Sciences of the United States of America*, *115*, 302–306. doi:10.1073/pnas.1705895114

Boserup, E. (1970). *Woman's role in economic development*. London: George Allen and Unwin.

Cardoso, F. L. (2009). Recalled sex-typed behavior in childhood and sports preferences in adulthood of heterosexual, bisexual, and homosexual men from Brazil, Turkey, and Thailand. *Archives of Sexual Behavior*, *38*, 726–736. doi:10.1007/s10508–008-9312-6

Carothers, B. J., & Reis, H. T. (2013). Men and women are from earth: Examining the latent structure of gender. *Journal of Personality and Social Psychology*, *104*, 385–407. doi:10.1037/a0030437

Chen, E. S. L., & Rao, N. (2011). Gender socialization in Chinese kindergartens: Teachers' contributions. *Sex Roles*, *64*, 103–116. doi:10.1007/s11199–010-9873-4

Coome, L. A., Skorska, M. N., van der Miesen, A. I. R., Peragine, D. E., & VanderLaan, D. P. (2018). An examination of the biodevelopment of gender expression in children ages 6-to-12 years. *Canadian Journal of Human Sexuality*, *27*, 133–143. doi:10.3138/cjhs.2018-0013

Diamond, L. M., Pardo, S. T., & Butterworth, M. R. (2011). In S. J. Schwartz, L. Koen, & V. L. Vignoles (Eds.), *Handbook of identity theory and research* (pp. 629–647). New York: Springer. doi:10.1007/978-1-4419-7988-9_26

Drummond, K. D., Bradley, S. J., Peterson-Badali, M., & Zucker, K. (2008). A follow-up study of girls with gender identity disorder. *Developmental Psychology*, *44*, 34–45. doi:10.1037/0012-1649.44.1.34

Edwards, C. P., de Guzman, M. R. T., Brown, J., & Kumru, A. (2006). Children's social behaviors and peer interactions in diverse cultures. In X. Chen, D. French, & B. Schneider (Eds.), *Peer relationships in cultural context* (pp. 23–51). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511499739.002

Egan, S. K., & Perry, D. G. (2001). Gender identity: A multidimensional analysis with implications for psychosocial adjustment. *Developmental Psychology*, *37*, 451–463. doi:10.1037/0012-1649.37.4.451

Eliot, L. (2009). *Pink brain, blue brain: How small differences grow into troublesome gaps – and what we can do about it*. New York: Houghton Mifflin Harcourt.

Ellis, L., Hershberger, S., Field, E., Wersinger, S., Pellis, S., Geary, D., … Karadi, K. (2013). *Sex difference: Summarizing more than a century of scientific research*. New York: Psychology Press. doi:10.4324/9780203838051

Endendijk, J. J., Groeneveld, M. G., Bakermans-Kranenburg, M. J., & Mesman, J. (2016). Gender-differentiated parenting revisited: Meta-analysis reveals very few differences in parental control of boys and girls. *PloS One*, *11*, e0159193. doi:10.1371/journal.pone.0159193

Fausto-Sterling, A. (2000). *Sexing the body: Gender politics and the construction of sexuality*. New York: Basic Books.

Furnham, A., Mak, T., & Tanidjojo, L. (2000). An Asian perspective on the portrayal of men and women in television advertisements: Studies from Hong Kong and Indonesian television. *Journal of Applied Social Psychology*, *30*, 2341–2364. doi:10.1111/j.1559-1816.2000.tb02440.x

Geary, D. C. (2010). *Male, female: The evolution of human sex differences* (2nd ed.). Washington, DC: American Psychological Association. doi:10.1037/12072-000

Geschwind, N., & Behan, P. (1982). Left-handedness: Association with immune disease, migraine, and developmental learning disorder. *Proceedings of the National Academy of Sciences of the United States of America*, *79*, 5097–5100. doi:10.1073/pnas.79.16.5097

Gibbons, J. L. (2000). Gender development in cross-cultural perspective. In T. Eckes & H. M. Trautner (Eds.), *The developmental social psychology of gender* (pp. 389–416). Mahwah, NJ: Lawrence Erlbaum.

Gómez, F. R., Semenyna, S. W., Court, L., & Vasey, P. L. (2018). Familial patterning and prevalence of male androphilia among Istmo Zapotec men and muxes. *PLoS One*, *13*, e0192683. doi:10.1371/journal.pone.0192683

Green, R., & Young, R. (2001). Hand preference, sexual preference, and transsexualism. *Archives of Sexual Behavior*, *30*, 565–574. doi:10.1023/A:1011908532367

Grimbos, T., Dawood, K, Burriss, R. P., Zucker, K. J., & Puts, D. A. (2010). Sexual orientation and the second to fourth digit ratio: A meta-analysis in men and women. *Behavioural Neuroscience*, *124*, 278–287. doi:10.1037/a0018764

Gutwinski, S., Löscher, A., Mahler, L., Kalbitzer, J., Heinz, A., & Bermpohl, F. (2011). Understanding left-handedness. *Deutsches Ärzteblatt International*, *108*, 849–853. doi:10.3238/arztebl.2011.0849

Hassett, J. M., Siebert, E. R., & Wallen, K. (2008). Sex differences in rhesus monkey toy preferences parallel those of children. *Hormones and Behavior*, *54*, 359–364. doi:10.1016/j.yhbeh.2008.03.008

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*, 61–83. doi:10.1017/S0140525X0999152

Heylens G., De Cuypere, G., Zucker, K. J., Schelfaut, C., Elaut, E., Vanden Bossche, H., … T'Sjoen G. (2012). Gender identity disorder in twins: A review of the case report literature. *Journal of Sexual Medicine*, *9*, 751–757. doi:10.1111/j.1743-6109.2011.02567.x

Hines, M. (2010). Sex-related variation in human behavior and the brain. *Trends in Cognitive Sciences*, *14*, 448–456. doi:10.1016/j.tics.2010.07.005

(2011). Gender development and the human brain. *Annual Review of Neuroscience*, *34*, 69–88. doi:10.1146/annurev-neuro-061010-113654

Hines, M., Constantinescu, M., & Spencer, D. (2015). Early androgen exposure and human gender development. *Biology of Sex Differences*, *6*, 3. doi:10.1186/s13293–015-0022-1

Hines, M., & Davis, J. (2018). Sex hormones and children's gender-typed toy play. In E. S. Weisgram & L. M. Dinella (Eds.), *Gender typing of children's toys: How early play experiences impact development* (pp. 97–120). Washington, DC: American Psychological Association. doi:10.1037/0000077-006

Hines, M., Pasterski, V., Spencer, D., Neufeld, S., Patalay, P., Hindmarsh, P., … Acerini, C. L. (2016). Prenatal androgen exposure alters girls' responses to information indicating gender-appropriate behaviour. *Philosophical Transactions of the Royal Society of London B, Biological Sciences*, *371*, 20150125. doi:10.1098/rstb.2015.0125

Hönekopp, J., & Watson, S. (2010). Meta-analysis of digit ratio 2D:4D shows greater sex difference in the right hand. *American Journal of Human Biology*, *22*, 619–630. doi:10.1002/ajhb.21054

Hughes, S. K., VanderLaan, D. P., Blanchard, R., Wood, H., Wasserman, L., & Zucker, K. J. (2017). The prevalence of only-child status among children and adolescents referred to a gender identity service vs. a clinical comparison group. *Journal of Sex and Marital Therapy*, *43*, 586–593. doi:10.1080/0092623X.2016.1208702

Hyde, J. S. (2014). Gender similarities and differences. *Annual Review of Psychology*, *65*, 373–398. doi:10.1146/annurev-psych-010213-115057

Johnson, L. L., Bradley, S. J., Birkenfeld-Adams, A. S., Kuksis, M. A. R., Maing, D. M., Mitchell, J. N., & Zucker, K. J. (2004). A parent-report gender identity questionnaire for children. *Archives of Sexual Behavior*, *33*, 105–116. doi:10.1023/B:ASEB.0000014325.68094.f3

Katz-Wise, S. L., Preiss, H. A., & Hyde, J. S. (2010). Gender-role attitudes and behavior across the transition to parenthood. *Developmental Psychology*, *46*, 18–28. doi:10.1037/a0017820

Kiefte-de Jong, J. C., Jaddoe, V. W. V., Uitterlinden, A. G., Steegers, E. A. P., Willemsen, S. P., Hofman, A., … Moll, H. A. (2013). Levels of antibodies against tissue transglutaminase during pregnancy are associated with reduced fetal weight and birth weight. *Gastroenterology*, *144*, 726–735. doi:10.1053/j.gastro.2013.01.003

Knafo, A., Iervolino, A. C., & Plomin, R. (2005). Masculine girls and feminine boys: Genetic and environmental contributions to atypical gender development in early childhood. *Journal of Personality and Social Psychology*, *88*, 400–412. doi:10.1037/0022-3514.88.2.400

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

Kraemer, B., Noll, T., Delsignore, A., Milos, G., Schnyder, U., & Hepp, U. (2009). Finger length ratio (2D:4D) in adults with gender identity disorder. *Archives of Sexual Behavior*, *38*, 359–363. doi:10.1007/s10508–007-9262-4

Lalumière, M. L., Blanchard, R., & Zucker, K. J. (2000). Sexual orientation and handedness in men and women: A meta-analysis. *Psychological Bulletin*, *126*, 575–592. doi:10.1037/0033-2909.126.4.575

Långström, N., Rahman, Q., Carlström, E., & Lichtenstein, P. (2010). Genetic and environmental effects on same-sex sexual behavior: A population study of twins in Sweden. *Archives of Sexual Behavior*, *39*, 75–80. doi:10.1007/s10508–008-9386-1

Leaper, C., Anderson, K. J., & Sanders, P. (1998). Moderators of gender effects on parents' talk to their children: A meta-analysis. *Developmental Psychology*, *34*, 3–27. doi:10.1037/0012-1649.34.1.3

Lee, J. F. K., & Collins, P. (2008). Gender voices in Hong Kong English textbooks – Some past and current practices. *Sex Roles*, *59*, 127–137. doi:10.1007/s11199–008-9414-6

Leversen, I., Torsheim, T., & Samdal, O. (2012). Gendered leisure activity behavior among Norwegian adolescents across different socio-economic status groups. *International Journal of Child, Youth and Family Studies*, *4*, 355–375. doi:10.18357/ijcyfs34201211482

Levine, S. C., Vasilyeva, M., Lourenco, S. F., Newcombe, N. S., & Huttenlocher, J. (2005). Socioeconomic status modifies the sex difference in spatial skill. *Psychological Science*, *16*, 841–845. doi:10.1111/j.1467-9280.2005.01623.x

Li, G., Kung, K. T. F., & Hines, M. (2017). Childhood gender-typed behavior and adolescent sexual orientation: A longitudinal population-based study. *Developmental Psychology*, *53*, 764–777. doi:10.1037/dev0000281

Li, G., & Wong, W. I. (2018). Single-sex schooling: Friendships, dating, and sexual orientation. *Archives of Sexual Behavior*, *47*, 1025–1039. doi:10.1007/s10508–018-1187-6

Li, R. Y. H., & Wong, W. I. (2016). Gender-typed play and social abilities in boys and girls: Are they related? *Sex Roles*, *74*, 399–410. doi:10.1007/s11199–016-0580-7

Liben, L. S., Schroeder, K. M., Borriello, G. A., & Wesigram, E. S. (2018). Cognitive consequences of gendered toy play. In E. S. Weisgram & L. M. Dinella (Eds.), *Gender typing of children's toys: How early play experiences impact development* (pp. 213–255). Washington, DC: American Psychological Association. doi:10.1037/0000077-011

Lonner, W. J., & Malpass, R. S. (1994). *Psychology and culture* (1st ed.). Upper Saddle River, NJ: Pearson.

Lust, J. M., Geuze, R. H., Van de Beek, C., Cohen-Kettenis, P. T., Bouma, A., & Groothuis, T. G. (2011). Differential effects of prenatal testosterone on lateralization of handedness and language. *Neuropsychology*, *25*, 581–589. doi:10.1037/a0023293

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

Maccoby, E. E. (1990). Gender and relationships: A developmental account. *American Psychologist*, *45*, 513–520. doi:10.1037/0003-066X.45.4.513

Martin, C. L., & Fabes, R. A. (2001). The stability and consequences of young children's same-sex peer interactions. *Developmental Psychology*, *37*, 431–446. doi:10.1037/0012-1649.37.3.431

Meerwijk, E. L., & Sevelius, J. M. (2017). Transgender population size in the United States: A meta-regression of population-based probability samples. *American Journal of Public Health*, *107*: e1–e8. doi:10.2105/AJPH.2016.303578

Moore, D. S. (2012). Sex differences in normal fetuses and infants: A commentary. *Child Development Perspectives*, *6*, 414–416. doi:10.1111/j.1750-8606.2012.00258.x

Murnen, S. K. (2018). Fashion or action? Gender-stereotyped toys and social behavior. In E. S. Weisgram & L. M. Dinella (Eds.), *Gender typing of children's toys: How early play experiences impact development* (pp. 189–211). Washington, DC: American Psychological Association. doi:10.1037/0000077-010

Nelson, A. (2005). Children's toy collections in Sweden - A less gender-typed country? *Sex Roles*, *52*, 93–102. doi:10.1007/s11199–005-1196-5

Ngun, T. C., Ghahramani, N., Sánchez, F. J., Bocklandt, S., & Vilain, E. (2011). The genetics of sex differences in brain and behavior. *Frontiers in Neuroendocrinology*, *32*, 227–246. doi:10.1016/j.yfrne.2010.10.001

Pennell, G. E. (1994). Babes in toyland: Learning an ideology of gender. *Advances in Consumer Research*, *21*, 359–364.

Peters, M., Reimers, S., & Manning, J. T. (2006). Hand preference for writing and associations with selected demographic and behavioral variables in 255,100 subjects: The BBC Internet study. *Brain and Cognition*, *62*, 177–189. doi:10.1016/j.bandc.2006.04.005

Petterson, L. J., Wrightson, C. R., & Vasey, P. L. (2017). Recalled gendered behavior in childhood: A comparison of androphilic men, gynephilic men, and androphilic women in Japan. *Archives of Sexual Behavior*, *46*, 119–127. doi:10.1007/s10508–016-0781-8

Reardon, S. F., Fahle, E. M., Kalogrides, D., Podolsky, A., & Zárate, R. C. (2018). Gender achievement gaps in U.S. school districts. cepa.stanford.edu/content/gender-achievement-gaps-us-school-districts

Ruble, D. N., Taylor, L. J., Cyphers, L., Greulich, F. K., Lurye, L. E., & Shrout , P. E. (2007). Effect of gender constancy on age-related changes in gender beliefs. *Child Development*, *78*, 1121–1136. doi:10.1111/j.1467-8624.2007.01056.x

Sasaki, S., Ozaki, K., Yamagata, S., Takahashi, Y., Shikishima, C., Kornacki, T., . . . Ando, J. (2016). Genetic and environmental influences on traits of gender identity disorder: A study of Japanese twins across developmental stages. *Archives of Sexual Behavior*, *45*, 1681–1695. doi:10.1007/s10508–016-0821-4

Schagen, S. E. E., Delemarre-van de Waal, H. A., Blanchard R., & Cohen-Kettenis, P. T. (2012). Sibling sex ratio and birth order in early-onset gender dysphoric adolescents. *Archives of Sexual Behavior*, *41*, 541–549. doi:10.1007/s10508–011-9777-6

Schneider, H. J., Pickel, J., & Stalla, G. K. (2006). Typical female 2nd–4th finger length (2D:4D) ratios in male-to-female transsexuals – Possible implications for prenatal androgen exposure. *Psychoneuroendocrinology*, *31*, 265–269. doi:10.1016/j.psyneuen.2005.07.005

Schwartz, G., Kim, R. M., Kolundziji, A. B., Rieger, G., & Sanders, A. R. (2010). Biodemographic and physical correlates of sexual orientation in men. *Archives of Sexual Behavior*, *39*, 93–109. doi:10.1007/s10508–009-9499-1

Semenyna, S. W., Petterson, L. J., VanderLann, D. P., & Vasey, P. L. (2017). A comparison of the reproductive output among the relatives of Samoan androphilic fa'afafine and gynephilic men. *Archives of Sexual Behavior*, *46*, 87–93. doi:10.1007/s10508–016-0765-8

Smiler, A. P., & Epstein, M. (2010). Measuring gender: Options and issues. In J. C. Chrisler & D. R. McCreary (Eds.), *Handbook of gender research in psychology* (pp. 133–157). New York: Springer. doi:10.1007/978-1-4419-1465-1_7

Steensma, T. D., McGuire, J. K., Kreukels, B. P., Beekman, A. J., & Cohen-Kettenis, P. T. (2013). Factors associated with desistence and persistence of childhood gender dysphoria: A quantitative follow-up study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *52*, 582–590. doi:10.1016/j.jaac.2013.03.016

Sun, T., & Walsh, C. A. (2006). Molecular approaches to brain asymmetry and handedness. *Nature Reviews Neuroscience*, *7*, 655–662. doi:10.1038/nrn1930

Todd, B. K., Fischer, R. A., Costa, S. D., Roestorf, A., Harbour, K., Hardiman, P., & Barry, J. A. (2018). Sex differences in children's toy preferences: A systematic review, meta-regression, and meta-analysis. *Infant and Child Development*, *27*, e2064. doi:10.1002/icd.2064

Totman, R. (2003). *The third sex-kathoey: Thailand's ladyboys*. London: Souvenir Press.

Turner, P. J., & Gervai, J. (1995). A multidimensional study of gender typing in preschool children and their parents: Personality, attitudes, preferences, behavior, and cultural differences. *Developmental Psychology*, *31*, 759–772. doi:10.1037/0012-1649.31.5.759

van der Miesen, A. I. R., Nabbijohn, A. N., Santorossa, A., & VanderLaan, D. (2018). Behavioral and emotional problems in gender-nonconforming children: A Canadian community-based study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *57*, 491–499. doi:10.1016/j.jaac.2018.03.015

van Langen, A., Bosker, R., & Dekkers, H. (2006). Exploring cross-national differences in gender gaps in education. *Educational Research and Evaluation*, *12*, 155–177. doi:10.1080/13803610600587016

VanderLaan, D. P., Blanchard, R., Wood, H., Garzon, L. C., & Zucker, K. J. (2015). Birth weight and two possible types of maternal effects on male sexual orientation: A clinical study of children and adolescents referred to a gender identity service. *Developmental Psychobiology*, *57*, 25–34. doi:10.1002/dev.21254

VanderLaan, D. P., Blanchard, R., Wood, H., & Zucker, K. J. (2014). Birth order and sibling sex ratio of children and adolescents referred to a gender identity service. *PLoS One*, *9*, e90257. doi:10.1371/journal.pone.0090257

VanderLaan, D. P., Forrester, D. L., Petterson, L. J., & Vasey, P. L. (2013). The prevalence of fa'afafine relatives among Samoan gynephilic men and fa'afafine. *Archives of Sexual Behavior*, *42*, 353–359. doi:10.1007/s10508–012-0015-7

VanderLaan, D. P., Petterson, L. J., & Vasey, P. L. (2016). Femininity and kin-directed altruism in androphilic men: A test of

an evolutionary developmental model. *Archives of Sexual Behavior*, *45*, 619–633. doi:10.1007/s10508–015-0632-z

(2017). Elevated kin-directed altruism emerges in childhood and is linked to feminine gender expression: A retrospective study of Samoan fa'afafine. *Archives of Sexual Behavior*, *46*, 95–108. doi:10.1007/s10508–016-0884-2

VanderLaan, D. P., Ren, Z., & Vasey, P. L. (2013). Male androphilia in the ancestral environment: An ethnological analysis. *Human Nature*, *24*, 375–401. doi:10.1007/s12110–013-9182-z

VanderLaan, D. P., & Vasey, P. L. (2011). Male sexual orientation in Independent Samoa: Evidence for fraternal birth order and maternal fecundity effects. *Archives of Sexual Behavior*, *40*, 495–503. doi:10.1007/s10508–009-9576-5

Vasey, P. L., & Bartlett, N. H. (2007). What can the Samoan fa'afafine teach us about the Western concept of gender identity disorder in childhood? *Perspectives in Biology and Medicine*, *50*, 481–490. doi:10.1353/pbm.2007.0056

Wai, J., Lubinski, D., & Benbow, C. P. (2009). Spatial ability for STEM domains: Aligning over 50 years of cumulative psychological knowledge solidifies its importance. *Journal of Educational Psychology*, *101*, 817–835. doi:10.1037/a0016127

Wallien, M. S. C., & Cohen-Kettenis, P. T. (2008). Psychosexual outcome of gender-dysphoric children. *Journal of the American Academy of Child & Adolescent Psychiatry*, *47*, 1413–1423. doi:10.1097/CHI.0b013e31818956b9

Wallien, M. S., Zucker, K. J., Steensma, T. D., & Cohen-Kettenis, P. T. (2008). 2D:4D finger-length ratios in children and adults with gender identity disorder. *Hormones and Behavior*, *54*, 450–454. doi:10.1016/j.yhbeh.2008.05.002

Wong, W. I., & Hines, M. (2016). Interpreting digit ratio (2D:4D)-behavior correlations: 2D:4D sex difference, stability, and behavioral correlates and their replicability in young children. *Hormones and Behavior*, *78*, 86–94. doi:10.1016/j.yhbeh.2015.10.022

Wong, W. I., & Yeung, S. P. (2019). Preschool gender differences in spatial and social skills and their relations to play and parental socialization in Hong Kong Chinese children. *Archives of Sexual Behavior*, *48*, 1589–1602.

Xu, Y., & Zheng, Y. (2015). The digit ratio (2D:4D) in China: A meta-analysis. *American Journal of Human Biology*, *27*, 304–309. doi:10.1002/ajhb.22639

(2016). The relationship between digit ratio (2D:4D) and sexual orientation in men from China. *Archives of Sexual Behavior*, *45*, 735–741. doi:10.1007/s10508–015-0535-z

(2017). Fraternal birth order, handedness, and sexual orientation in a Chinese population. *Journal of Sex Research*, *54*, 735–741. doi:10.1080/00224499.2015.1104530

Yu, L., & Winter, S. (2011). Gender atypical behavior in Chinese school-aged children: Its prevalence and relation to sex, age, and only child status. *Journal of Sex Research*, *48*, 334–348. doi:10.1080/00224491003774867

Yu, L., Winter, S., & Xie, D. (2010). The child play behavior and activity questionnaire: A parent-report measure of childhood gender-related behavior in China. *Archives of Sexual Behavior*, *39*, 807–815. doi:10.1007/s10508–008-9403-4

Yu, L., Xie, D., & Shek, D. T. L. (2012). Factor structure of a multidimensional gender identity scale in a sample of Chinese elementary school children. *Scientific World Journal*, Article ID 595813. doi:10.1100/2012/595813

Zosuls, K. M., & Ruble, D. N. (2018). Gender-typed toy preferences among infants and toddlers. In E. S. Weisgram & L. M. Dinella (Eds.), *Gender typing of children's toys: How early play experiences impact development* (pp. 49–72). Washington, DC: American Psychological Association. doi:10.1037/0000077-004

Zucker, K. (2017). Epidemiology of gender dysphoria and transgender identity. *Sexual Health*, *14*, 404–411. doi:10.1071/SH17067

Zucker, K. J., Beaulieu, N., Bradley, S. J., Grimshaw, G. M., & Wilcox, A. (2001). Handedness in boys with gender identity disorder. *Journal of Child Psychology and Psychiatry*, *42*, 767–776. doi:10.1111/1469-7610.00773