

## Sexual Dials (Not Switches) Theory: An Evolutionary Perspective on Sex and Gender Complexity

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When talking about sex and gender, it's important to ground discussions with basic definitions. Sex, or *sexual identity*, is usually defined as whether one identifies as male or female (or something else). Sex differences, then, are typically about differences between groups of males and females. Whether one is psychologically male-typical or female-typical within a given society is one's *gender identity* (e.g., masculine, feminine, androgynous, etc.). The effects of gender identity can be thought of as the combined impacts of masculinity and femininity across individuals (and within sexes; Eagly and Wood 2013).

Despite these common foundational definitions, challenges remain when addressing sex and gender effects scientifically (Richardson 2013; Maney 2016). For one, human sexual psychologies, as Kinsey, Pomeroy, and Martin (1948) famously noted, rarely take the form of discrete sheep versus goat categories. Even categories as basic as "male" versus "female" are oversimplifications of many people's sexual experience. People with complete Androgen Insensitivity Syndrome, for instance, have an X and a Y chromosome (typically, this pairing of chromosomes makes one "male"), but they usually grow up female, often unaware they are chromosomally male until infertility issues lead to a genetic revelation (Dreger 2000).

Additional intersexual conditions and disorders of sexual development further complicate defining sexual identity as categorical, including different types of Congenital Adrenal Hyperplasia (CAH), Klinefelter Syndrome, Swyer Syndrome, and 5-Alpha Reductase

Deficiency (5-ARD) in which a person with X and Y chromosomes has a feminine looking body until reaching puberty, after which their body begins to take on a masculine appearance. Interestingly, field studies of 5-ARD find even though parents often assign and raise these children as girls, once puberty is reached nearly all develop male sexual identities (Gray, McHale, and Carré 2016). In total, perhaps as many as 1.7% of all humans have an intersexual condition (Fausto-Sterling 2000). So, discrete sexual categories can be scientifically problematic, even for something as seemingly simple as male/female sexual identity.

Another challenge with defining sexual identities is most expressions of human sexuality fail to fall along one, simple dimension (let alone category). For instance, most sexual scientists view human sexual orientation as varying along at least two dimensions: androphilia (finding male bodies erotic) and gynephilia (finding female bodies erotic). It's true many people excel on only one of those dimensions, but many others (especially women) do not find only one sex erotically interesting (Lippa 2006; Chivers, Seto, and Blanchard 2007). Indeed, even a two-dimensional framework is probably too simplistic a conception of the structure and stability of sexual orientation (Klein, Sepeckoff, and Wolf 1985; Bailey et al. 2016).

One response to the complex definitional problems of sexual diversity is to think about sex and gender as stemming from a series of interconnected, dimensional sex/gender dials (instead of just a few independent, categorical switches). So, rather than thinking about men/

women as categorically different (or different along one all-encompassing gender dimension of masculinity versus femininity), sex differences can be thought of as resulting from many different evolved sexual components (or context-sensitive psychological adaptations; Schmitt and Pilcher 2004). Each of these sex/gender dials may be designed so as to turn up or down (individually, or in combinations) depending on one's genetics (autosomal and allosomal), organizational hormone effects *in utero*, activational hormone effects at puberty, current hormone levels, current relationship status, self-perceived mate value, political and religious ideology, and a wide range of other developmental, social, and cultural factors (see Pirlott and Schmitt 2014).

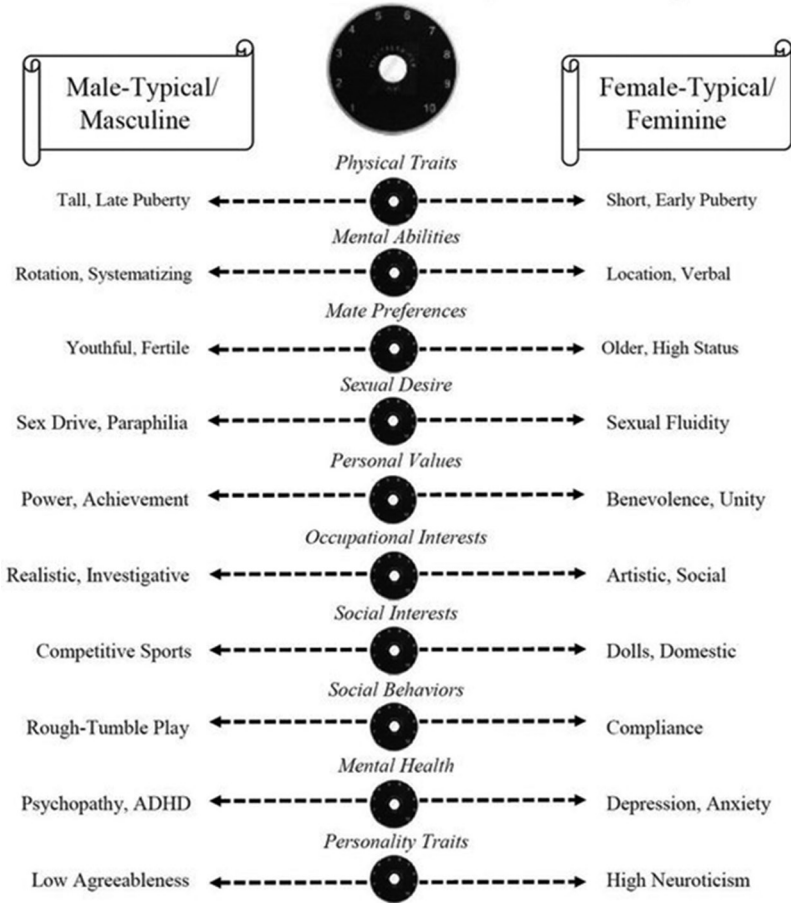
As an example, one potential source of evolved sex/gender dials moving up and down is the degree of prenatal androgen exposure. According to the *organizational hypothesis*, a key cause of sexual differentiation is the prenatal experience (or lack thereof) of androgen-related brain masculinization (Baron-Cohen 2004). In humans, a critical gestational period exists during the second trimester during which male brains, but typically not female brains, are permanently altered in function and structure in ways producing masculinized psychological traits (e.g., personalities, cognitive abilities, play preferences). Prenatal androgen exposure is not a switch, however, it is a series of events over time that tend to turn the psychology of human males, to varying degrees depending on timing and intensity, in the male-typical direction.

Confirmatory evidence supporting *organizational effects* on sexual psychology is limited, but it arises from several sources (Hines 2010). For instance, CAH girls prenatally exposed to male-typical levels of androgens (compared to their unaffected sisters) express more male-typical psychology (Udry, Morris, and Kovenock 1995; Alexander, Wilcox, and Farmer 2009). This is true despite direct and intense feminine gender role socialization of CAH girls (Udry 2000; Pasterski et al. 2005), though additional confounding factors may exist (Jordan-Young

2012). Girls with male cotwins also show some evidence of masculinization (Vuoksima et al. 2010), and the amount of prenatal androgen exposure within *normal* levels also predicts sex differentiated psychology in girls and boys (Cohen-Bendahan, van de Beek, and Berenbaum 2005; Hines 2006; Auyeung et al. 2009), often in a causally suggestive dose-dependent manner (Nordenström et al. 2002). Infants exhibit sex-typical sex differences before extensive gender role socialization (Geary 2010; Alexander and Wilcox 2012), with many children exhibiting sex differences before they know what gender roles are or even what gender is (see Campbell, Shirley, and Candy 2004). Many experimental and observational studies of the neural and hormonal substrates of adult sexual identity, gender dysphoria, and transsexualism imply biological origins are behind men's and women's psychological differences (Udry 2000; Saraswat, Weinand, and Safer 2015; Olsson et al. 2016). Similarly, studies of nonhuman animals (including primates) implicate evolved origins for many sex differences in personality, cognition, and behavior (Gosling and John 1999; Alexander and Hines 2002; Hassett, Siebert, and Wallen 2008; Hines 2010). Sex-linked predispositions toward masculinity or femininity arising from prenatal experiences in no way imply men's and women's psychologies form a simple dichotomous binary, nor are such sex differences fixed and unchangeable after birth (Fausto-Sterling 2012).

Nevertheless, perhaps as a result of differential *in utero* exposure to testosterone (alongside many other factors that may generate sex differences in bodies and brains; Ingahlalikar et al. 2014; Cahill and Aswad 2015; Satterthwaite et al. 2015; Paus et al. 2017), when evolutionary researchers look around the world they find in all (or nearly all) cultures that men and women differ, on average and to varying degrees, across a wide variety of physical and behavioral characteristics (Ellis 2011; Schmitt 2015). Figure 1 displays 10 types of sex/gender dials that appear to reliably produce sex differences in nearly all human cultures, including the following:

## *Sex and Gender as Dials (not Switches)*



**FIGURE 1** Sex and Gender as Dials (Not Switches).

1. *Physical Traits* (e.g., height, upper-body strength, pubertal timing, vocal tone and pitch, facial structure, hirsuteness, waist-to-hip ratios; Puts, Jones, and DeBruine 2012)
2. *Mental Abilities* (e.g., mental rotation and systematizing versus mental location and verbal ability; Lippa, Collaer, and Peters 2010)
3. *Mate Preferences* (e.g., facial and bodily cues found most attractive; fertility and youth cues versus status and older age as preferred in mate choice; Schmitt 2014)
4. *Sexual Desires* (e.g., sex drive, paraphilias, and interest in casual/short-term sex versus sexual fluidity and preference for long-term mating; Baumeister, Catanese, and Vohs 2001)
5. *Personal Values* (e.g., power, stimulation, hedonism, achievement versus benevolence, universalism; Schwartz and Rubel-Lifschitz 2009)
6. *Occupational Interests* (e.g., things/realistic/investigative versus people/artistic/social professions; Lippa 2010)

7. *Social Interests* (e.g., stick toys and competitive sports versus doll toys and domestic interests; Deaner and Smith 2013)
8. *Social Behaviors* (e.g., rough-tumble play, physical aggression, risk-taking versus compliance and conformity; Archer 2009)
9. *Mental Health* (e.g., psychopathy, ADHD, and mental retardation versus depression, anxiety, dependence-related disorders; Hyde, Mezulis, and Abramson 2008)
10. *Personality Traits* (e.g., neuroticism, agreeableness; there is less than 10% overlap in men's and women's overall personalities; Del Giudice, Booth, and Irwing 2012)

From an evolutionary perspective, each sex/gender dial presented in figure 1 is an oversimplification of the many evolved psychological adaptations—and the developmental experiences to which they are especially sensitive—that generate culturally pervasive sex differences. Still, as a first step toward understanding sex/gender varieties, it is critical to think beyond categories, beyond singular dimensions, and beyond dichotomous/binary causes of variation along those dimensions.

Especially enlightening will be how sexual scientists track evidence regarding the dynamic confluence of developmentally timed and domain-specific causes of sex/gender variations (Savic, Garcia-Falgueras, and Swaab 2010; Fausto-Sterling, Garcia Coll, and Lamarre 2012). For instance, the sex/gender dial for masculine “rough and tumble play” preference may be turned up or down by prenatal androgen exposure at a particular week of *in utero* development, whereas masculine “mental rotation abilities” are influenced by varying levels of prenatal androgen exposure during a different week of development (or activationally during puberty; Saxton 2015). Sex differences in vocal pitch and grip strength are extremely large (with very little overlap), but clearly these sex differences are not present at birth and fully emerge only after puberty (Puts et al. 2016). Evolutionary selection pressures may have

designed many sex differences to adaptively emerge across a cascading series of developmental stages, each dial turning a little bit up or down at key times, given key experiences.

Undoubtedly, some master-dials exist and affect many other dials (e.g., both rough and tumble play and mental rotation, both vocal pitch and grip strength), and some dials may have antagonistic effects on other dials (i.e., more masculinity along one dial may cause less masculinity along another dial). Moreover, sex/gender movement along dials at one time might affect subsequent sexuality, both of which may depend on other direct genetic and activation effects. The evolved systems of sex/gender development are likely to be incredibly dynamic and complex (Kenrick, Li, and Butner 2003; Fausto-Sterling, Garcia Coll, and Lamarre 2012), and many dials (rather than a few switches) are, in my view, a useful theoretical perch for understanding how and why we exhibit such a variety of sex/gender expressions within individuals, between the sexes, and around the world (see also Diamond 2006; van Anders 2015).

A sex/gender as dials (not switches) perspective may be quite useful for understanding features of transsexuality. Accumulating evidence suggests some (but not all) male-to-female transsexuals show signs of their sex/gender dials being turned toward feminine psychological and physical traits *before* transitioning (Zucker, Lawrence, and Kreukels 2016). That doesn't mean male-to-female transsexuals have women-typical psychology along *every* dimension (Veale, Clarke, and Lomax 2008), neither do nontranssexual cisgender women. Instead, many male-to-female transsexuals have had some of their sex/gender dials (including in their brains) (Guillamon, Junque, and Gómez-Gil 2016; Zucker, Lawrence, and Kreukels 2016) turned toward female-typical/feminine psychology, and which ones at which times may be especially informative regarding the causal origins of their (and everyone's) sexual identity expression. Female-to-male transsexuals also show signs of

male-typicality before transitional treatments, including brain differences (Kreukels and Guillamon 2016) and body builds, such as bone proportions and fat distribution (Bosinski et al. 1997). Reviewing the extant literature on preexisting brain differences, Kreukels and Guillamon (2016) concluded that “brain phenotypes for FtM and MtF seem to exist, and provided evidence for the role of prenatal organization of the brain in the development of gender incongruence” (125).

The sex/gender as dials (not switches) view suggests for most people their sexual psychology, including their identity, may not be entirely “male” or “female” but very likely something in between. As many other cultures have done, modern societies need to make greater room for a wider, dial-based variety of sex/gender expressions. A person may be born male but consider herself primarily a woman in terms of sexual identity, androgynous in gendered identity (e.g., equally prefers masculine and feminine interests/activities), gynephilic in sexual orientation (i.e., is a self-identified lesbian), polyamorous in mating orientation, and so forth. Her sex/gender dials may not be aligned in a cisgender manner, but her sex/gender expressions may be entirely consistent with the causal biological origins and dynamic developmental processes giving rise to sex/gender in all people. Even if they weren’t, however, that would not make her sexual rights illegitimate. It’s dangerous ground to have our sexual rights depend on our sexuality having a naturalistic origin (Bailey et al. 2016; Diamond and Rosky 2016).

Some researchers mistakenly claim evolution does not apply to human sexual psychology because men and women do not have any evolved nature (Butler 1990), or because male and female psychologies do not form totally separate binaries (e.g., Joel et al. 2015). Put simply, that is not how sexual selection processes and the evolution of sex difference adaptations work in the natural world (Buss 1995; Del Giudice et al. 2016). Just because not all men are taller than all

women does not imply sex differences in height are not important, evolved, or “real” (Gaulin and Boster 1992). Nor does finding sex differences in height are not present at birth, or are not fully mediated by sex differences in testosterone levels, or systematically vary in size across cultures—the list of misconceptions about the evolutionary origins of sex/gender differences is long (Buss and Schmitt 2011; Schmitt et al. 2012; Schmitt 2015;). Yes, evolutionary selection pressures may lead male sexual identity to generally coalign with other expressions of masculinity (e.g., a deeper voice, Puts et al. 2016; a stronger sex drive, Baumeister, Catanese, and Vohs 2001; more interest in competitive team sports; Deaner and Smith 2013), but evolution in sexually reproducing species produces variation along many sex/gender dials (due, for instance, to sexually antagonistic selection pressures; Stearns et al. 2012; Stulp et al. 2012). Sex/gender dials do not all need to be turned “all the way up to 11” for evolution to play a role in producing human sexual diversity.

Understanding sex and gender as *interconnected, dimensional dials* is completely consistent with evolutionary psychology. From an adaptationist perspective, it is extremely unlikely there is one “gender switch” adaptation invariably giving rise to essentialist, determined, and dichotomous male and female psychologies. Such a portrait is a straw man view of evolutionary psychology. Rather, dozens (perhaps hundreds) of evolved sexuality adaptations likely exist, each turning the sex/gender dials of men and women in oblique, context-sensitive ways, each contributing a small part in generating the endless forms most beautiful and most wonderful of the sex/gender variations observed in our species.

Portions of this essay were previously published as a blog post: <https://www.psychology-today.com/blog/sexual-personalities/201605/sex-and-gender-are-dials-not-switches> (retrieved December 2, 2016).

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