No relation between digit ratio (2D:4D) and visual attention patterns to sexually preferred and non-preferred stimuli

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ABSTRACT

Digit ratio (2D:4D) is a marker of prenatal androgenic exposure that is correlated with different behaviour patterns. Here, we explore the relationship between 2D:4D ratio and early versus late attention to sexually preferred stimuli using an eye-tracking paradigm with 78 androphilic or gynephilic men and women. We simultaneously presented preferred and non-preferred adult stimuli and assessed visual attention across time to first fixation and total duration fixation on entire body and three specific areas (face, chest and pelvis), and investigated whether digit ratio was related to visual attentional biases towards sexually preferred stimuli. As expected, participants tended to fixate faster and for more time on the preferred gender. However, we found no significant interactions between 2D:4D and attentional biases towards the preferred gender, for any measure of attention. These results suggest that attention towards the preferred gender is not related to the 2D:4D digit ratio.

1. Introduction

1.1. Digit ratio

The ratio between index (2D) and annular (4D) finger lengths (Brown, Finn, & Breedlove, 2002), has been considered as an indirect indicator of prenatal androgen exposure that is relevant to the masculinization of brain structures and behaviour (Hönekopp & Bartholdt, 2007; Manning, 2011; Manning, Churchill, & Peters, 2007; van Honk et al., 2011). Although the mechanisms underlying the influence of androgens on finger growth are still unclear, recent evidence shows that androgens and oestrogens differentially regulate the network of genes that control the proliferation of chondrocytes, leading to differential growth of the fourth digit in males and females (Zheng & Cohn, 2011). Experimentally inactivating androgen receptors in monkeys decreases 4D growth, causing higher 2D:4D ratios, while inactivation of oestrogen receptors increases 4D growth, leading to lower 2D:4D ratios. These results suggest that 2D:4D ratio could be a stable indicator of prenatal hormonal exposure (Zheng & Cohn, 2011).

The 2D:4D ratio is lower in men than in women. In their meta-analysis of gender differences in 2D:4D ratio, Hönekopp and Watson (2010) found a moderate gender difference, with considerable

heterogeneity (possibly driven by soft tissue differences) that was moderated by type of finger length measurement (direct measurements and measurements from radiographs results in smaller gender differences than indirect measurements) and hand measured (a larger gender difference in the right hand).

The 2D:4D ratio is correlated with other variables as cognitive abilities, aggression, or dominant personality (Alexander & Son, 2007; Barel & Tzischinsky, 2017; van der Meij et al., 2012). Recently, Turanovic, Pratt, and Piquero (2017) found an association between 2D:4D digit ratio and aggression in their meta-analysis, with a weak but statistically significant effect size across a variety of methodological conditions (measures, kinds of samples).

However, some empirical studies suggest that 2D:4D ratio is not a reliable indicator of prenatal testosterone action (Hampson & Sankar, 2012; Voracek, 2014; Zhang et al., 2013). Based on the neuroandrogenic theory put forward by Ellis and Ames (1987), it has been suggested that an unbalanced exposure to prenatal androgens would increase the likelihood of homosexuality in men and women, because both homosexual men and women had experienced significantly higher levels of perinatal androgen that heterosexual men and women (Brown, Finn, Cooke, & Breedlove, 2002; Williams et al., 2000). However, evidence for an association between 2D:4D ratio and sexual orientation

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has shown mixed results. Results are mixed for men (e.g. Kangassalo, Pölkki, & Rantala, 2011; Xu & Zheng, 2016), and indeed Grimbos, Dawood, Burriss, Zucker, and Puts (2010) found significant association between sexual orientation and 2D:4D ratio for women only in their meta-analysis, with a larger effect size for the right versus left hand.

Less research is available on sexual preference and behaviour. These studies suggest low 2D:4D ratios are associated with increased sexual jealousy in men (Bendixen et al., 2015), higher reproductive success in men (Klimek, Galbarczyk, Nenko, Alvarado, & Jasienska, 2014; Manning & Fink, 2008) and lower reproductive success in women (Manning & Fink, 2008), sexually attractive facial characteristics in men (Ferdenzi, Lemaître, Leongómez, & Roberts, 2011), more interest in short- versus long-term sexual relationships and number of sex partners in men (Honekopp, Voracek, & Manning, 2006; Schwarz, Mustafić, Hassebrauck, & Jörg, 2011), and greater erotic gift-giving to female romantic partners (Nepomuceno, Saad, Stenstrom, Mendenhall, & Iglesias, 2016). There are no studies investigating the association between 2D:4D ratio and sexual preferences and behaviour in homosexual people.

1.2. Visual attention

Research using eye-tracking and pupillometry techniques has found that visual attention prioritizes sexually attractive stimuli and areas of interest (Dixson, Grimshaw, Linklater, & Dixson, 2011; Hewig, Trippe, Hecht, Straube, & Miltner, 2008; Lykins, Meana, & Strauss, 2008). Fromberger et al. (2012, 2013); found that heterosexual men who sexually preferred adults, looked at stimuli depicting women faster and longer than non-preferred stimuli (men or children of either gender). Similar results have been found in homosexual men and women, who are more influenced by the presence of sexually dimorphic, attractive physical characteristics of the preferred sex, than heterosexual women, who show a non-specific response in their sexual preferences (Dawson & Chivers, 2016; Dawson, Fretz, & Chivers, 2017; Hewig et al., 2008; Rieger & Savin-Williams, 2012; Samson & Janssen, 2014).

It is assumed that when there is sexual interest, attention will be focused more on the body than on the face, given reproductive signals such as chest-to-waist ratio in men and waist-to-hip ratio in women (Bolmont, Cacioppo, & Cacioppo, 2014; Lykins et al., 2008; Lykins, Meana, & Kambe, 2006). These body signals could be influenced by variations in prenatal testosterone levels. Huh (2013), in a study about attention allocation in which participants selected whether to uncover the face or the body of stimuli, did not find significant differences in the 2D:4D ratios of 64 men and 45 women, but did find that people who chose to view the body of an opposite-gender target had significantly lower ratios than those who chose the face. Thus, a low 2D:4D ratio, regardless of participant gender, could be associated with greater attention to bodies than to faces. However, there are no studies using eye-tracking to test the association between 2D:4D ratios and visual attention responses to sexually preferred stimuli, aside from Strong (2014), who found no association between digit ratio and more attention towards opposite-gender stimuli in a sample of 25 men and 45 women.

1.3. The present study

In the present study, we explore gender and sexual orientation differences in 2D:4D ratio, and the relationship between the 2D:4D ratio and early versus late attention to sexually preferred stimuli in an eye-tracking paradigm. Chivers (2017), based on previous findings (Dawson & Chivers, 2016; Hamann et al., 2014; Vásquez-Amézquita et al., in press), hypothesised that lower prenatal androgenisation could be related to non-specific response patterns in terms of preferred gender, whereas greater prenatal androgenisation would be associated with greater gender-specific response. Therefore, we predicted that men and women of any sexual orientation with low (more masculinized)

2D:4D ratios would fixate faster (initial orientation) and longer (late attention) on bodies, and especially sexual areas (face, chest and pelvis) of sexually preferred stimuli than men and women with high ratios.

4. Methods

4.1. Participants

Data were extracted from a larger study involving two experiments on the identification of sexual preferences through patterns of visual attention. The present sample consisted of 78 men and women (mean age ± SD = 19.54 ± 1.24 years old), divided into 4 groups: 23 gynephilic men (21.13 ± 2.55), 21 androphilic women (19.14 ± 1.08), 18 androphilic men (20.44 ± 1.73), and 16 gynephilic women (20.06 ± 1.24). Sexual orientation was classified using the Kinsey scale (Kinsey, Pomeroy, & Martin, 2003), and only individuals who scored 0 or 1 (exclusively or mainly heterosexual), and 5 or 6 (mainly or exclusively homosexual) took part in the study. To avoid inaccuracies in the calculation of the 2D:4D ratio, participants were selected from an initial pool of 119 students, after excluding those who were left handed, reported fractures or dislocations of the index or ring fingers, as well as those who, for diverse reasons (calibration, loss of attention, or somnolence), presented a sampling of eye movements of < 85% of trials.

4.2. Measures and procedure

All procedures obtained approval from the Institutional Ethics Committee. Students were invited to participate voluntarily and the study procedure was explained. Those who agreed to participate provided written informed consent and completed a series of questionnaires that included sociodemographic data, the Kinsey scale (Kinsey, Pomeroy, and Martin, 2003) for the identification of sexual orientation, and an evaluation of psychosomatic symptoms (Sandín, Valiente, Chorot, Santed, & Lostao, 2008) to rule out psychological or psychiatric symptoms (e.g. depression, psychotic symptoms at the time of the study). The experimental phase only included students who completed the questionnaires and met all the criteria (n = 78), and included eye-tracking data, subjective valence and arousal ratings of all stimuli, and hand scanner to measure 2D:4D ratios. For a detailed description of eye movement data collection, subjective sexual attractive measurements, and 2D:4D ratio measurement techniques see the Supplementary Materials.

4.3. Statistical analyses

To identify fixations, the Tobii Fixation Filter was used, which filters out saccadic movements. The dispersion threshold for fixations was 30 pixels, with a minimum duration of 100 ms. Following Dawson and Chivers (2016), if the speed was kept below this threshold, the data were assigned to the same fixation. Time to first fixation is the latency of first fixation for each area of interest (Hewig et al., 2008), and it is considered a valid measure of early attention (Dawson & Chivers, 2016). Total duration fixation and fixation count are indices of later attention, and they correspond to the mean total amount of time spent looking at a specific stimulus region and the mean total number of fixations on a specific region, respectively (Dawson & Chivers, 2016; Lykins et al., 2006; Mitrovic, Tinio, & Leder, 2016). Each stimulus was divided into four areas of interest: Entire body, then face (non-erotic area), chest, and pelvis (erotic areas) (Hall, Hogue, & Guo, 2011; Hewig et al., 2008; Suschinsky, Elias, & Krupp, 2007). We also examined subjective reports of valence and arousal. For a detailed description of statistical analyses, see the Supplementary Materials.