HETEROSEXUAL MEN'S PUPILLARY RESPONSES AND VISUAL ATTENTION TO GYNANDROMORPHIC STIMULI

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ABSTRACT

Sexual interactions between *gynandromorphs*—feminine males who may or may not have breasts, and who retain their penises—and cisgender heterosexual males have been documented across a diverse range of cultures. This has led some scholars to hypothesize that heterosexual males may be universally capable of experiencing sexual attraction and arousal to feminine males. The studies contained in this thesis present new empirical data on heterosexual males' sexual interest in gynandromorphs. In a single sample of heterosexual men (n = 65), I demonstrated that pupillary responses (i.e., a measure of sexual arousal) and visual attention (i.e., a measure of sexual interest) did differ meaningfully between gynandromorphs and cisgender males unless the former had breasts—a female-typical secondary sex trait. These results suggest that female *sex*-based traits play a more primary role in gynephilic men's sexual arousal than feminine *gender*-based traits (e.g., hairstyle, posture, makeup).

AUTHOR'S CONTRIBUTIONS

Lambert C. Heatlie, Lanna J. Petterson, and Paul L. Vasey conceived of this study. Lanna J. Petterson constructed and standardized all nude images. Lambert C. Heatlie and Lanna J. Petterson designed the study. Lambert C. Heatlie collected the data, analyzed the data, and drafted the manuscript. Paul L. Vasey and Lanna J. Petterson critically revised the manuscripts and thesis.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 2

LIST OF FIGURES

CHAPTER 2

CHAPTER 3

CHAPTER 1 – INTRODUCTION

Same-sex sexual interactions are phylogenetically widespread (Bagemihl, 1999; Bailey & Zuk, 2009). For example, male African bat bugs (*Afrocimex constrictus*) traumatically inseminate other males with such frequency that the structure of their sexual organs are characterized by unique compensatory mechanisms (Reinhardt, 2007). Bottlenose dolphins (*Thursiops truncatus*) are known to demonstrate one of the highest rates of same-sex sexual behaviour among non-human animals, with both males and females frequently engaging in same-sex mounting behaviours (Mann, 2006). Male garter snakes (*Thamnophis sirtalis parietalis*) have been known to mimic the pheromones of females which sometimes invites courtship behaviours from other males (Shine et al., 2003). The most compelling instance of same-sex sexual behaviour in non-human animals is perhaps that of the common ram (*Ovis aries*). Roughly 6% of male rams direct courtship displays and copulatory behaviours exclusively toward other males, even in the presence of reproductively viable females (Perkins & Roselli, 2007; Price et al., 1988).

In humans, same-sex sexual interactions between males[1] appear to be cross-culturally universal (Hames et al., 2017). For example, in the review conducted by Hames et al. (2017), the authors found evidence for male same-sex sexual behavior in 123 of the

[1] For the purpose of this thesis, sex refers to one's objective status as male or female, which is based on biological parameters such as chromosomes, gonads, gametes and genitals. Gender refers to the constellation of socialized male-typical (masculine) and female-typical (feminine) psycho-behavioral characteristics an individual manifests (gender role), which in turn, can influence an individual's (gender) identity. As such, individuals can be simultaneously sexed and gendered (e.g., a cisgender male is a biological male who presents in a masculine manner). It is important to note that some sex differences in psycho-behavioral phenomena are not due to socialization (e.g., Connellan et al., 2000).

186 (66%) cultures that they surveyed from the Standard Cross-Cultural Samples.[2] In some cases, this type of behaviour may be socially prescribed, such that within a given culture, all males are expected to engage in ritualized sexual interactions with higher ranking males (e.g., Herdt, 2006). Similarly, sexual interactions between males appear to be facilitated by environments wherein access to female sexual partners is severely limited (e.g., Money & Bohmer, 1980; Saum et al., 1995; Moodie et al., 1989; Fay et al., 1989; Whitam, 1992). For example, Moodie et al. (1989) describes the case of South African "mine marriages," in which heterosexual males would "marry" young boys while stationed at remote gold mines. Boy-wives were expected to cook, clean, and provide sexual services for their "husbands" in exchange for financial compensation. When their work contracts ended, miners generally terminated their mine marriages and returned home to their female wives.

As the above examples illustrate, sexual interactions between males are driven not only by sexual orientation, but also by sociocultural dynamics. This makes it necessary to employ language that can distinguish between incidental and preferential sexual behaviour. Consequently, I use the terms *androphilia* and *gynephilia* to discuss monosexual orientations (Blanchard, 1985). *Androphilia* refers to the enduring sexual attraction and arousal to adult males (who typically, are relatively masculine), whereas *gynephilia* refers to the enduring sexual attraction and arousal to adult females (who typically, are relatively feminine).

[2]It should be noted that 51 of the cultures used in this study simply did not have data on sexual interactions between males. Ergo, the prevalence rate of male homosexual interactions for this study is technically 91% (123/135).

Male Androphilia

Although sexual orientation identities such as "gay" vary across cultures, male androphilia usually takes on one of two forms: *cisgender* or *transgender* male androphilia (Whitam, 1987; Whitam & Mathy, 1986). Cisgender male androphiles tend to be more common in the West and typically identify as men (Whitam, 1983). These individuals usually present in a relatively masculine manner when compared to average androphilic females, despite exhibiting some relatively feminine characteristics (e.g., occupational interests) when compared to gynephilic males (e.g., Lippa, 2005; 2007).

Transgender male androphiles' exhibit a relatively feminine gender role presentation and do not identify as men. In the West, these individuals are typically referred to as trans women or simply women. However, in many non-Western cultures, transgender male androphiles adopt or are prescribed "third" gender identities that are distinguished linguistically from the gender-normative categories of "man" and "woman." Third gender categories have been documented in many cultures, including, but not limited to, India (Stief, 2017), Samoa (Vasey & VanderLaan, 2021), Mexico (Gómez-Jiménez & Vasey, 2021), and Indonesia (Peletz, 2009). For example, Samoan transgender male androphiles are referred to as *fa'afafine*, which translates directly to "in the manner of a woman." The cross-cultural mutability of transgender male androphiles' gender identities can often hinder cross-cultural comparisons. Consequently, I employ the more cross-culturally neutral term *gynandromorph* to refer to transgender male androphiles who may or may not have breasts, and who retain their penises. This term can rightfully be used to discuss the majority of transgender male androphiles, as most of these individuals do not undergo genital reconstruction surgery or breast augmentation (Petterson & Vasey, 2022). While both forms of male androphilia can exist

simultaneously in a given culture, one or the other tends to predominate (Whitam, 1983; Hames et al., 2017).

Despite the cross-cultural variability associated with male androphilia, both forms tend to share cross-culturally universal correlates. For example, both forms of male androphilia are associated with being later born among siblings (Blanchard, 2004; VanderLaan & Vasey, 2011; Vasey & VanderLaan, 2007), having greater numbers of older brothers (e.g., Bogaert & Skorska, 2011; VanderLaan & Vasey, 2011; Vasey & VanderLaan, 2007), and occur at similar prevalence rates across different cultures (~1.5-5%) (Vasey and VanderLaan, 2014). In childhood, both forms of male androphilia tend to exhibit greater levels of female-typical behaviour (e.g., playing with dolls), lower levels of male typical behaviour (e.g., rough and tumble play), relatively elevated recalled childhood separation (i.e., fear of being separated from one's caregiver), and are more likely to express cross-sex beliefs (e.g., "I believe that I was meant to be a girl") (Bailey & Zucker, 1995; Bartlett & Vasey, 2007; Whitam, 1983; VanderLaan et al., 2011; Gomez, Semenyna, & Vasey, 2017). In adulthood, androphilic males exhibit a cross-culturally consistent interest in female-typical careers (e.g., interior design) (Lippa, 2005; Whitam & Dizon, 1979; Gomez, Court & Vasey, 2021; Semenyna and Vasey, 2016). Indeed, regardless of its particular manifestation, male androphilia is often associated with varying degrees of gender atypicality—although this is not always the case.

Third-gender gynandromorphs sometimes occupy social roles unique to their gender category. For example, the Indian *hijra* are gynandromorphs who are believed to be capable of blessing or cursing the fertility of others (Stief, 2017). *Hijra* are expected to live in their own communities, and it is not uncommon for individuals to castrate themselves to gain social status within these sub-cultures. In parallel, third gender

gynandromorphs from certain North American indigenous cultures, such as the Yokut, were often given ceremonial privileges and obligations (Kroeber, 1925; Gayton, 1948). For instance, these individuals were tasked with preparing corpses for burials or ceremonies, and often conducted the musical components of annual mourning rituals.

Relationship Configurations

The gender role presentation of individuals influences the types of sexual relationships they form. Relationship configurations between opposite-sex attracted males and females tend to be relatively straightforward because one partner tends to be relatively masculine (the male partner) and attracted to feminine females, whereas the other tends to be feminine (the female partner) and attracted to masculine males (Savin-Williams & Vrangalova, 2013). Because cisgender androphilic males embody (at least in a relative sense), and are sexually attracted to, maleness and masculinity, they form sexual relationships with one another (e.g., Glick et al., 2012).

The situation is different for androphilic gynandromorphs given that they present in a feminine manner. This diminishes their sexual attractiveness from the perspectives of both cisgender androphilic males, as well as other gynandromorphs. Instead, androphilic gynandromorphs' ideal sexual partners are usually gynephilic males because cisgender gynephilic males exhibit relatively more masculine characteristics than cisgender androphilic males and are sexually attracted to femininity. Consequently, when androphilic gynandromorphs engage in sexual activity they typically do so with men who are predominately gynephilic. Consistent with this line of reasoning, sexual interactions between gynephilic males and gynandromorphs have been formally documented in at least 43 countries, prompting some scholars to describe such behaviour as a cross-cultural

universal (Petterson and Vasey, 2022). It is worth noting that the nature of such behaviour may vary from short-term sexual interactions to long-term romantic relationships.

Among men who pursue sexual relationships with gynandromorphs, a commonly cited motivation is the degree to which gynandromorphs express their femininity (Kulick, 1997; Operario et al., 2008; Reback & Larkins, 2006; Rosenthal et al., 2017; Mitsuhashi, 2006). For example, these men often report that they specifically seek out gynandromorphs who are visually indistinguishable from cisgender females, or who accentuate their femininity more so than the average cisgender female (i.e., some gynandromorphs may constitute a *supernormal* feminine stimulus). In their qualitative study of men who have sex with gynandromorphs, Operario et al. (2008) noted that these individuals perceived gynandromorphs as "trying harder" in regard to their appearance and thus, investing more effort in terms of appearance enhancement. Moreover, they reported an appreciation for the purportedly eroticized and hyper-feminine clothing worn by gynandromorphs.

Male gynephiles who engage in anal sex with gynandromorphs frequently report that they always assume the penetrative role during these interactions, and in many cultures, sexual interactions between gynandromorphs and gynephilic males are considered acceptable, insofar as the gynephilic male is never penetrated by the gynandromorph (Petterson and Vasey, 2022). Overall, sexual interactions between gynandromorphs and gynephilic males appear to reflect many of the key dynamics underpinning normative male-female sexual relationships.

Gynandromorphophilia and Sexual Orientation Identities

In the psychological literature, the sexual attraction to feminine males who retain their penises was first addressed by Money and Lamacz (1984), who introduced the term *gynemimetophilia* (i.e., the sexual attraction to males who *mimic* feminine qualities). Soon after, Blanchard and Collins (1993) later introduced the term, *gynandromorphophilia,* which they used to designate "all men with distinct sexual interest in feminized men, including in the latter men wearing women's attire and men with surgically or hormonally feminized bodily contours, but intact male genitalia." Gynandromorphophilia does not necessarily imply preferential sexual interest in gynandromorphs, and it does not include cases in which someone is sexually attracted to a gynandromorph whom they falsely believe to be cisgender. Like gynephilia and androphilia, gynandromorphophilia denotes the sexual attraction to *adult* gynandromorphs.

Although the sexual orientation identities of Western gynandromorphophilic males have not been thoroughly investigated, recent scholarship would suggest that these individuals generally consider themselves to be heterosexual (i.e., gynephilic) (Hsu et al., 2016; Rosenthal, Hsu, & Bailey, 2017). For example, Rosenthal, Hsu, and Bailey (2017) surveyed 314 self-described gynandromorphophilic men and found that 52.9% of the sample identified as heterosexual. Although 37.3% of the sample identified as bisexual, only 7.1% *preferred* sexual interactions with males to sexual interactions with females. Overall, these data suggest that Western gynandromorphophilic men perceive themselves to be primarily gynephilic, albeit more likely to identify as bisexual then typical gynephilic males. This is also reflected in gynandromorphophilic men's Kinsey scores, as these individuals usually identify as Kinsey 1s (i.e., predominantly heterosexual,

incidentally homosexual) (Petterson & Vasey, 2022). It is worth noting that some gynandromorphophilic men identify as bisexual because they are unsure of how else to describe gynandromorphophilic interests (e.g., Operario et al., 2008).

In regard to gynandromorphophilic men from non-Western cultures, it is also the case that these individuals tend to identify as heterosexual although an appreciable minority identify as bisexual (Degtyar et al., 2018; Lim, 2015; Long et al., 2020; Mitsuhashi, 2006; Reisner et al., 2019; Schifter & Madrigal, 1997). In many of these cultures, men who have sex with gynandromorphs are given a unique title. For example, men who have sex with gynandromorphs are called *mayaté* in the Istmo region of Oaxaca, Mexico, *panthi* in India, and *callboys* in the Philippines (Petterson and Vasey, 2022). However, it is not always the case that these titles reflect a preferential sexual attraction to gynandromorphs, as many men who have sex with gynandromorphs do so in to earn money (e.g., Mirandé, 2017; Whitam, 1992). This highlights the importance of quantifying sexual orientation in terms of sexual attraction and arousal, rather than relying solely on cross-culturally variable demarcations such as sexual identities.

Gynandromorphophilic Men's Patterns of Subjective Sexual Attraction and Arousal

In the West, gynandromorphophilic men commonly report that they are sexually aroused by the thought of having sex with gynandromorphs, and often masturbate to such fantasies (Rosenthal, Hsu & Bailey, 2017). These fantasies most commonly involve the man assuming the penetrative role and the gynandromorph assuming the receptive role. However, gynandromorphophilic men still have a marked interest in cisgender females. Indeed, Rosenthal, Hsu, and Bailey (2017) found that most of their sample (55.9%) described cisgender women as their preferred sexual partner. Nonetheless, when asked to

subjectively rate the sexual attractiveness of gynandromorphic and cisgender female stimuli, both categories received similar scores. Because of this, Rosenthal, Hsu, and Bailey (2017) proposed that gynandromorphophilia may not be a sexual orientation in its own right, but rather, a *variant* of gynephilia.

In regard to non-Western samples, there have been few attempts to quantify gynandromorphophilic men's patterns of subjective sexual arousal, save for research conducted in Samoa and India. Petterson and Vasey (2021a) compared the sexual interests of Samoan men who have sex with *fa'afafine,* and Samoan men who only have sex with cisgender females. In line with Hsu et al. (2016) and Rosenthal, Hsu, and Bailey, (2017), the gynandromorphophilic group reported an elevated sexual interest in gynandromorphs, relative to the non-gynandromorphophilic group. However, Petterson and Vasey's (2021) results differed from Western research in that Samoan gynandromorphophiles' subjective sexual arousal to cisgender women *exceeded* their subjective sexual arousal to gynandromorphs.

Similarly, Stief (2017) examined the sexual preferences of Indian gynandromorphs, the *hijra*, and their sexual partners, the *panthi*. In contrast to Western research, Stief (2017) found Indian gynandromorphophilic men's sexual preferences to be relatively ambiphilic. That is, these individuals were equally attracted to men and women. Even though Western gynandromorphophilic men generally have a higher chance of identifying as bisexual, they usually exhibit a predominantly gynephilic sexual (genital) arousal profile (Hsu et al., 2016; Rosenthal, Hsu, & Bailey, 2017).

Petterson and Vasey (2022) proposed that the apparent cross-cultural heterogeneity in the patterning of gynandromorphophilic men's subjective sexual attraction and arousal might be explained by the effects of past sexual interactions with

gynandromorphs. Specifically, they posited that the sexual partners of gynandromorphs are more likely to identify as bisexual, whereas gynandromorphophilic men who have not formed romantic relationships or engaged in sexual interactions with gynandromorphs are more likely to identify as heterosexual. It is possible that this hypothesis may also account for cross-cultural differences in the patterning of gynandromorphophilic men's subjective sexual arousal.

Gynandromorphophilic Men's Patterns of Sexual Arousal and Visual Attention

Because questions pertaining to sexual preferences may be perceived as intrusive or unsafe to answer truthfully, it is not uncommon for participants to exhibit *response styles* when answering sensitive questions (i.e., a bias that is stable across questionnaires) (Tourangeau and Yan, 2007). Consequently, sex researchers often employ measures of sexual arousal such as penile plethysmography (i.e., the continuous measurement of penile blood flow), because physiological metrics are usually resistant to manipulation (e.g., Chivers et al., 2004). Moreover, such measures do not depend on the participant's capacity to recall past experiences.

In the West, only one study has evaluated gynandromorphophilic men's genital responses when presented with gynandromorphic stimuli (Hsu et al., 2016). Hsu et al. (2016) presented self-described gynandromorphophilic men with sexual films featuring two males only, two females only, and various pairings of gynandromorphs (with breasts) with males and females—while continuously measuring penile blood flow. Although gynandromorphophilic men responded maximally to gynandromorphic stimuli, their genital responses to videos featuring two females did not differ from the genital responses of typical gynephilic males when viewing the same stimuli. Moreover, the non-

gynandromorphophilic group exhibited a larger genital response to gynandromorphic stimuli than to male-male stimuli. Taken together, these patterns are consistent with the tendency for gynandromorphophilic and gynephilic preferences to differ in degree, rather than kind.

Similarly, Petterson and Vasey (2021b) used eye-tracking—a non-invasive behavioural measure of sexual interest (reviewed in Wenzlaff, Briken, & Dekker, 2016)—to examine Western gynephilic males' sexual interest in gynandromorphic stimuli. In this study, participants were presented with various pairings of cisgender males, cisgender females, and gynandromorphs with, and without breasts (i.e., a forced-choice paradigm). Although the sample did not consist of explicitly gynandromorphophilic men, participants exhibited relatively more sexual interest in gynandromorphs than in cisgender males, as evinced by shorter initial fixation latencies, prolonged fixation durations, and higher total fixation counts. Petterson and Vasey (2021b) concluded that their study demonstrated the efficacy of gender-based (e.g., hair, posture) traits in eliciting sexual arousal from gynephilic males, above and beyond the effects of sex-based traits (e.g., breasts, genitals). That being said, participants' viewing patterns indicated a far stronger sexual preference for images of cisgender females than for gynandromorphs, with or without breasts.

Regarding non-Western samples, genital measures of sexual arousal have yet to be implemented in the study of gynandromorphophilia. However, Stief (2017) and Petterson and Vasey (2021a) used eye-tracking to evaluate the sexual preferences of non-Western gynandromorphophilic men. Consistent with the apparent cross-cultural variation in gynandromorphophilic men's sexual orientation identities, the viewing time patterns of participants from both cultures were relatively ambiphilic. This too may be a consequence

of cross-cultural variation in the frequency by which gynephilic males engage in sexual interactions with gynandromorphs (Petterson and Vasey, 2022). It is worth noting that, due to Samoan law, Petterson and Vasey (2021a) were unable to use fully nude stimuli. Instead, they used images depicting only the faces of gynandromorphs and cisgender males and females. Similarly, Stief (2017) presented their participants with clothed full-body images of men and women, but did not include gynandromorphic stimuli. Therefore, it is possible that the apparent cross-cultural heterogeneity in gynandromorphophilic men's sexual preferences may be an artifact of inconsistent methodologies.

Gynandromorphophilia as an Invariant Characteristic of Male Gynephilia

In light of the aforementioned literature, some scholars have proposed that gynandromorphophilia may be an invariant characteristic of male gynephilia, rather than a sexual orientation in its own right (Rosenthal, Hsu, and Bailey, 2017; Petterson and Vasey, 2021b). That is, *all* gynephilic males may have the innate capacity to experience *some* sexual attraction and arousal to gynandromorphic stimuli. This capacity may then be modulated by culturally specific factors, such as the frequency by which one is exposed to gynandromorphs, as well as sexual norms and prescriptions. This hypothesis is consistent with the tendency for gynandromorphophilic men to identify as heterosexual, exhibit sexual attraction and arousal to both cisgender females and gynandromorphs, and to prefer engaging in sexual activity with cisgender females. It may also explain why sexual interactions between gynandromorphs and gynephilic males occur over such a diverse range of cultures, and why these interactions are more common in some cultures than in others (Petterson and Vasey, 2022).

Blanchard et al. (2012) demonstrated that gynephilic men's sexual orientation can be defined as their maximum sexual arousal along a sexual stimulus gradient. As such, sexual arousal in response to less-preferred stimuli (i.e., gynandromorphs, cisgender males) is contingent on the degree to which they resemble preferred stimuli (i.e., cisgender females). Thus, if Petterson and Vasey's (2021b) hypothesis holds, gynephilic males' sexual attraction and arousal to gynandromorphic stimuli should exceed their sexual attraction and arousal to cisgender male stimuli, as the former shares more features with gynephilic male's preferred sexual target.

I aimed to test this prediction using two different methods to quantify sexual interest. In Chapter 2, I used pupil dilation to assess a sample of gynephilic males' sexual arousal to images of cisgender males, cisgender females, and gynandromorphs with, and without breasts. Previous research indicates that pupil dilation to sexual stimuli furnishes an accurate, automatic measure of sexual arousal that is difficult to fake (e.g., Rieger & Savin-Williams, 2012; Rieger et al., 2015). Chapter 3 presents on a study that built upon Petterson and Vasey's (2021b) work by examining gynephilic males' viewing patterns in response to gynandromorphic stimuli. In order to evaluate precisely where and how participants allocated their attention during the stimulus presentation, I constructed regions of interest for each stimulus consisting of background, chest, face, genital, and waist-hips areas. Chapter 4 summarizes the results of this thesis and discusses the broader implications of my findings.

CHAPTER 2 – Heterosexual Men's Pupillary Responses to Stimuli Depicting Cisgender Males, Cisgender Females, and Gynandromorphs[3,4]

ABSTRACT

This study examined Canadian cisgender gynephilic men's (n = 65) pupillary responses and subjective ratings of sexual arousal when presented with nude images of cisgender males, cisgender females, and gynandromorphs with, and without, breasts. Subjective arousal to cisgender females was highest, followed by subjective arousal to gynandromorphs with breasts, gynandromorphs without breasts and cisgender males. However, subjective arousal to gynandromorphs without breasts and to cisgender males did not differ significantly. Participants' pupils dilated more to images of cisgender females than to all other stimulus categories. Participants' pupils dilated more to gynandromorphs with breasts than to cisgender males, but pupillary response to gynandromorphs without breasts and cisgender males did not differ significantly.

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[4] Lambert C. Heatlie, Lanna J. Petterson, and Paul L. Vasey conceived of this study. Lanna J. Petterson constructed and standardized all nude images. Lambert C. Heatlie and Lanna J. Petterson designed the study. Lambert C. Heatlie collected the data, analyzed the data, and drafted the manuscript. Paul L. Vasey and Lanna J. Petterson critically revised the manuscripts and thesis.

INTRODUCTION

Monosexual males' (i.e., males who are only attracted to a single class of sexual stimuli, [e.g., cisgender females]) sexual orientation has been defined as their maximum arousal along a sexual stimulus generalization gradient (Blanchard et al., 2012). Along this gradient, arousal tapers off dramatically from most to least preferred sexual stimuli. Thus, while arousal to lesser preferred stimuli does occur, it exists at far lower levels than arousal to the most preferred stimuli. Differential arousal to various lesser preferred stimuli is contingent on the degree to which those stimuli share features with the stimuli that is the most preferred. Arousal to lesser preferred stimuli can occur even if those stimuli are subjectively experienced as undesirable. Consequently, some degree of sexual attraction and arousal by gynephilic men in response to gynandromorphs, particularly those with breasts, would be expected given that such stimuli share features with cisgender females (Petterson & Vasey, 2021b).

Consistent with these ideas, Petterson and Vasey (2021b) examined the viewing patterns of Canadian gynephilic men in response to stimuli depicting cisgender males, cisgender females and gynandromorphs (including those with and without breasts). While gynephilic men exhibited a clear pattern of sexual interest (i.e., prolonged fixation duration) in females, they spent significantly more time fixating on stimuli depicting gynandromorphs than on stimuli depicting their least preferred sex—males. Self-reported patterns of sexual attraction paralleled these eye-tracking results. These data are consistent with the conclusion that the capacity for some, albeit low level of sexual interest in gynandromorphs is an invariant capacity of male gynephiles, even in cultures such as Canada where sexual interactions between gynandromorphs and gynephilic men are relatively rare (Scheim and Bauer, 2017). Hsu et al. (2016) obtained similar results for

gynephilic men using self-report and penile plethysmography measures of men's sexual arousal to video stimuli of cisgender women, cisgender men, and gynandromorphs with breasts.

There have been recent calls in the scientific literature to replicate research findings using different methods (Munafò & Smith, 2018). The present study aimed to triangulate and expand upon previous eye-tracking (Petterson & Vasey, 2021b) and penile plethysmography (Hsu et al., 2016) research by examining Canadian gynephilic males' pupillary responses and subjective ratings of sexual arousal when presented with nude images of cisgender males, cisgender females, and gynandromorphs with, and without, breasts. Whereas previous research employed a behavioural measure of sexual interest (i.e., eye-tracking), the measure we employ here—pupil dilation—taps into physiological arousal in response to sexual stimuli (Rieger & Savin-Williams, 2012; Rieger et al., 2015; Laeng et al., 2012; Hess & Polt, 1960).

Pupil dilation indicates activation of the autonomic nervous system, which is responsible for many physiological processes such as digestion, perspiration, and vascular function (Steinhauer et al., 2004). Human pupils also dilate in association with many cognitive functions, such as exerting mental effort or emotional processing (e.g., Kahneman et al., 1969; Bradley et al., 2008). With respect to the specific issue of *sexual* arousal, pupillary response to sexual stimuli approximates the maximal dilation that can be elicited by psychologically relevant stimuli (Laeng et al., 2012). Further, men's genital arousal to sexual stimuli corresponds to their pupillary responses, and these measures, in turn, correspond to their self-reported sexual orientation and arousal (Rieger et al., 2015).

Based on the existing research, we predicted that gynephilic male's pupillary responses would be largest for cisgender females, followed by gynandromorphs with

breasts, gynandromorphs without breasts, and lastly, cisgender males. We also predicted that subjective ratings of sexual arousal would follow the same pattern. Attraction to both types of gynandromorphs would be consistent with the conclusion that gynephilic men's patterns of sexual attraction and arousal are responsive to traits that are both sex- and gender-based. In contrast, if gynephilic men are only sexually responsive to gynandromorphs with breasts, then this would be more consistent with the conclusion that secondary sex-based traits are much more important determinants of their sexual attraction and arousal than gender-based ones.

METHODS

Participants

To qualify for the study, participants were required to identify as heterosexual cisgender men, be over the age of 18, have normal or corrected vision and to have viewed porn at least once in their life. A total of seventy-one cisgender males were recruited. Most participants were recruited from a small university on the Canadian prairies through a course credit system, online platforms, and posters. The latter two recruitment strategies were also used to recruit additional participants from the local community. Online platforms included Reddit and Twitter, whereas posters were placed on university campus and community bulletin boards.

Three participants were excluded from analyses because their patterns of self-reported sexual arousal indicated either bisexuality or androphilia (i.e., sexual attraction and arousal to cisgender males). Technical issues resulted in data loss for another three participants. In total, 65 gynephilic male participants (M_{age}= 23.12, SD_{age}= 5.2; range= 18-38) were included in the final analyses. Regarding ethnicity, 80.49% of participants

identified as Caucasian, 7.3% Black, 4.88% Asian, 2.4% Indigenous, and 4.88% as "other." Most participants were not affiliated with any religion (58.5%), 31.7% of religious participants were Christian, 2.4% were Buddhists, and 7.3% selected "Other" religious affiliation. Most participants reported growing up as middle class (46.3%), followed by upper middle class (31.7%), lower middle class (19.5%) and lastly, lower class (2.4%). Consequently, the sample was relatively homogeneous in terms of their ethnicity, religious background, and socioeconomic status during childhood.

Stimuli

Nude images were taken from freely accessible websites using search terms such as "hot" and "sexy." Backgrounds were removed leaving only the model and images were converted to grey scale. Individual images were set at 450 pixels high with a resolution of 72 pixels/inch.

The final stimulus set consisted of 44 nude images depicting females who appeared to be cisgender, males who appeared to be cisgender, and gynandromorphs with, and without, breasts in unstandardized poses (11 images per category). Gynandromorphs without breasts were identified as such due to visible qualities such as their female-typical hairstyles and poses, and because they did not appear to have surgically augmented breasts or signs of breast budding from hormone use. Each image was presented individually on a white background, and the face, chest, and genitals were always visible.

Apparatus

Questionnaire data were collected on a 17-inch laptop with 1920x1080 resolution. Pupil size was estimated using a Tobii X120-3 near-infrared eye-tracker, which was

calibrated for each participant. Stimulus presentation was conducted using Tobii Pro Studio Software. During the study, participants' heads were stabilized using a chin rest.

Procedure

Participants first completed a consent form and were given time to ask questions. Participants were told that the study's purpose was to understand how people pay attention when evaluating the sexual appeal of humans who vary in their gender presentation. The true purpose of the study was concealed from participants at the study outset so they would not attempt to adjust their gaze.

Participants then completed a survey which included questions addressing biodemographics and scale measures of their sexual history and moral beliefs, and seven personality characteristics. Scale measures were collected for a separate study.

Following this, participants were positioned 65cm from the eye tracker. The eye tracker was calibrated to participants' eye movements. Next, participants were presented with a text screen notifying them that they would be shown images, to rate how sexually arousing they found each model, and to focus their gaze on the fixation crosses whenever they appeared. After 10 seconds, the presentation automatically began. Participants were shown a dark grey fixation cross and, two seconds later, a nude model was presented for 10 seconds. Following this, another screen appeared with a prompt asking participants to rate their sexual arousal to the previous image (discussed further below). Participants were prompted to click a button to continue to the next image. This sequence (i.e., fixation cross, nude image, arousal rating) was repeated for all 44 nude images. Presentation of the stimuli was randomized, but all participants saw the stimuli in the same randomized order. Each participant was tested individually, and each session lasted

approximately 45 minutes. After the experiment was completed, participants were debriefed and informed of the true purpose of the study.

Measures

Subjective Sexual Arousal

Participants were asked, "How sexually arousing do you find this person?" after each image. They responded using a 7-point Likert-like scale that ranged from 1 ("not at all arousing") to 7 ("very arousing").

Pupil Dilation

Tobii Pro Studio automatically marks eye blinks and high-quality versus low-quality measurements in a categorical manner. In addition, data can be exported with quality ranked along an ordinal scale. All low-quality measurements were ranked as the lowest possible value and excluded from final analyses. All high-quality data were ranked as the highest possible quality, and were included in the analysis.

To compute pupil dilation, we first created averages per stimulus type, and then standardized stimulus averages within each participant's dataset. We then subtracted each participant's average standardized pupil diameter during fixation-cross presentations from their average standardized pupil diameter for each stimulus category. For each participant, this resulted in an average pupil dilation score for each of the four human stimulus categories. Higher scores indicate greater pupil dilation for the image category relative to their response to the neutral stimuli.

Statistical Analyses

Data was exported using Tobii Pro Studio Software, and statistical analyses were conducted using JASP version 0.15. Because subjective arousal was skewed positively

for some stimulus categories, but negatively for others, an omnibus Friedman test and post-hoc Wilcoxon signed-rank tests were used to conduct pairwise comparisons of stimulus category ratings. To examine the effect of stimulus category on pupil dilation, a one-way repeated measures analysis of variance (ANOVA) was used followed by post-hoc Bonferroni-corrected *t*-tests for pairwise comparisons. Because the assumption of sphericity was violated, a Greenhouse-Geisser correction was used.

P-values under .005 were treated as significant, whereas those between .005 and .05 were taken as suggestive. This was done not only because our analyses required multiple individual tests, but also because even in appropriate contexts, the traditional threshold of significance (i.e., $p < .05$) may contribute to false positives (Benjamin et al., 2017)

RESULTS

Subjective Sexual Arousal

Men's average (SD) subjective sexual arousal to cisgender females was 5.38 (1.1), to gynandromorphs with breasts was 2.22 (1.31), to gynandromorphs without breasts was 1.57 (0.77), and to cisgender males was 1.71 (1.1). The Friedman test was significant, $\chi^2(3, N = 65) = 144.80$, $p < .001$. Wilcoxon's tests revealed that cisgender females were ranked as significantly more arousing than gynandromorphs with breasts, $Z = -6.95$, $p < .001$, $r_{rb} = .9$, gynandromorphs without breasts, $Z = -6.95$, $p < .001$, $r_{rb} = .9$, $p < .001$, and cisgender males, $Z = -7.01$, $p < .001$, $r_{rb} = .9$, $p < .001$. Gynandromorphs with breasts were ranked as more attractive than those without breasts, $Z = -5.17$, $p < .001$, $r_{rb} = .87$, and cisgender males, $Z = -3.73$, $p < .001$, $r_{rb} = .56$. The difference between cisgender

males and gynandromorphs without breasts was not significant, $Z = .27$, $p = .79$. (Figure 2.1).

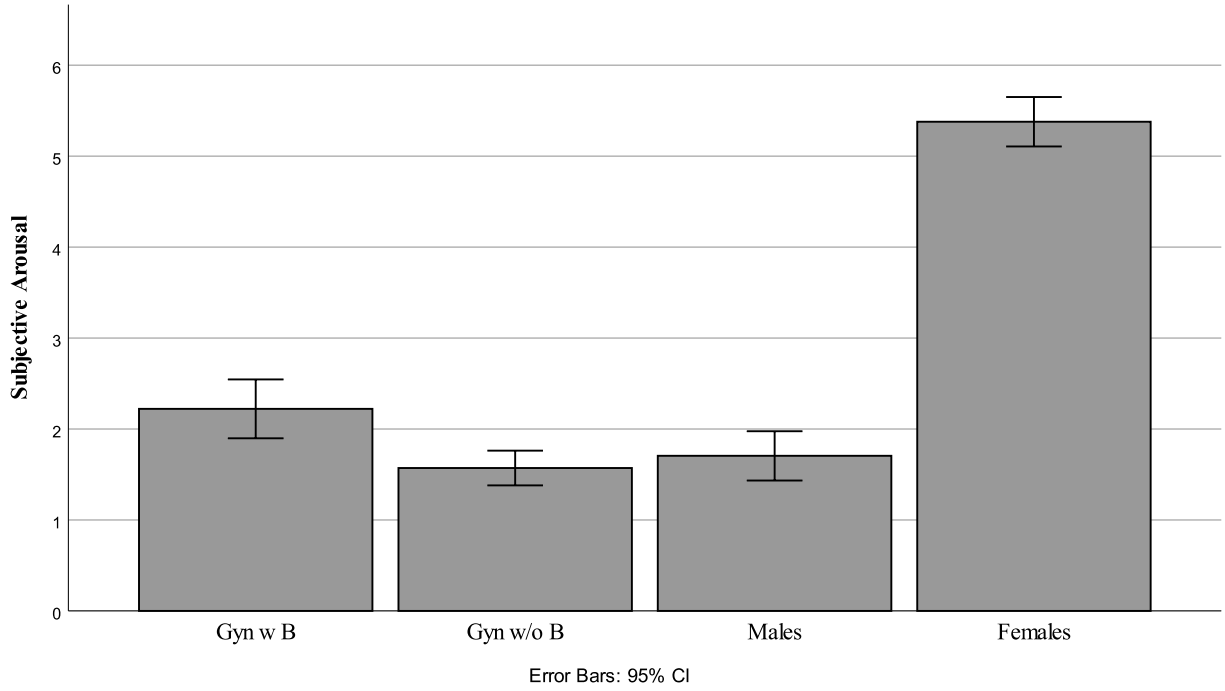

Figure 2.1. Participants' average subjective arousal ratings for images of cisgender males, cisgender females, and gynandromorphs with, and without, breasts (error bars denote 95% confidence intervals).

Pupillary Responses

Men's average (SD) standardized change in pupil size was 0.25 (0.27) when viewing cisgender females, 0.1 (0.17) when viewing gynandromorphs with breasts, 0.03 (0.19) when viewing gynandromorphs without breasts, and -0.05 (0.17) when viewing cisgender males. The ANOVA was significant, $F(3, 192) = 21.44$, $p < .001$, partial $\eta^2 = .25$. Post-hoc *t*-tests using a Bonferroni correction revealed that participants' pupils dilated more in response to cisgender females than to gynandromorphs with breasts, $t = 3.84$, $p < .001$, $d = .73$, gynandromorphs without breasts, $t = 5.76$, $p < .001$, $d = 1.1$, and

cisgender males, $t = 7.67$, $p < .001$, $d = 1.46$. Participants' pupils dilated more to gynandromorphs with breasts than to cisgender males, $t = 3.84$, $p = .001$, $d = .73$. Participants' pupil dilation to gynandromorphs without breasts did not differ significantly from their pupil dilation to cisgender males, $t = 1.91$, $p = .34$, or gynandromorphs with breasts, $t = 1.92$, $p = .34$. (Figure 2.2).

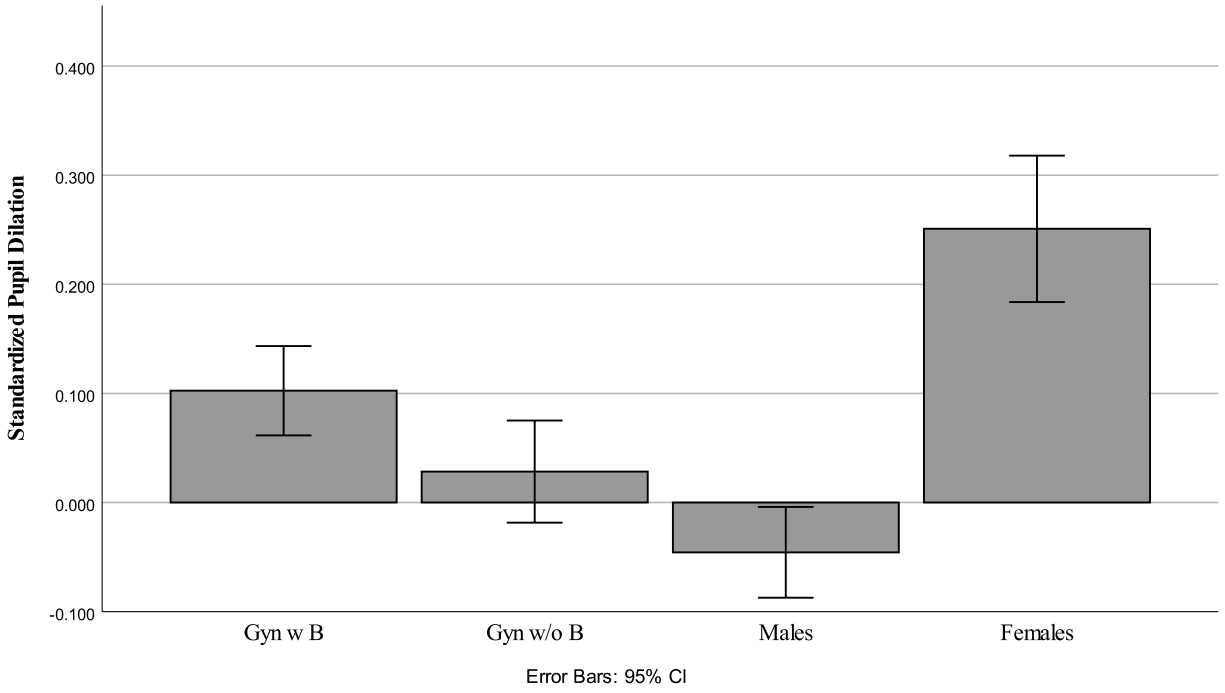

Figure 2.2. Standardized average changes in pupil size in response to mages of cisgender males, cisgender females, and gynandromorphs with, and without, breasts (error bars denote 95% confidence intervals).

Consistency Across Measures

Table 2.1 lists the correlations between subjective arousal and pupil dilation across all stimulus categories. Regarding the correspondence between subjective and pupillary measures of sexual arousal, only responses to female stimuli converged, $r_s = 0.26$, $p = 0.04$. Subjective arousal and pupil dilation to female stimuli were negatively correlated with pupil dilation to images of males, $r_s = -0.35$, $p = .006$ and $r_s = -0.40$, $p <$

.001, respectively. Similarly, pupil dilation to female stimuli was negatively correlated with pupil dilation to gynandromorphs without breasts, $r_s = -0.31$, $p = 0.01$.

	Sub. Gyn w B	Sub. Gyn w/o B	Sub. Cis Males	Sub. Cis Females	Dil. Gyn w B	Dil. Gyn w/o B	Dil. Cis Males	Dil. Cis Females
Sub. Gyn w B								
Sub. Gyn w/o B	.792**							
Sub. Cis Males	.629**	.652**						
Sub. Cis Females	.506**	.472**	.194					
Dil. Gyn w B	.059	.123	.062	.183				
Dil. Gyn w/o B	.048	-.019	-.028	.053	.047			
Dil. Cis Males	-.132	-.120	.002	-.338**	.043	-.180		
Dil. Cis Females	.249*	.193	.053	.257*	-.039	-.313*	-.402**	

Table 2.1. Correlations between subjective arousal (sub) and pupil dilation (dil) across all stimulus categories.

**correlation is significant at the 0.01 level.

*correlation is significant at the 0.05 level.

DISCUSSION

The present study examined gynephilic men's subjective sexual arousal and pupillary responses to nude images of cisgender males, cisgender females, and gynandromorphs with, and without, breasts. Regarding self-reported sexual arousal, participants' responses were generally patterned in the predicted direction. As stimuli had more traditionally feminine appearances and female primary and secondary sex-characteristics, participants reported being more sexually aroused by the individual with cisgender females ranked as more arousing than all other stimuli. However, the difference in subjective sexual arousal between gynandromorphs without breasts and cisgender males was non-significant.

To some extent, pupillary responses mirrored the patterns of self-reported sexual arousal. Men's pupils dilated significantly more to nude images of cisgender females than to all other stimulus categories. Also, men's pupils dilated more to gynandromorphs with breasts than to cisgender males. Participants' pupil dilation in response to gynandromorphs without breasts was intermediate to gynandromorphs with breasts and cisgender males but did not differ significantly from either.

Subjective arousal and pupil dilation generally did not correspond to one another directly, save for participants' responses to female stimuli. This may suggest that pupil dilation failed to gauge participants' sexual arousal to images of males and gynandromorphs. Indeed, past studies have reported moderate-to-large correlations between subjective measures of sexual attraction and pupillary responses to less-preferred sexual video stimuli (Rieger & Savin-Williams, 2012; Rieger et al., 2015). It is possible that the lack of correspondence between subjective arousal and pupil dilation can be attributed to our use of static images, rather than video stimuli. Indeed, past research

demonstrates that men's responses to sexual stimuli are heavily dependent on stimulus modality (Dawson & Chivers, 2018). It is also possible that our findings differ from past research due to the eye-tracking system we employed, as some eye-trackers yield greater effect sizes than others (Attard-Johnson et al., 2021). Another factor that may have affected correspondence between subjective arousal and pupil dilation may have been the stimulus categories we employed for this study. Previous research of this type has employed stimulus categories that vary in terms of sex (i.e., male vs. female) and age, but not gynandromorphic versus cisgender status (e.g., Rieger & Savin-Williams, 2012; Rieger et al., 2015; Attard-Johnson, Bindemann, & Ciardha, 2016). Nonetheless, our subjective and pupillary data converge indirectly, as across both measures participants' responses were highest for images of cisgender females, and lowest for images of cisgender males. Additionally, we found a moderate negative correlation between pupil dilation to cisgender female stimuli and pupil dilation to cisgender male stimuli. As such, our pupil data correspond to participants' self-reported sexual orientation (i.e., heterosexual).

This study assessed subjective and objective responses to gynandromorphs with breasts, and to those without, *individually* in relation to cisgender males. This revealed that participants did not meaningfully discriminate between cisgender males and gynandromorphs without breasts. Rather, participants only exhibited sexual attraction and arousal to gynandromorphs who had breasts—a female-typical secondary sex trait. Thus, although there may be an additive effect of feminine gender-based traits (e.g., feminine hair style, posture) on gynephilic male's sexual arousal, our subjective and physiological data suggest that the effect of sex-based traits (e.g., breasts) is much more substantial. Even so, participants' subjective reports of sexual arousal and their objective measures of

pupillary dilation were significantly higher for cisgender females than they were for gynandromorphs with breasts.

Hsu et al. (2016) contended that sexual attraction to gynandromorphs with breasts, and to those without, are not analogous to one another. Gynandromorphs without breasts better reflect the existence of androphilic gynandromorphs in ancestral conditions (VanderLaan et al., 2013), whereas gynandromorphs with breasts are a historically novel phenomenon whose breast development is contingent on modern hormonal and surgical interventions (Meyerowitz, 2002). Consistent with this distinction, our data would suggest that gynephilic males distinguish between gynandromorphs with breasts and those without. However, this distinction is subtle when evaluated in terms of pupillary response.

Many men who seek out gynandromorphs as sexual partners cite the femininity of such individuals as being a key motivator (e.g., Kulick, 1997; Operario et al., 2008; Reback & Larkins, 2006; Rosenthal, Hsu, & Bailey, 2017; Mitsuhashi, 2006). Some studies have characterized the femininity of gynandromorphs as more accentuated than the average cisgender female (Gerico, 2015; Operario et al., 2008; Reback & Larkins, 2006). These findings could be viewed as at odds with our results, given that participants were more sexually aroused to cisgender females than to gynandromorphs, with or without breasts. Consequently, our nude stimuli may have failed to capture many of the qualities (e.g., clothing, voice, and body movements) that communicate femininity, or accentuated femininity, and elicit sexual interest from gynephilic males in naturalistic contexts.

If gynephilic males have a capacity for gynandromorphophilic attraction, then these data suggest that this capacity may only extend to gynandromorphs with breasts.

However, many if not most gynandromorphs, especially those living outside Western cultures, do not augment their breasts (Petterson & Vasey, 2022). Nonetheless, sexual interactions between these individuals and gynephilic males still occur (Petterson & Vasey, 2022). Additional qualities, above and beyond feminine gender role presentation and breast augmentation, may motivate gynephilic men to engage in sexual interactions with gynandromorphs. Indeed, some men report that they find gynandromorphs to be more sexually confident, assertive, and open-minded when compared to most cisgender females and that these attributes are appealing when expressed by markedly feminine individuals (see Petterson & Vasey, 2022). Similarly, some men pursue sexual relationships with gynandromorphs because they find that the latter are not only feminine, but also exhibit heightened interest in sexual activity, a tendency which the men in question find appealing (Reback, Larkins, & Clark, 2019).

Researchers aiming to better understand gynandromorphophilia and its possible relation to male gynephilia might consider implementing more dynamic visual stimuli (e.g., Hsu et al., 2016; Chivers et al., 2004). It may be informative to use this methodology to examine gynandromorphs' behavioural characteristics (e.g., sexual assertiveness, openness) as they relate to the sexual arousal patterns of gynephilic men. For example, past research demonstrates that sexual proceptivity enhances the perceived attractiveness of cisgender women (Clark, 2008). As such, it is possible that proceptivity may also enhance the perceived attractiveness of gynandromorphs. Although this hypothesis is supported by qualitative scholarship (e.g., Weinberg & Williams, 2010; Reback, Larkins, & Clark, 2019), it has yet to be tested within a quantitative framework.

LIMITATIONS

This study relied primarily on a convenience sample of Canadian undergraduate men, although some participants were recruited from the community. This limits the study's generalizability, as Western undergraduate students are usually outliers in psychological studies (Henrich et al., 2010). Until this study is replicated using community and non-Western samples, we cannot assume that other men would respond in a similar manner. It is possible, for example, that when men grow up in a culture where gynandromorphs are more prevalent, greater attraction to such individuals develops over the life course.

There may have been a self-selection bias in participant recruitment. Individuals who volunteer for sex research studies tend to score higher in sexual openness and have more extensive sexual histories than those who do not (Strassberg and Lowe, 1995). It is possible that one of the recruitment requirements—that participants need to have watched porn in the past—amplified this bias.

Participants completed the questionnaire package prior to viewing the stimuli, which could conceivably have influenced their response patterns. Replication studies could consider randomizing the order with which the questionnaires and experiment are administered.

Stimuli were selected and classified based on their visual characteristics. As such, it is possible that some models, whom we designated cisgender in appearance, may in fact have identified differently. Further, we may have assumed, for example, that a model was male or female when, in fact, they were intersexed.

Lastly, the average luminance levels of neutral stimuli (i.e., fixation crosses) were subjectively matched to that of the stimulus set. As such, it is possible that some variance

in pupil dilation may be attributable to discrepancies in luminance levels, rather than sexual arousal. That being said, the luminance levels of all fixation crosses were consistent for each image and category.

Chapter 3 – Heterosexual Men's Visual Attention to Stimuli Depicting Cisgender Males, Cisgender Females, and Gynandromorphs[5,6]

ABSTRACT

This study examined Canadian cisgender gynephilic men's (n = 65) visual attention and subjective ratings of sexual arousal when presented with nude images of cisgender males, cisgender females, and gynandromorphs with, and without, breasts. Visual attention was assessed using an infrared eye-tracker. Subjective arousal to cisgender females was highest, followed by subjective arousal to gynandromorphs with breasts, gynandromorphs without breasts and cisgender males. However, subjective arousal to gynandromorphs without breasts and to cisgender males did not differ significantly. Participants exhibited unique visual fixation patterns for images of cisgender females. Although viewing patterns in response to images of cisgender males and gynandromorphs with and without breasts were for the most part homogenous, participants fixated onto the chests of gynandromorphs with breasts for longer durations than those of cisgender males. These results further suggest that female sex-based traits play a more primary role in gynephilic men's sexual arousal than feminine gender-based traits.

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[5] A version of this manuscript has been published in the Archives of Sexual Behaviour as Heatlie, L.C., Petterson, L.J., & Vasey, P.L. (2023). Heterosexual men's visual attention to nude images depicting cisgender males, cisgender females and gynandromorphs. *Archives of Sexual Behaviour*.

[6] Lambert C. Heatlie, Lanna J. Petterson, and Paul L. Vasey conceived of this study. Lanna J. Petterson constructed and standardized all nude images. Lambert C. Heatlie and Lanna J. Petterson designed the study. Lambert C. Heatlie collected the data, analyzed the data, and drafted the manuscript. Paul L. Vasey and Lanna J. Petterson critically revised the manuscripts and thesis.

INTRODUCTION

There has been a growing interest in the use of eye-tracking as a quantitative measure of sexual interest (e.g., Hewig et al., 2008, Numenmma et al., 2012; Hall, Hogue & Guo, 2011; Petterson & Vasey, 2021a; Lykins, Meana & Kambe, 2007; Lykins et al., 2008; Fromberger, Jordan, & Herder, 2012). Eye-tracking can effectively measure sexual interest because sexually relevant stimuli tend to capture both automatic and sustained visual attention more effectively than sexually irrelevant stimuli, which is subsequently reflected in eye movements (reviewed in Wenzlaff, Briken, & Dekker, 2016). For instance, when gynephilic males are simultaneously shown nude images of a cisgender female and a cisgender or transgender male, gynephilic males will attend relatively faster, more frequently, and for greater durations to the sexually relevant image (i.e., females; Fromberger, Jordan, & Herder, 2012; Peterson & Vasey, 2021b).

The eye movements most commonly investigated in eye-tracking research are saccades and fixations. Saccades are rapid movements of the eye and can be either voluntary or reflexive. Fixations are periods of time during which an individual's gaze dwells (i.e., >200 ms) on a specific area of the visual space, and play a key role in extracting and processing information from the environment (Holmqvist et al., 2011). Fixations are often assessed in terms of time to first fixation (TTF), total fixation duration (TFD), and total fixation count (TFC). TFF is a measure of how much time has passed before a fixation is made onto a stimulus and is usually expressed in seconds. This measure is considered to gauge automatic attentional processes, as it is generally difficult for participants to consciously manipulate their initial fixation patterns (Spiering & Everaerd, 2007). Humans generally exhibit lower TFFs when presented with sexually arousing stimuli (e.g., Hewig et al., 2008; Petterson & Vasey, 2021a). By contrast, TFD,

which is a measure of time spent visually fixated on a stimulus (measured in seconds), and TFC (measured in whole-number integers), which is a tally of fixations made onto a stimulus, are considered measures of consciously directed attention (Spiering & Everaerd, 2007). Humans generally exhibit higher TFDs and TFCs when presented with sexually arousing stimuli (e.g., Hall, Hogue, & Guo, 2011; Petterson & Vasey, 2021b).

To better understand gynephilic males' sexual interest in gynandromorphic stimuli, Petterson and Vasey (2021b) presented Canadian gynephilic men with nude images of cisgender males, cisgender females, and gynandromorphs with and without breasts, while using an eye-tracker to continuously measure eye movements. Consistent with past research (Hsu et al., 2016), the gynephilic men in Petterson and Vasey's (2021b) study exhibited peak sexual interest in stimuli depicting cisgender females. That said, they also exhibited lower, but relatively greater sexual interest in gynandromorphs than in cisgender males, as they were quicker to affix and maintain their gaze on images of gynandromorphs than those of cisgender males. Additionally, fixations onto images of gynandromorphs were sustained for longer durations compared to fixations on cisgender males. However, fixations onto images of gynandromorphs with breasts were sustained for longer than fixations onto gynandromorphs without breasts. These results were mirrored by participants' self-reported sexual arousal to each class of stimulus.

This study builds upon past research by evaluating the viewing patterns of gynephilic males when presented with nude images of cisgender males, cisgender females, and gynandromorphs with, and without, breasts. Although past research has already examined gynephilic males' visual attention to gynandromorphic stimuli (Petterson & Vasey, 2021b), it remains unclear whether participants attend to the bodies of cisgender males differently than to the bodies of gynandromorphs. As such, the use of

regions of interest (ROI) (e.g., Numenmma et al., 2012; Hewig et al., 2009; Hall, Hogue, & Guo, 2011) furnishes a novel visual-attention paradigm with which to further examine the hypothesis that all male gynephiles are capable of experiencing gynandromorphophilic interests. Based on past research (Petterson & Vasey, 2021b), and the exploratory nature of this study, we predicted that across all measures of visual attention, the viewing patterns elicited by gynandromorphic stimuli as assessed across each ROI would be shifted in an intermediate manner away from that of cisgender male stimuli and towards those of cisgender female stimuli.

METHODS

Participants

Participants were required to be over the age of 18, male, identify as cisgender and heterosexual, have normal or corrected vision, and to have watched porn at least once in their life. Overall, 71 cisgender males were recruited for this study. Most participants were students recruited from a small university on the Canadian prairies, however, some participants were recruited from the local community by means of physical posters and online platforms. Physical posters were placed on university and community bulletin boards, and online platforms including Twitter and Reddit.

Three participants were excluded from the final analyses, as their patterns of subjective arousal indicated that they were either androphilic or bisexual. Data for another three participants were lost due to technical issues. In total, 65 heterosexual men (M_{age}= 23.12, SD_{age}= 5.2; range= 18-38) were included in the final analyses. Regarding ethnicity, 80.49% of participants identified as Caucasian, 7.3% Black, 4.88% Asian, 2.4% Indigenous, and 4.88% as “other.” Most participants were not affiliated with any religion

(58.5%). Of those that were affiliated with a religion, 31.7% were Christian, 2.4% were Buddhists, and 7.3% selected "Other" as their religious affiliation. Most participants reported growing up as middle class (46.3%), followed by upper middle class (31.7%), lower middle class (19.5%) and lastly, lower class (2.4%). As such, the sample was relatively homogeneous in terms of ethnicity, religious background, and socioeconomic status during childhood.

Stimuli

Nude images were taken from freely accessible websites using search terms such as "hot" and "sexy." Backgrounds were removed leaving only the model and images were converted to grey scale. Individual images were set at 450 pixels high with a resolution of 72 pixels/inch.

The final stimulus set consisted of 44 nude images depicting females who appeared to be cisgender, males who appeared to be cisgender, and gynandromorphs with, and without breasts in unstandardized poses (11 images per category). Gynandromorphs without breasts were identified as such due to traditionally feminine qualities such as their female-typical hairstyles and poses, and because they did not appear to have surgically or hormonally augmented their bodies. Each image was presented individually on a white background. Models were posed such that the face, chest and genitals were always visible.

Apparatus

Questionnaire data were collected on a 17-inch laptop with 1920x1080 resolution. In addition to a biodemographic survey, participants completed a battery of questionnaires pertaining to various personality characteristics. Participants' responses to

these measures will be reported in a different study. Viewing patterns (i.e., eye-movements) were measured using a Tobii X120-3 near-infrared eye-tracker, which was calibrated for each participant. Stimulus presentation was conducted using Tobii Pro Studio Software. During the study, participants' heads were stabilized using a chin rest.

Procedure

Participants were first required to complete a consent form, and were given the opportunity to ask questions related to the study. The true purpose of the study was concealed from participants at the study outset so they would not attempt to adjust their gaze. Participants were told that the study's purpose was to understand how people pay attention when evaluating the sexual appeal of humans who vary in their gender presentation. The study began with participants using the laptop to answer various questions addressing biodemographics. Participants also completed surveys pertaining to their sexual history and moral beliefs, and seven personality characteristics for a separate study.

Following this, participants were positioned 65cm from the eye-tracker and laptop. The eye tracker was calibrated to each participant's eye movements. Next, participants were presented with a text screen notifying them that they would be shown nude images, to rate how sexually arousing they found each model, and to focus their gaze on fixation crosses whenever they appeared. After 10 seconds, the presentation automatically began. Participants were shown a dark grey fixation cross which appeared randomly in one of eight positions towards the edges of the screen. Two seconds later, a nude model was presented for 10 seconds in the center of the screen. This was done to create a time to first fixation (TFF) measure, as the nude images always appeared outside

of the participant's center of vision (i.e., stimuli subtended a visual angle >2° from each fixation cross). Following this, another screen appeared with a prompt asking participants to rate their sexual arousal to the previous image (discussed further below). Lastly, participants were prompted to click a button to continue to the next image. This sequence (i.e., fixation cross, nude image, arousal rating) was repeated for all 44 nude images. Presentation of the stimuli was randomized, and all participants saw the stimuli in the same randomized order. Each participant was tested individually, and each session lasted approximately 45 minutes. After the experiment was completed, participants were debriefed and informed of the purpose of the study.

Measures

Subjective Sexual Arousal

Participants were asked, "How sexually arousing do you find this person?" after each image. They responded using a 7-point Likert-like scale that ranged from 1 ("not at all arousing") to 7 ("very arousing").

Viewing Pattern Measures

Automatic visual attention was assessed using time to first fixation (TFF) , whereas controlled visual attention was assessed using total fixation duration (TFD) and total fixation count (TFC).

Regions of Interest

Non-overlapping regions of interest (ROI) were hand-drawn onto each stimulus using Tobii Pro Studio. The exact size and shape of each ROI varied in tandem with each model's body and posture. Using this approach, polygonal ROIs were drawn separately over the face, chest, genitals, and waist-hips area. To assess the degree to which

participants directed their attention away from the stimulus, the background of each image was also designated as an ROI.

Statistical Analyses

Data were exported using Tobii Pro Studio, and statistical analyses were conducted in JASP version 0.16.4. Because subjective arousal was skewed for some stimulus categories, but not others, an omnibus Friedman test and post-hoc Wilcoxon signed-rank tests were used to conduct pairwise comparisons of subjective arousal ratings. To evaluate participants' viewing patterns, we conducted separate 4 (stimulus category) × 5 (ROI) repeated measures analyses of variance (ANOVAs) for TFF, TFD, and TFC. We used follow-up pairwise comparisons with Bonferroni corrections to examine differences in eye-movement patterns across ROIs and stimulus categories. Effect sizes are presented as Cohen's *d*. Whenever the assumption of sphericity was violated, we used the Greenhouse-Geisser correction. To evaluate the degree to which learning effects confounded TFF, we ran a correlational analysis (i.e., Pearson's *r*) using stimulus order and TFF. *P*-values under .005 were treated as significant, whereas *p*-values between .005 and .05 were taken as suggestive evidence (Benjamin et al., 2017).

We conducted *a priori* power analyses using G*Power and determined that for a moderate effect size (i.e., partial $\eta^2 = .06$), optimal statistical power could be achieved with a sample size of 42 (Faul et al., 2007). As such, the present sample (n = 65) exceeded the requirements to optimize statistical power (i.e., $1\text{-}\beta > .99$).

RESULTS

Subjective Arousal

Participants' average (SD) subjective sexual arousal to cisgender females was 5.38 (1.1), to gynandromorphs with breasts was 2.22 (1.31), to gynandromorphs without breasts was 1.57 (0.77), and to cisgender males was 1.71 (1.1). With respect to subjective arousal, the effect of stimulus category was significant, Friedman test, $\chi^2(3, N = 65) = 144.80$, $p < .001$. Wilcoxon's tests revealed that cisgender females were ranked as significantly more arousing than gynandromorphs with breasts, $Z = -6.95$, $p < .001$, $r_{rb} = .9$, gynandromorphs without breasts, $Z = -6.95$, $p < .001$, $r_{rb} = .9$, $p < .001$, and cisgender males, $Z = -7.01$, $p < .001$, $r_{rb} = .9$, $p < .001$. Gynandromorphs with breasts were ranked as more attractive than those without breasts, $Z = -5.17$, $p < .001$, $r_{rb} = .87$, and cisgender males, $Z = -3.73$, $p < .001$, $r_{rb} = .56$. The difference between cisgender males and gynandromorphs without breasts was non-significant, $Z = .27$, $p = .79$. (Figure 3.1).

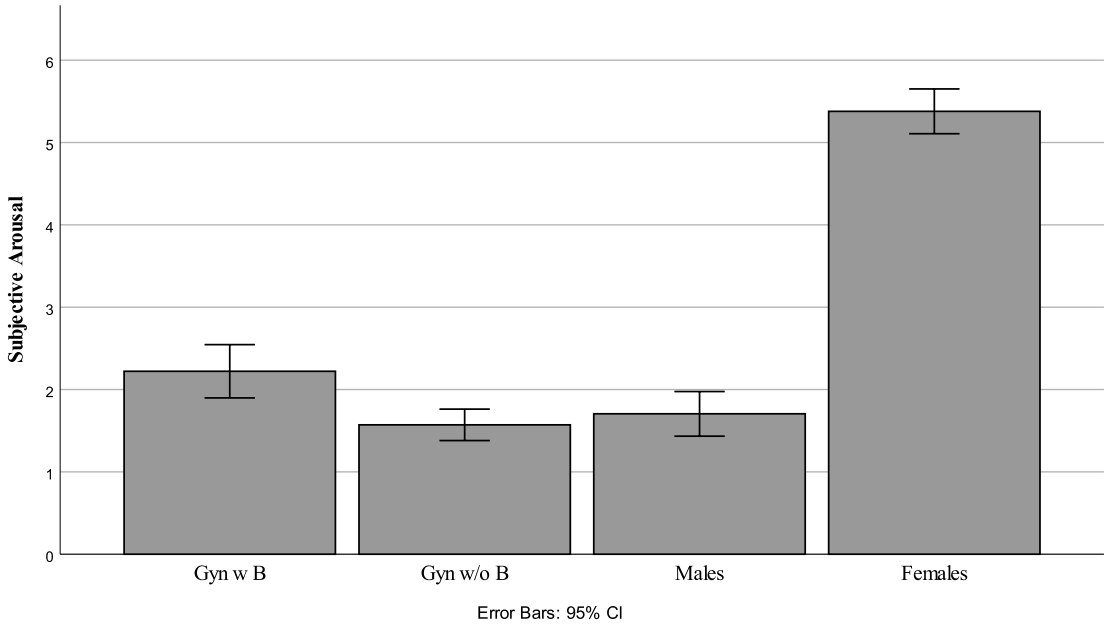

Figure 3.1. Average subjective arousal scores for images of cisgender females, cisgender males, gynandromorphs with breasts (Gyn w B) and gynandromorphs without breasts (Gyn w/o B) (95% CIs).

Time to First Fixation

Regarding TFF, the effect of stimulus category was non-significant, Greenhouse-Geisser corrected $F(3, 177) = 1.12$, $p = .34$, partial $\eta^2 = .02$. However, the effect of ROI was significant, $F(4, 236) = 76.32$, $p < .001$, $\eta^2 = 0.56$, as was the interaction between stimulus category and ROI, Greenhouse-Geisser corrected $F(12, 708) = 8.71$, $p < .001$, $\eta^2 = 0.13$ (Figure 2). Because transitions from fixation cross to sexual stimulus were near instantaneous, it is possible that initial fixations made onto the background ROI were the consequence of participants already attending to that area of the screen, rather than directing their attention away from the stimulus. For this reason, and to improve readability, we did not include the background ROI in figure 3.2.

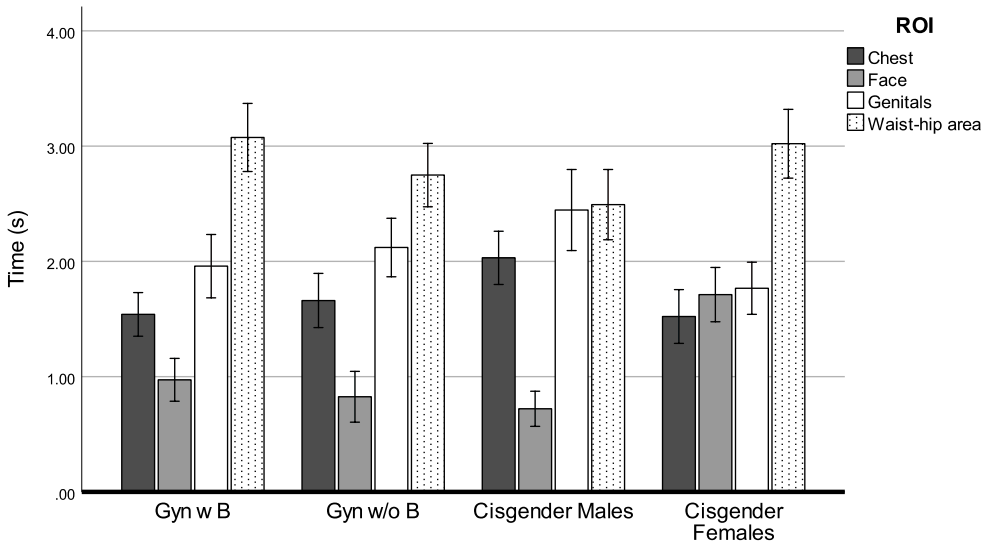

Figure 3.2. Time to first fixation (in seconds) for images of cisgender females, cisgender males, gynandromorphs with breasts (Gyn w B) and gynandromorphs without breasts (Gyn w/o B) (95% CIs).

Within-Target Category Comparisons of ROIs

For images of females, TFF was significantly higher for the waist-hips area than for all other females stimulus ROIs ($d_z \geq 1.25$. all $p < .001$). The remaining comparisons were all non-significant ($p > .999$).

For images of gynandromorphs with breasts, TFF for the face ROI was lower than all other bodily ROIs ($d_z \geq 0.60$, $p \leq .003$). TFF was significantly lower for the background ROI than for the waist-hips ($d_z = 1.77$, $p < .001$). The remaining comparisons were all non-significant ($p > .999$).

For images of gynandromorphs without breasts TFF was significantly lower for the face ROI than for all other ROIs ($d_z \geq 0.83$, all $p < .001$). TFF for the waist-hips ROI was significantly higher than that of all other ROIs ($d_z \geq 0.63$, $p \leq .003$). The remaining comparisons were all non-significant ($p \geq .100$).

For images of cisgender males, TFFs for the face ROI were significantly lower than that of all other bodily ROIs ($d_z \geq 0.39$, all $p > .001$). Similarly, TFF for the background ROI was significantly lower than the chest, genitals and waist-hips ROIs ($d_z \geq 0.900$, all $p < .001$). The remaining comparison was non-significant ($p \geq .100$).

Between-Target Category Comparisons of ROIs

TFF for the face ROI of cisgender female stimuli was significantly higher than all other stimulus categories ($d_z \geq 0.74$, all $p < .001$). TFF for the genitals ROI was higher for cisgender males than it was for cisgender females ($d_z = 0.62$, $p < .001$). There was suggestive evidence that TFF for the backgrounds of gynandromorphs without breasts was lower than that of cisgender males ($d_z = 0.64$, $p = .019$). The remaining comparisons were all non-significant ($p \geq .216$).

Total Fixation Duration

Regarding TFD, there was a significant effect of stimulus category, $F(3, 186) = 32.1$, $p < .001$, $\eta^2 = 0.34$, and ROI, Greenhouse-Geisser corrected $F(1.95, 121.16) = 110.26$, $p < .001$, $\eta^2 = 0.64$. There was also a significant interaction between stimulus category and ROI, Greenhouse-Geisser corrected $F(5.13, 318.12) = 33.2$, $p < .001$, $\eta^2 = 0.35$. Overall, participants spent the most time fixating on the face, regardless of stimulus category (all $p < .001$; Figure 3.3).

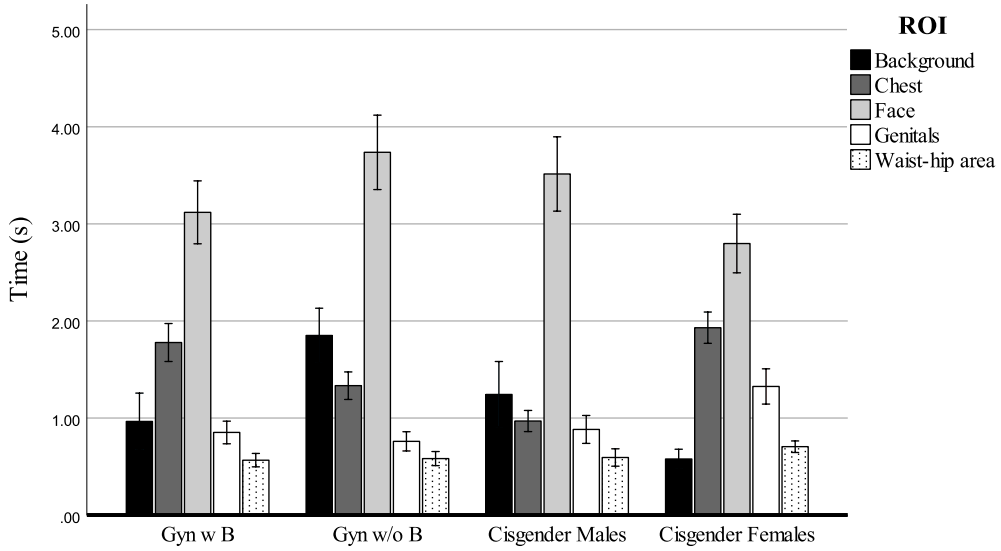

Figure 3.3. Total fixation duration for images of cisgender females, cisgender males, gynandromorphs with breasts (Gyn w B) and gynandromorphs without breasts (Gyn w/o B) (95% CIs).

Within-Target Category Comparisons of ROIs

For images of cisgender females, participants spent the most time fixating on the face, followed by the chest, genitals, background and the waist-hips. While most of these differences were significant ($d_z \geq 0.69$, $p < .001$), time spent fixating on the waist-hips area did not differ significantly from time spent fixating on the background ($p > .999$).

For images of gynandromorphs with breasts, participants spent more time fixating on the face than any other ROI ($d_z \geq 1.45$, all $p > .001$). Participants spent more time fixating on the chest ROI than the background, genitals and waist-hips ROIs ($d_z \geq 0.82$, all $p < .001$). The remaining comparisons were all non-significant ($p \geq .057$).

For images of gynandromorphs without breasts, participants spent more time fixating on the face than any other ROI ($d_z \geq 2.15$, all $p < .001$). TFD for the background ROI was higher than that of the genitals and waist-hips ROIs ($d_z \geq 0.61$, $p \leq .001$). TFD was higher for the chest ROI than for the waist-hips area ($d_z = 0.86$, $p < .001$). The remaining comparisons were non-significant ($p \geq .372$).

For images of cisgender males, participants spent more time fixating on the face ROI than any other ROI ($d_z \geq 2.59$, all $p < .001$). Participants spent more time fixating on the background ROI than on the waist-hips ROI, although this difference was suggestive ($d_z = 0.74$, $p = .020$). The remaining comparisons were all non-significant ($p \geq .999$).

Between-Target Category Comparisons of ROIs

TFDs for the face ROIs of gynandromorphs without breasts and cisgender males were higher than that of gynandromorphs with breasts ($d_z \geq 0.27$, $p \leq .005$), and cisgender females ($d_z \geq 0.82$, $p \leq .005$). The remaining comparison was non-significant ($p \geq .999$).

TFDs for the chest ROIs of gynandromorphs with breasts and cisgender females were significantly higher than that of gynandromorphs without breasts ($d_z \geq 0.72$, both $p < .001$), and cisgender males ($d_z \geq 1.29$, both $p < .001$), but did not differ significantly from one another ($p = .19$). TFD for the chest ROI of gynandromorphs without breasts was higher than that of cisgender males ($d_z = 0.42$, $p < .019$).

TFD for the waist-hips ROI of cisgender females was significantly higher than that of gynandromorphs with breasts ($d_z = 0.51$, $p < .001$) and gynandromorphs without breasts ($d_z = 0.46$, $p = .002$), and suggestively higher than that of cisgender males ($d_z = 0.41$, $p = .008$). The remaining comparisons were all non-significant (all $p > .999$).

TFD for the genital ROI of cisgender female stimuli was significantly higher than that of all other stimulus categories ($d_z \geq 0.51$, all $p < .001$). The remaining comparisons were all non-significant ($p > .999$).

Participants spent significantly less time fixated onto the backgrounds of cisgender females than onto the backgrounds of all other stimulus categories ($d_z \geq 0.39$, $p \leq .005$). TFD for the backgrounds of gynandromorphs without breasts was significantly higher than all other stimulus categories ($d_z \geq 0.47$, all $p < .001$). The remaining comparison was non-significant ($p = .540$).

Total Fixation Count

Regarding TFC, there was a significant effect of stimulus category, Greenhouse-Geisser corrected $F(1.53, 859) = 126.76$, $p < .001$, $\eta^2 = 0.67$, a significant effect of ROI, Greenhouse-Geisser corrected $F(1.63, 104.23) = 20.5$, $p < .001$, $\eta^2 = 0.243$, and a significant interaction effect between stimulus category and ROI, Greenhouse-Geisser corrected $F(3.8, 243.2) = 27.45$, $p < .001$, $\eta^2 = 0.3$. (Figure 3.4).

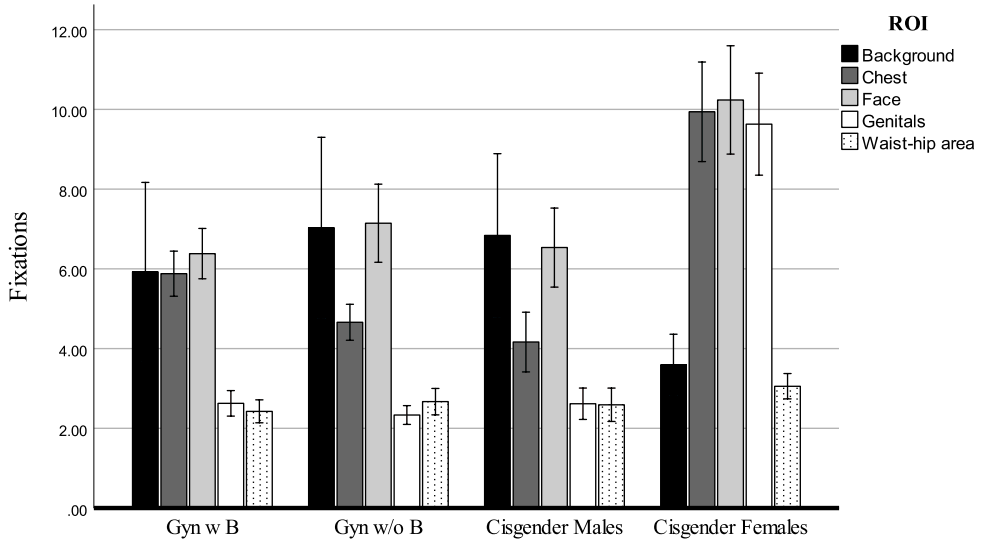

Figure 3.4. Total fixation counts for images of cisgender females, cisgender males, gynandromorphs with breasts (Gyn w B), and gynandromorphs without breasts (Gyn w/o B) (95% CIs).

Within-Target Category Comparisons of ROIs

For cisgender females, TFCs were higher for these chest, face, and genitals than for the background and waist-hip area ROIs ($d_z \geq 1.36$, all $p < .001$). The remaining comparisons were all non-significant (all $p > .999$).

For images of gynandromorphs with breasts, TFCs for the background, face, and chest ROIs were all significantly higher than that of the waist-hips and genital ROIs ($d_z \geq 0.74$, all $p < .001$). The remaining comparisons were all non-significant (all $p > .999$).

For images of gynandromorphs without breasts, TFCs for the face and background ROIs were significantly higher than that of the genitals and waist-hips ROIs ($d_z \geq 0.43$, all $p < .001$). The remaining comparisons were all non-significant ($p \geq .199$).

For images of cisgender males, TFCs for face and background were significantly higher than that of waist-hips and genitals ($d_z \geq 0.88$, $p < .001$). All remaining comparisons were non-significant ($p \geq .334$).

Between-Target Category Comparisons of ROIs

Regarding the face ROI, cisgender female stimuli elicited significantly higher TFCs than all other stimulus categories ($d_z \geq 0.70$, all $p < .001$). The remaining comparisons were all non-significant (all $p < .999$).

Regarding the chest ROI, cisgender female stimuli elicited significantly higher TFCs than all other stimulus categories ($d_z \geq 1.24$, all $p < .001$). The remaining comparisons were all non-significant ($p \geq .186$).

Regarding the waist-hips ROI, there were no significant differences (all $p < .999$).

Regarding the genital ROIs, TFC for cisgender females was significantly higher than all other stimulus categories ($d_z \geq 1.57$, $p < .001$). The remaining comparisons were all non-significant ($p > .999$).

Regarding the background ROI, cisgender female stimuli elicited lower TFCs than gynandromorphs with breasts ($d_z = 0.52$, $p = .002$), gynandromorphs without breasts ($d_z = 0.77$, $p < .001$) and cisgender males ($d_z = 0.73$, $p < .001$). The remaining comparisons were all non-significant ($p \geq .999$).

Learning Effects

It is possible that TFF decreased over time because stimuli always appeared in the same position. To determine the extent to which such an effect may have confounded our results, we ran correlational analyses (Pearson's *r*). Because Tobii Pro Studio cannot export timestamps alongside ROI data, we instead examined the relationship between stimulus order and TFF. Across all stimulus categories and ROIs, there was a weak negative correlation between stimulus order and TFF, $r = -0.07$, $p < .001$, suggesting that participants attended to stimuli somewhat faster over time. However, this effect was small and only accounted for .005% of variance. Analyzing the relationship between stimulus order and TFF within each stimulus category revealed that this effect was statistically suggestive for the viewing patterns of gynandromorphs with breasts, $r = -0.08$, $p = .037$, significant for gynandromorphs without breasts, $r = -0.14$, $p < .001$, but non-significant for the viewing patterns of cisgender males and females ($p \geq .055$). Thus, it is possible that participants attended to gynandromorphic stimuli somewhat faster over time, although this effect appears to be small.

DISCUSSION

The present study examined cisgender gynephilic males' subjective sexual arousal and viewing patterns in response to images of cisgender males, cisgender females, and gynandromorphs with, and without breasts. Regarding subjective sexual arousal, average ratings for cisgender females were significantly higher than average ratings for all other stimulus categories. Gynandromorphs with breasts were rated as significantly more arousing than both cisgender males and gynandromorphs without breasts. However, subjective sexual arousal for gynandromorphs without breasts did not differ from cisgender males. As such, on a subjective level, participants discriminated between individuals with breasts—a female-typical secondary sex trait—and those without breasts.

Our results pertaining to TFF are consistent with past research, insofar as participants generally fixated first on the face regardless of stimulus category (e.g., Hewig et al., 2008; Numenmma et al., 2012). However, when participants were presented with images of cisgender females, they were equally likely to fixate first onto the face, chest or genitals. Given that our stimuli appeared at least 6° away from all fixation crosses, and consequently, outside of the foveal vision area, it is unlikely that participants were able to extract detailed visual information from each stimulus before fixating onto them directly (e.g., Levi, Klein & Aitsebaomo, 1985; Thibos, Cheney, & Walsh, 1987). This suggests that low-level stimulus characteristics (e.g., the presence or lack of a body part in a particular area) extracted from the parafoveal visual area may have affected participants' initial fixation patterns. Although detailed form recognition is generally restricted to the foveal visual area, the acuity of parafoveal and peripheral vision is enhanced when humans can reliably predict where in space a stimulus will appear (reviewed in

Strasburger, Rentschler, & Jüttner, 2011), and when a stimulus is presented in isolation (e.g., Bouma, 1973). Both factors were present in our experiment. Consequently, our data suggest that when assessed outside of the foveal visual area, a model's primary sex-based traits (i.e., genitals) affect men's initial fixation patterns to a greater degree than secondary sex-traits (i.e., breasts, waist-hip ratio) and gender-based traits.

TFDs were significantly higher for the chest ROIs of cisgender females and gynandromorphs with breasts than for cisgender males and gynandromorphs without breasts. Additionally, we found suggestive evidence that participants fixated onto the chests of gynandromorphs without breasts for greater durations than onto the chests of cisgender males. However, this pattern may not necessarily indicate sexual interest, as gynandromorphs without breasts did not differ from cisgender males in terms of the subjective sexual arousal they elicited. Moreover, participants fixated onto the backgrounds of gynandromorphs without breasts for significantly greater durations than all other stimulus categories. It is possible that this pattern reflects participants' attempts to identify the models' sex. When processing stimuli that are ambiguous relative to population norms (e.g., incongruencies between an individual's male-typical/female-typical characteristics), initial fixations may contribute to the generation of first hypotheses, whereas prolonged fixations contribute to hypothesis verification (Kietzmann & König, 2015). In other words, participants may have fixated onto the chests of gynandromorphs without breasts in order to classify the stimulus, as opposed to being motivated by sexual interest. More research is needed, however, to determine the degree to which gynephilic males perceive gynandromorphic stimuli as ambiguous.

TFCs for the chest, face and genital ROIs of cisgender female stimuli did not differ significantly from one another. Participants viewed these regions more frequently

than they viewed the background and waist hips of cisgender female stimuli. Furthermore, participants viewed the backgrounds of gynandromorphic and cisgender male stimuli more frequently than the backgrounds of cisgender females. Moreover, there were no significant differences in the patterning of TFCs for gynandromorphs with breasts, gynandromorphs without breasts, and cisgender male stimuli. Thus, for this measure, viewing patterns elicited by gynandromorphic and cisgender male stimuli were homogenous.

Participants tended to direct their gaze to the models' waist and hip less than other regions. This was surprising given that the waist-to-hip ratio (WHR) is considered an important indicator of sexual attractiveness to gynephilic males (Singh, 1993; Singh et al., 2010). However, while WHRs certainly affect viewing patterns (e.g., Pazhoohi et al., 2020), gynephilic males do not fixate directly onto the waist-hips area for relatively prolonged durations when evaluating the sexual attractiveness of cisgender female stimuli (Cornelissen et al., 2009; Hall, Hogue, and Guo, 2011; Numenma et al., 2012). Singh (1993) proposed that WHRs may serve as a "first pass filter" when men rate the attractiveness of female stimuli. Consistent with this idea, Dixson et al. (2011) found that men exhibited brief fixations (<150ms) onto the waist-hips area during the first 200ms of viewing stimuli depicting nude females. Over the rest of the stimulus presentation, however, face and chest ROIs accumulated the highest TFCs and TFDs. Hence, while it is likely that the WHRs of our stimuli influenced participants' sexual arousal, this process may not be associated with prolonged fixations on the waist-hip region.

We predicted that that across all measures of visual attention, the viewing patterns elicited by gynandromorphic stimuli as assessed across each ROI would be shifted in an intermediate manner away from that of cisgender male stimuli, and towards those of

cisgender female stimuli. In general, these predictions did not hold. Although the viewing patterns elicited by gynandromorphic stimuli differed with respect to some ROIs (e.g., TFD for the chests of gynandromorphs with breasts), they were largely homogenous with those of cisgender male stimuli. This was true regarding measures of both automatic (i.e., TFF) and consciously-directed (i.e., TFD, TFC) attention. Given that our stimuli were nude, the obvious presence of gynandromorphs' penises may have contributed to avoidant eye-movements, as evidenced by relatively greater average TFDs and TFCs for the backgrounds of stimuli depicting gynandromorphs with and without breasts, and cisgender males. Men who pursue sexual relationships with gynandromorphs often report a preference for overt femininity, and during these types of sexual interactions, some men avoid direct contact with gynandromorphs' penises (Kulick, 1997; Operario et al., 2008; Reback & Larkins, 2006; Rosenthal, Hsu, & Bailey, 2017; Hsu et al., 2017; Mitsuhashi, 2006). Consequently, the use of nude gynandromorphic stimuli may be somewhat aversive, due to the salience of the models' male genitals. In naturalistic contexts, gynandromorphs are often perceived to present themselves in a hyper-feminine manner (Gerico, 2015; Operario et al., 2008; Reback & Larkins, 2006). As such, it is possible that images of partially clothed gynandromorphs may be more effective than fully nude images at eliciting sexual arousal from gynephilic males.

Overall, these data suggest that if gynephilic males have a capacity to experience gynandromorphophilic patterns of sexual attraction and arousal, this capacity may be predominantly based on gynomorphic traits rather than purely gendered characteristics. However, this conclusion remains paradoxical when one considers that in many cultures, sexual interactions between gynandromorphs without breasts and gynephilic males are not infrequent (Petterson & Vasey, 2022). Consequently, additional behavioural qualities,

beyond feminine gender role presentation and breast augmentation, may motivate gynephilic men to pursue sexual relationships with gynandromorphs (e.g., Operario et al., 2008; Reback & Larkins, 2006). Future research is needed to ascertain whether typical gynephilic males have the capacity to experience sexual arousal and attraction to stimuli depicting gynandromorphs without breasts when they are accompanied by behavioural cues.

LIMITATIONS

This study shares the same recruitment limitations listed in chapter 2, as these data were collected from the same sample of gynephilic men.

CHAPTER 4 - DISCUSSION

In Chapter 1, I described the phylogenetically and cross-culturally ubiquitous nature of same-sex sexual behaviour. Thereafter, I described the two most common forms of exclusive same-sex sexual attraction in human males (i.e., cisgender and transgender male androphilia). Additionally, I discussed sexual attraction and arousal to gynandromorphs (i.e., gynandromorphophilia), and addressed a recent hypothesis which posits that gynandromorphophilia may reflect an overall heightened attraction to femininity, which may be expressed to a greater degree under certain sociocultural conditions (Petterson & Vasey, 2021b). I used a physiological measure of sexual arousal (Chapter 2), and a cognitive-behavioural measure of sexual attraction (Chapter 3) to further test a prediction derived from this hypothesis: that gynephilic males should exhibit

sexual attraction and arousal to gynandromorphic stimuli that is intermediate to their sexual attraction and arousal to cisgender male and female stimuli.

In Chapter 2, I found that gynandromorphic stimuli elicited levels of pupil dilation that were similar to the pupil dilation elicited by cisgender male stimuli. Similarly, Chapter 3 demonstrated that viewing patterns in response to gynandromorphic and cisgender male stimuli were for the most part homogenous. However, I did find statistically significant evidence that gynandromorphs *with* breasts elicited greater levels of subjective sexual arousal and pupil dilation, and relatively more visual attention to the chest area (i.e., breasts) than did images of cisgender males. Taken in isolation, this suggests that if gynandromorphophilic potential does indeed characterize male gynephiles, this capacity may only extend to gynandromorphs with breasts. However, this interpretation cannot account for the cross-cultural ubiquity of sexual activity involving gynephilic males and gynandromorphs, given that few gynandromorphs actually augment their breasts (Petterson & Vasey, 2022).

Sociocultural Environments

Evolutionary theory predicts that most males will be sexually attracted to reproductively viable females, because in the absence of reproduction evolution cannot occur (Symons, 1995). Consequently, the mechanisms underpinning male gynephilia should have been under strong selective pressure. In keeping with this logic, most males exhibit a sexual *preference* for females, regardless of cultural context (Rahman et al., 2019). However, sexual *aversion* to less-preferred partners (i.e., males) might have been under less intense selective pressure, provided that sexual activity of this nature does not interfere with reproduction. If sexual aversion to same-sex partners is under less selective

pressure than sexual preference for opposite-sex partners, then it is possible that the former is more susceptible to sociocultural influences (Petterson et al., 2016). Consistent with this reasoning, the frequency of sexual activity involving gynandromorphs and gynephilic males appears to be elevated in some cultures (e.g., Petterson et al., 2016; Petterson & Vasey, 2021b; Whitam, 1992; Niven et al., 2018; Murray, 1995; Rodriguez, 1996), but attenuated in others (e.g., Petterson & Vasey, 2021a; Scheim & Bauer, 2017; Bailey, 2003).

What sociocultural factors might account for this cross-cultural variation? Petterson & Vasey (2022) suggested that men may be more likely to engage in sexual activity with gynandromorphs if they develop in an environment where androphilic gynandromorphs are prevalent. Consistent with this hypothesis, in many non-Western cultures, the transgender form of male androphilia predominates (Murray, 1995) and sexual activity between gynephlic men and gynandromorphs is relatively common (e.g., Whitam, 1992; Petterson & Vasey, 2021b; Niven et al., 2018). In contrast, in the West, where androphilic males tend to be cisgender (Whitam, 1983), gynandromorphophilia is relatively uncommon (e.g., Petterson & Vasey, 2021a; Scheim & Bauer, 2017). Thus, in cultures where androphilic males present in a feminine manner, sexual activity between gynephilic men who desire feminine sexual partners and gynandromorphs is more common. In contrast, in cultures where androphilic males present in a relatively masculine manner, gynephilic men's sexual contact with androphilic gynandromorphs is relatively uncommon owing, at least in part, to their extremely low prevalence in such populations.

Access to female sexual partners may also influence the degree to which gynephilic men engage in sexual activity with gynandromorphs. The frequencies of

opposite-sex sexual interactions, and relatedly, the willingness of females to engage in sexual activity also varies substantially across cultures (Wellings et al., 2006; Schmitt, 2005). Consequently, in some cultures it is easier for gynephilic males to successfully initiate sexual interactions with females than it is in others. The relative ease with which gynephilic males can access female sexual partners likely influences the expression of gynandromorphophilia, as some gynephilic males may pursue sexual relationships with gynandromorphs because they are unable to obtain female mates (e.g., Reback, Larkins, & Clark, 2019; Rodriguez, 1996; Whitam, 1992; Whitam, 1983; Cardoso, 2013). In the Philippines, for instance, sexual relationships involving cisgender males and females are constrained by economic facts, as the latter often rely on marriage to escape poverty (Rodriguez, 1996). Moreover, it is common for Filipino cisgender females to preserve their virginity until they are courted by affluent men (Whitam, 1992). Because of this, many Filipino gynephilic males struggle to acquire female sexual partners, and instead initiate sexual relationships with gynandromorphs (i.e., the *bayot*) to offset the frustration of not actualizing their sexual desires.

Economic factors may also incentivize gynephilic males to initiate sexual interactions with gynandromorphs from whom they can obtain resources. For instance, sexual interactions with the *bayot* afford Filipino gynephilic males the opportunity to earn resources such as money, clothing, alcohol, and even career advancement (Whitam, 1992; Rodriguez, 1996). As a consequence, sexual activity of this nature has been institutionalized into a complex and extensive network of sexual and social relations and is known in the Philippines as the *callboy* system. It has been estimated that up to 90 percent of gynephilic males in the Philippines have at some point been paid for sex work involving the *bayot* (Whitam, 1992). Similar cases wherein resource-based incentives

motivate gynephilic males to seek out sexual relationships with gynandromorphs have been described in Timor-Leste, Laos, South Africa, Brazil, and the Istmo region of Oaxaca, Mexico (Niven et al., 2018; Kulick, 1997; Mirandé, 2017; Masvawure et al., 2015).

Overall, gynandromorphophilic preferences appear to be expressed and actualized more frequently under certain sociocultural conditions. To some extent, the manner in which male androphilia is expressed, relative access to female sexual partners, and economic pressure may account for variation in the expression of gynandromorphophilia. However, these variables may not fully account for *within-culture* variation. Indeed, even in cultures such as Samoa and the Philippines, where sexual interactions between gynandromorphs and gynephilic males appear to be relatively frequent, many males exhibit exclusive gynephilia (Petterson et al., 2016; Petterson & Vasey, 2021a; Whitam, 1992). This raises an important question: do gynandromorphophilic men differ from exclusively gynephilic men?

Personality and Gynandromorphophilia

Personality refers to the set of psychobiological mechanisms within an individual that influences their interactions with social and physical environments (Larsen and Buss, 2005). Personalities are largely heritable and vary interpersonally (Vukasović & Bratko, 2015). Throughout the literature, myriad personality characteristics have been isolated and validated by traditional psychometric standards. The most commonly accepted and empirically supported framework of personality trait structure, however, is the Five-Factor Model (FFM) (McCrae & John, 1992). In this model, five trait dimensions subsume a number of specific trait facets (Costa & McCrae, 2017). The dimensions are

openness (the tendency to seek out novel experiences), *conscientiousness* (organization and goal-directed behaviour), *extraversion* (the quantity and intensity of interpersonal interactions), *agreeableness* (the concern for cooperation and social harmony), and *neuroticism* (the degree to which someone is prone to emotional instability). The FFM has been validated across different age groups, languages, and cultures (Allik et al., 2017; Caspi et al., 2005; Schmitt, 2008).

FFM traits are significantly correlated with many aspects of sexual behaviour and may offer insight into the *within-culture* variance seen in gynephilic males' willingness to pursue sexual interactions with gynandromorphs (Allen & Walter, 2018). That is, gynephilic males with certain personality trait configurations may be more likely than others to seek out sexual activity with gynandromorphs. For instance, openness and extraversion are both negatively correlated with homophobic attitudes, and positively correlated with one's lifetime number of sexual partners and range of sexual experiences (Allen & Walter, 2018; Costa et al. 2015; Paunonen, 2003). In parallel, recent quantitative scholarship suggests that Western gynandromorphophilic men acquire relatively more sexual partners throughout their lives, and exhibit an elevated interest in unusual, or paraphilic sexual behaviour (Hsu et al., 2016; Rosenthal, Hsu, & Bailey, 2017). Thus, it is possible that gynandromorphophilic males are characterized by relatively greater levels of openness and extraversion.

For instance, extraverts tend to spend more time at bars and clubs, and consume relatively more alcohol (Matz & Harari, 2021; Paunonen, 2003). Past research demonstrates that bar and night club settings often facilitate sexual interactions between gynephilic males and gynandromorphs (Weinberg & Williams, 2010; Mitsuhashi, 2006; Operario et al., 2008). It is likely that the psychological and physiological effects of

alcohol consumption are causally relevant to this phenomenon. Alcohol has substantial effects on sexual behaviour and functioning, such as increasing one's willingness to engage in sexual activity, elevating subjective sexual arousal, and impairing one's ability to inhibit sexual feelings (reviewed in Markos, 2005; Sheldon-Scott et al., 2016; George & Stoner, 2000). These effects may occur even when an individual consumes a non-alcoholic beverage, but believes that their drink contains alcohol (e.g., Lang et al., 1980). Thus, if highly extraverted gynephilic males are biased towards spending time at bars and consuming alcohol, it is possible that such individuals will be more likely to engage in sexual activity with gynandromorphs.

Additionally, openness and extraversion are both negatively correlated with the tendency to *conform* (i.e., to match one's behaviour to the responses of others; Deyoung, Peterson, & Higgins, 2002). As such, it is possible that gynephilic males who report elevated levels of openness and extraversion may be especially resistant to social proscriptions, which, in many cultures, forbid sexual relations with same-sex partners (Poushter & Kent, 2020). For instance, the social status of gynandromorphs is very low in certain Indian cultures, and consequently, sexual relationships between such individuals and gynephilic males are often met with social stigma (Khan et al., 2009). Nonetheless, sexual activity of this nature occurs (e.g., Stief, 2017), suggesting that certain Indian gynandromorphophilic males are willing to deviate from social norms to actualize their sexual preferences.

Personality measures validated outside of the FFM may also be relevant to gynephilic males' willingness to pursue sexual relations with gynandromorphs. *Sexual curiosity* (i.e., one's level of curiosity towards sexual acts), which draws parallels with the FFM trait openness, is associated with bisexual patterns of sexual arousal in males

(Rieger et al., 2013). Given that gynandromorphophilic males are more likely than non-gynandromorphophilic males to identify as bisexual (Hsu et al., 2016; Rosenthal, Hsu, & Bailey, 2017), it is possible that gynephilic males who report high levels of sexual curiosity may be more likely to pursue sexual relationships with gynandromorphs who exhibit both male-typical and female-typical phenotypic traits. Indeed, qualitative research suggests that curiosity motivates some gynephilic males to seek out feminine same-sex sexual partners (e.g., Reback & Larkins, 2010; Reback, Larkins, & Clark, 2019; Operario et al., 2008).

Because gynandromorphophilic men appear to be predominantly gynephilic in terms of their genital arousal (e.g., Hsu et al., 2016; Rosenthal, Hsu, & Miller, 2017; Operario et al., 2008), and sexual interactions with gynandromorphs involve being in close proximity with male genitals (i.e., a less-preferred and possibly aversive morphological trait), gynandromorphophilic males may also be characterized by relatively low levels of *sexual disgust sensitivity*. Some evolutionists theorize that sexual disgust deters humans from engaging in sexual behaviour with individuals who exhibit low reproductive viability (Tybur et al., 2009). As such, gynephilic males who score high in sexual disgust sensitivity may be less likely to engage in sexual activity with gynandromorphs.

Lastly, inter-individual differences in masculinity-femininity may account for some variation in gynephilic males' willingness to pursue sexual relations with gynandromorphs. There is ample evidence to suggest that an individual's masculinity-femininity is related to sexual strategizing (e.g., Cunningham & Russell, 2004; Ostovich & Sabini, 2004; Mikach & Bailey, 1999). For example, compared to ordinarily masculine gynephilic males, relatively feminine gynephilic males place less value on the physical

appearance of their sexual partners (Cunningham & Russell, 2004). Male masculinity is positively associated with homophobia (Parrott, Adams, & Zeichner, 2002; Barron et al., 2008), and inversely, the adherence to traditional male gender roles is statistically predicted by homophobia and transphobia (Krulewitz & Nash, 1980; Patel et al., 1995; Costa & Davies, 2012). Because gynandromorphophilic males tend to report greater levels of femininity than exclusively gynephilic males (Rosenthal, Hsu, & Bailey, 2017), it is possible that relatively masculine gynephilic males are less likely to pursue sexual relationships with gynandromorphs.

In summary, some gynephilic males are more likely to exhibit and actualize gynandromorphophilic preferences than others. Although past research would suggest that personality characteristics such as FFM traits, sexual curiosity, sexual disgust sensitivity and masculinity/femininity may account for some variance in this aspect of male sexual behaviour, the link between personality and gynandromorphophilia has yet to be demonstrated within a quantitative framework.

As I have noted, many gynandromorphophilic males report that they are primarily sexually attracted to femininity (Kulick, 1997; Operario et al., 2008; Reback & Larkins, 2006; Rosenthal et al., 2017; Mitsuhashi, 2006; Reback & Larkins, 2019; Reback et al., 2016). For instance, many gynephilic males seek out sexual interactions with gynandromorphs who pass for cisgender females (Reback & Larkins, 2006). However, the empirical chapters of this thesis suggest that for typical gynephilic men, visible cues of gender-based femininity (e.g., hairstyle, posture, makeup) may not be sufficient in eliciting sexual attraction and arousal. This raises another important question: aside from visible feminine cues, do gynandromorphs exhibit other characteristics that are sexually attractive to gynephilic men?

Behavioural Characteristics

Across species, the sex that invests less in offspring tends to show a greater eagerness to engage in mating behaviours (Trivers, 1972). Consistent with this, humans generally exhibit a sex difference with regard to *sociosexuality* (i.e., the willingness to engage in sexual activity outside of committed relationships; Schmitt, 2005). Males tend to exhibit relatively *unrestricted* sociosexualities, which are characterized by more positive attitudes towards casual sex, and the tendency seek short-term sexual relationships (reviewed in Baumeister, Catanese, & Vohs, 2001). By comparison, the sociosexualities of females tend to be relatively *restricted*, and are characterized by a greater desire for stable, long-term sexual relationships. Although androphilic males tend to be relatively feminine with respect to certain psychological characteristics (e.g., occupational interests: Lippa, 2005; Lippa, 2007), gynephilic and androphilic males generally to exhibit similarly unrestricted sociosexualities (Schmitt, 2007). It is possible that this overlap in male sociosexuality may contribute to sexual interactions between gynephilic males and gynandromorphs.

Many gynandromorphophilic men report that courting gynandromorphs feels easy and uncomplicated (Weinberg & Williams, 2010; Reback, Larkins, & Clark, 2019; Prestursteun, 2014). This is, in part, because gynandromorphs are perceived to exhibit male-typical sexual proceptivity (Kublick, 1997; Weinberg & Williams, 2019; Reback, Larkins, & Clark, 2019). Sexual proceptivity is characterized by attempts to initiate or encourage further sexual interaction with the intended partner, and is generally attractive to gynephilic males (Givens, 1978; Clark, 2008). In keeping, gynandromorphophilic males frequently cite the sexual proceptivity of gynandromorphs as especially attractive (e.g., Weinberg & Williams, 2010). It is not uncommon for these males to receive

flattery, flirtatious comments, and physical contact from gynandromorphs in a bar or club setting that they typically would not receive from cisgender females. Moreover, gynandromorphs are often perceived to be more interested in sexual activity that is free of intimacy, attachment, and obligation (i.e., behaviour that is characteristic of individuals with unrestricted sociosexualities; Reback, Larkins, & Clark, 2019). Thus, it is possible that gynephilic males and gynandromorphs share similarities with regard to the patterning of their mating strategies, which in turn, may facilitate sexual interactions of this nature. It is worth noting that much of this research has focused on the perspective of gynandromorphophilic males, rather than measuring the sexual preferences of gynandromorphs directly.

Some gynandromorphophilic males report that they perceive gynandromorphs to be male-typical with regard to their sexual openness, as the latter are more willing to engage in unusual or extreme sexual activity (Reback, Larkins, & Clark, 2019). For example, gynandromorphophilic men tend to be relatively more interested in paraphilic sexual behaviour, such as masochism, fetishism and sadism (Rosenthal, Hsu, & Bailey, 2017). Additionally, many gynandromorphophilic males cite the innate novelty of a gynandromorphic sexual partner as a key motivator (e.g., Operario et al., 2008). To these males, the combination of masculine and feminine traits reflects a uniqueness that cannot be found in cisgender female sexual partners. Thus, in terms of both their physical and psychological characteristics, gynandromorphs are perceived as an avenue by which gynephilic males can actualize their unconventional sexual preferences.

Conclusions

Past scholarship suggests that the capacity for gynandromorphophilic patterns of sexual attraction and arousal may characterize all gynephilic males. This thesis furnishes

two additional studies on Western gynephilic males' sexual interest in gynandromorphic stimuli. The present findings demonstrated that participants responded maximally to images of cisgender females, followed by images of gynandromorphs with breasts, gynandromorphs without breasts, and cisgender males. However, participants only appeared to discriminate between gynandromorphic and cisgender male stimuli when the former had breasts, a female-typical secondary *sex* trait.

Given that sexual activity involving gynephilic males and gynandromorphs appears to be cross-culturally widespread and few gynandromorphs augment their breasts, it is possible that gynandromorphs exhibit behavioural characteristics, such as increased proceptivity, that are attractive to certain gynephilic males. Furthermore, individual-level characteristics such as personality traits (e.g., openness to experience) may account for some of the within-culture variation seen in the expression of gynandromorphophilia. At present, there have been few attempts to measure and compare the personality characteristics of gynandromorphophilic males to those of exclusively gynephilic males.

This thesis also adds to the evidence that the patterning of gynephilic males' sexual attraction and arousal varies continuously along a stimulus generalization gradient, rather than categorically (Blanchard et al., 2012), as feminine sexual stimuli which contained male-typical primary sex-based characteristics elicited some, albeit low, sexual arousal. As such, further study of gynandromorphophilia may yield further valuable insights into the fundamental mechanisms of male gynephilia.

REFERENCES

Allen, M.S., & Walter, E.E. (2018). Linking big five personality traits to sexuality and sexual health: A meta-analytical review. *Psychological Bulletin, 144*(10), 1081–1110.

Allik, J., Church, A.T., Ortiz, F.A., Rossier, J., Hrebírková, M., De Fruyt, F., Realo, A., & McCrae, R.R. (2017). Mean profiles of the NEO Personality Inventory. Journal of Cross-cultural Psychology, 48 (3), 402–420. https://doi.org/10.1177/0022022117692100

Attard-Johnson, J., Bindemann, M. & Ó Ciardha, C. (2016). Pupillary response as an age-specific measure of sexual interest. *Archives of Sexual Behavior, 45,* 855–870. https://doi.org/10.1007/s10508-015-0681-3

Attard-Johnson, J., Vasilev, M. R., Ó Ciardha, C., Bindemann, M., & Babchishin, K. M. (2021). Measurement of sexual Interests with pupillary responses: A meta-analysis. *Archives of sexual behavior*, *50*(8), 3385–3411. https://doi.org/10.1007/s10508-021-02137-y

Bagemihl, B. (1999). *Biological exuberance: animal homosexuality and natural diversity.* New York: St. Martin's Press.

Bailey, J.M. (2003). *The man who would be queen: The science of gender-bending and transsexualism*. Joseph Henry Press.

Bailey, J.M., Pillard, R.C., Dawood, K., Miller, M.B., Farrer, L.A., Trivedi, S., & Murphy, R.L. (1999). A family history study of male sexual orientation using three independent samples. *Behavior Genetics, 29*, 79–86.

Bailey, J.M., & Zucker, K.J. (1995). Childhood sex-typed behavior and sexual orientation: A conceptual analysis and quantitative review. Developmental Psychology, 31(1), 43–55. http://dx.doi.org/10.1037/0012-1649.31.1.43

Bailey, N.W., and Zuk, M. (2009). Same-sex sexual behaviour and evolution. *Trends in Ecology and Evolution*, 24(8), 439–446.

Baumeister, R.F., Catanese, K.R., & Vohs, K.D. (2001). Is there a gender difference in strength of sex drive? Theoretical views, conceptual distinctions, and a review of relevant evidence. *Personality and Social Psychology Review, 5*(3), 242–275. DOI: 10.1207/S15327957PSPR0503_5

Barron, J.M., Struckman-Johnson, C., Quevillon, R., & Banka, S.R. (2008). Heterosexual men's attitudes toward gay men: A hierarchical model including masculinity, openness, and theoretical explanations. *Psychology of Men & Masculinity, 9*(3), 154–166. https://doi.org/10.1037/1524-9220.9.3.154

Bartlett, N. H., & Vasey, P. L. (2007). A retrospective study of childhood gender-atypical behavior in Samoan fa'afafine. *Archives of Sexual Behavior, 35*, 559–566.

Benjamin D.J., Berger, J.O., Johansson, M., et al. (2017). Redefining statistical significance. *Nature Human Behaviour, 2*, 6–10. DOI: https://doi.org/10.1080/00031305.2018.1543135

Blanchard, R. (1985). Typology of male-to-female transsexualism. *Archives of Sexual Behavior, 14,* 247–261.

Blanchard, R. (2004). Quantitative and theoretical relationship between older brothers and homosexuality in men. *Journal of Theoretical Biology, 230(2)*, 173–187. http://dx.doi.org/ 10.1016/j.jtbi.2004.04.021 Medline:15302549

Blanchard, R., & Collins, P. I. (1993). Men with sexual interest in transvestites, transsexuals, and she-males. *Journal of Nervous and Mental Disease*, *181*(9), 570–575. https://doi.org/10.1097/00005053- 199309000-00008

Blanchard, R., Kuban, M.E., Blak, T., Klassen P.E., Dickey, R. & Cantor, J.M. (2012). Sexual attraction to others: A comparison of two models of alloerotic responding in men. *Archives of Sexual Behavior*, *41*, 13–29.

Blanchard, R., & Lippa, R.A. (2007). Birth order, sibling sex ratio, handedness, and sexual orientation of male and female participants in a BBC internet research project. *Archives of Sexual Behavior, 36(2),* 163–176. http://dx.doi.org/10.1007/s10508-006- 9159-7 Medline:17345165

Bouma, H. (1973). Visual interference in the parafoveal recognition of initial and final letters of words. *Vision Research, 13*(4), 767–782. DOI: 10.1016/0042-6989(73)90041-2

Bradley, M.M., Miccoli, L., Escrig, M.A., and Lang, P.J. (2008). The pupil as a measure of emotional arousal and autonomic activation. *Psychophysiology*, *45*, 602–607. DOI: 10.1111/j.1469-8986.2008.00654.x

Cardoso, F.L. (2013). The relationship between sexual orientation and gender identification among males in a cross-cultural analysis in Brazil, Turkey and Thailand. *Sexuality and Culture, 17*, 568–597.

Caspi, A., Roberts, B. W., & Shiner, R. L. (2005). Personality development: Stability and change. *Annual Review of Psychology, 56*(1), 453–484. https://doi.org/10.1146/annurev.psych.55.090902.141913

Chivers, M.L., Rieger, G., Latty, E., & Bailey, J.M. (2004). A sex difference in the specificity of sexual arousal. *Psychological Science 15*, 736–744.

Clark, A.P. (2008). Attracting interest: Dynamic displays of proceptivity increase the attractiveness of men and women. *Evolutionary Psychology, 6*(4), 563–574.

Connellan, J., Baron-Cohen, S., Wheelwright, S., Batki, A., & Ahluwalia, J. (2000). Sex differences in human neonatal social perceptions. Infant Behavioral Development, 23, 113–118. DOI: https://doi.org/10.1016/S0163-6383(00)00032-1

Cornelissen, P.L., Hancock, P.J.B., Kiviniemi, V., George, H.R., and Tovée, M.J. (2009). Patterns of eye movements when male and female observers judge female attractiveness body fat, and waist-to-hip ratio. *Evolution and Human Behaviour*, *30* (6), 417–428. DOI: https://psycnet.apa.org/doi/10.1016/j.evolhumbehav.2009.04.003

Costa, P.A., & Davies, M. (2012) Portuguese adolescents' attitudes toward sexual minorities: transphobia, homophobia, and gender role beliefs. *Journal of Homosexuality*, 59(10), 1424–1442, DOI: 10.1080/00918369.2012.724944

Costa, P.T. Jr, Fagan, P.J., Piedmont, R.L., Ponticas, Y., & Wise, T.N. (1992). The five-factor model of personality and sexual functioning in outpatient men and women. *Psychiatric Medicine*, *10*(2), 199–215. PMID: 1615160

Costa, P.T., & McCrae, R.R. (2017). The NEO inventories as instruments of psychological theory. In T. A. Widiger (Ed.), The Oxford handbook of the five factor model (pp. 11–37). Oxford University Press.

Cunningham, S. J., & Russell, P. A. (2004). The influence of gender roles on evolved partner preferences. *Sexualities, Evolution & Gender, 6*(2-3), 131–150. doi:10.1080/14616660412331332909

Dawson, S.J., & Chivers, M.L. (2018) The effect of static versus dynamic stimuli on visual processing of sexual cues in androphilic women and gynephilic men. *Royal Society Open Science,* **5**: 172286. DOI: http://dx.doi.org/10.1098/rsos.172286

Degtyar, A., George, P. E., Mallma, P., Díaz, D. A., Cárcamo, C., García, P. J., . . . Bayer, A. M. (2018). Sexual risk, behavior, and HIV testing and status among male and transgender women sex workers and their clients in Lima, Peru. *International Journal of Sexual Health*, *30*(1), 81–91. https://doi.org/10.1080/19317611.2018.1429514

DeYoung, C.G., Peterson, J.B., & Higgins, D.M. (2002) Higher-order factors of the Big Five predict conformity: Are there neuroses of health? *Personality and Individual Differences*, *33*(4), 533–552. DOI: https://doi.org/10.1016/S0191-8869(01)00171-4.

Dixson, B.J., Grimshaw, G.M., Linklater, W.L., & Dixson, A. (2011) Eye-tracking of men's preferences for waist-to-hip ratio and breast size of women. *Archives of Sexual Behaviour, 40*, 43–50. https://doi.org/10.1007/s10508-009-9523-5

Fay, R.E., Turner, C.F., Klassen, A.D., and Gagnon, J.H. (1989). Prevalence and patterns of same-gender sexual contact among men. *Science*, *243*, 338–48.

Fromberger, P., Jordan, K., von Herder, J., Steinkrauss, H., Nemetschek, R., Stolpmann, G., & Müller, J. L. (2012). Initial orienting towards sexually relevant stimuli: Preliminary evidence from eye movement measures. *Archives of Sexual Behavior*, 41, 919–928. doi:10.1007/s10508-011- 9816-3

George, W.H., & Stoner, S.A. (2000) Understanding acute alcohol effects on sexual behavior. *Annual Review of Sex Research, 11*(1), 92–124, DOI: 10.1080/10532528.2000.10559785

Gerico, H. (2015). *Looking for that "special" lady: Exploring hegemonic masculinity in online dating profiles of trans-attracted men*. (Unpublished Master's Thesis). Central European University.

Gayton, A. H. (1948a). Yokuts and Western mono ethnography. *Anthropological Records, 10*(1), i-x, 1–140.

Givens, D. B. (1978). The nonverbal basis of attraction: Flirtation, courtship, and seduction. *Psychiatry*, *41*, 346–359.

Glick, S.N., Morris, M., Foxman, B., Aral, S.O., Manhart, L.E., Holmes, K.K., Golden, M.R. (2012), A comparison of sexual behavior patterns among men who have sex with men and heterosexual men and women. *Journal of Acquired Immune Deficiency Syndromes*, *60(1)*, 83–90. DOI: 10.1097/QAI.0b013e318247925e

Goméz Jiménez, F.R., Court, L., & Vasey, P.L. (2021). Occupational preferences and recalled childhood sex-atypical behavior among Istmo Zapotec men, women, and *muxes. Human Nature*, *32,* 729–747.

Gómez, F.R., Semenyna, S.W., Court, L., & Vasey, P.L. (2017). Recalled separation anxiety in childhood in Istmo Zapotec men, women, and *muxes. Archives of Sexual Behaviour, 46*(1), 109–117 DOI: 10.1007/s10508-016-0917-x

Gómez-Jiménez, F.R. & Vasey, P. L. (2021). *Muxes*. In A. Goldberg & G. Beemyn (eds.), *The SAGE encyclopedia of trans studies, Vol. 2* (pp. 556–558). Thousand Oaks, CA: SAGE Publications.

Hall, C., Hogue, T., & Guo, K. (2011) Differential gaze behavior towards sexually preferred and non-preferred human figures. *The Journal of Sex Research, 48*(5), 461–469. DOI: 10.1080/00224499.2010.521899

Hames, R., Garfield, Z., and Garfield, M. (2017). Is male androphilia a context-dependent cross-cultural universal? *Archives of Sexual Behaviour, 46*, 63–71.

Henrich, J., Heine, S.J., & Norenzayan, A. (2010) The weirdest people in the world? *Behavioral and Brain Sciences*, *33,61–83.* https://doi.org/10.1017/S0140525X0999152X

Hess, E.H., & Polt, J. M. (1960). Pupil size as related to interest value of visual stimuli. *Science, 132,* 349–350. DOI: https://doi.org/10.1126/science.132.3423.349

Hewig, J., Trippe, R.H., Hecht, H., Straube, T., & Miltner, W.H.R. (2008). Gender Differences for Specific Body Regions When Looking at Men and Women. *Journal of Nonverbal Behaviour*, *32*, 67–78. DOI: https://psycnet.apa.org/doi/10.1007/s10919-007-0043-5

Holmqvist, K., Nyström, M., Andersson, R., Dewhurst, R., Jarodzka, H., & Van de Weijer, J. (2011). Eye tracking: A comprehensive guide to methods and measures. Oxford, UK: University Press.

Hsu, K.J., Rosenthal, A.M., Miller, D.I., & Bailey, J.M. (2016). Who are gynandromorphophilic men? Characterizing men with sexual interest in transgender women. *Psychological Medicine*, *46,* 819–827.

Kahneman, D., Tursky, B., Shapiro, D., & Crider, A. (1969). Pupillary, heart rate, & skin resistance changes during a mental task. *Journal of Experimental Psychology*, *79*(1), 164–167. DOI: https://doi.org/10.1037/h0026952

Khan, S. I., Hussain, M. I., Parveen, S., Bhuiyan, I., Gourab, G., Sarker, G. F., ... Sikder, J. (2009). Living on the extreme margin: Social exclusion of the transgender population (hijra) in Bangladesh. *Journal of Health, Population, and Nutrition, 27*, 441–451.

Khorashad, B. S., Zucker, K. J., Talaei, A., Farid, F., Fayyazi Bordbar, M. R., Rajabzadeh, F., & Blanchard, R. (2020). Birth order and sibling sex ratio in a sample of Iranian transsexuals. *Journal of Sexual Medicine*, *287*(1923), DOI: https://doi.org/10.1016/j.jsxm.2020.02.004

Kietzmann, T.C., & König, P. (2015). Effects of contextual information and stimulus ambiguity on overt visual sampling behavior. *Vision Research*, *110*, 76–86. DOI: https://doi.org/10.1016/j.visres.2015.02.023

Kroeber, A. L. (1925). *Handbook of the Indians of California*. Washington, D.C.: Government Printing Office.

Krulewitz, J.E., & Nash, J.E. (1980). Effects of sex role attitudes and similarity on men's rejection of male homosexuals. *Journal of Personality and Social Psychology, 38*, 215–228.

Kulick, D. (1997). The gender of Brazilian transgendered prostitutes. *American Anthropologist, 99*(3), 574–585.

Lang, A.R., Searles, J., Lauerman, R., & Adesso, V. (1980). Expectancy, alcohol, and sex guilts as determinants of interest in and reaction to sexual stimuli. *Journal of Abnormal Psychology, 89*(5), 644–653.

Laeng, B., Sirois, S., & Gredebäck, G. (2012). Pupillometry: A window into the mind? *Perspectives on Psychological Science, 7*(1), 18–27. DOI: 10.1177/1745691611427305

Larsen, R. J., & Buss, D. M. (2005). Personality psychology: Domains of knowledge about human nature (2nd Ed.). New York: McGraw Hill.

Levi, D. M., Klein, S.A., & Aitsebaomo, A.P. (1985). Vernier acuity, crowding and cortical magnification. *Vision Research, 25*(7), 963–977. https://doi.org/10.1016/0042-6989(85)90207-X

Lim, D.C.L. (2015) Visualizing the invisible: Social constructions of straight identified men who have sex with transsexuals and feminized gay men on/off Malaysian film. *Studies in Gender and Sexuality*, *16(3)*, 183–203. DOI: 10.1080/15240657.2015.1073047

Lippa, A.R. (2005) Sexual orientation and personality. *Annual Review of Sex Research, 16(1),* 119–153. DOI: 10.1080/10532528.2005.10559831

Lippa, A.R. (2007). Sex differences and sexual orientation differences in personality: Findings from the BBC Internet Survey. *Archives of Sexual Behaviour*, *37*, 173–187.

Lykins, A.D., Meana, M., and Kambe, G. (2006). Detection of differential viewing patterns to erotic and non-erotic stimuli using eye-tracking methodology. *Archives of Sexual Behaviour*, *35*, 569–575. DOI: https://psycnet.apa.org/doi/10.1007/s10508-006-9065-z

Lykins, A.D., Meana, M., and Strauss, G.P. (2008). Sex differences in visual attention to erotic and non-erotic stimuli. *Archives of Sexual Behavior, 37,* 219–228. DOI: https://psycnet.apa.org/doi/10.1007/s10508-007-9208-x

Markos, A.R. (2005). Alcohol and sexual behaviour. *International Journal of STD & Aids*, *16*, 123–127.

Masvawure, T.B., Sandfort, T.G.M., Reddy, V., Collier, K.L. & Lane, T. (2015). 'They think that gays have money': Gender identity and transactional sex among black men who have sex with men in four South African townships. *Culture, Health & Sexuality*. 17(7), 891–905. http://hdl.handle.net/20.500.11910/1905

Matz, S. C., & Harari, G. M. (2021). Personality–place transactions: Mapping the relationships between Big Five personality traits, states, and daily places. *Journal of Personality and Social Psychology, 120*(5), 1367–1385. DOI: https://doi.org/10.1037/pspp0000297

McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality, 60*(2), 175–215. https://doi.org/10.1111/j.1467-6494.1992.tb00970.x

Meyerowitz, J. (2002). *How Sex Changed: A History of Transsexuality in the United States.* Cambridge, MA: Harvard University Press.

Mikach, S. M., & Bailey, J. M. (1999). What distinguishes women with unusually high numbers of sex partners? Evolution and Human Behavior, 20, 141–150.

Mitsuhashi, J. (2006). The transgender world in contemporary Japan: The male to female cross-dressers' community in Shinjuku. *Inter-Asia cultural studies, 7*(2), 202–227.

Money, J., & Bohmer, C. (1980). Prison Sexology: Two Personal Account of Masturbation, Homosexuality, & Rape. *The Journal of Sex Research*, *16(3)*, 256–266.

Money, J., & Lamacz, M. (1984). Gynemimesis and gynemimetophilia: individual and cross-cultural manifestations of a gender-coping strategy hitherto unnamed. *Comprehensive psychiatry, 25(4), 392–403. https://doi.org/10.1016/0010-440x(84)90074-9*

Moodie, T.D., Ndatshe, V., and Sibuyi, B. 1989. Migrancy and male sexuality on the South African gold mines. Duberman, M.B., Vicinus, M., and Chauncey, G. (Eds), *Hidden from history: Reclaiming the gay and lesbian past* (pp. 411–25). New York: Penguin

Munafò, M.R. & Smith, G.D. (2018). Robust research needs many lines of evidence. *Nature*, *553*, 399–401. DOI: 10.1038/d41586-018-01023-3

Murray, S. O. (1995). *Latin American male homosexualities*. University of New Mexico Press.

Niven, H., Jose, H., Rawstorne, P., & Nathan, S. (2018) 'They love us just the way they love a woman': gender identity, power and transactional sex between men who have sex with men and transgender women in Timor-Leste. *Culture, Health & Sexuality, 20*(8), 858–872. DOI: 10.1080/13691058.2017.1388928

Nummenmaa, L., Hietanen, J.K., Santtila, P., & Hyönä, J. (2012). Gender and visibility of sexual cues influence eye-movements. *Archives of Sexual Behaviour, 41,* 1439–1451. DOI: https://psycnet.apa.org/doi/10.1007/s10508-012-9911-0

Operario, D., Burton, J., Underhill, K. & Sevelius, J. (2008) Men who have sex with transgender women: Challenges to category-based HIV prevention. *AIDS and Behaviour, 12,* 18–26. DOI: https://doi.org/10.1007/s10461-007-9303-y

Ostovich, J.M., & Sabini, J. (2004). How are sociosexuality, sex drive, and lifetime number of sexual partners related? *Personality and Social Psychology Bulletin, 30*, 1255–1266.

Parrott, D.J., Adams, H.E., & Zeichner, A. (2002). Homophobia: Personality and attitudinal correlates. *Personality and Individual Differences, 32*(7), 1269–1278.

Patel, S., Long, T.E., McCammon, S.L., & Wuensch, K.L. (1995). Personality and emotional correlates of self-reported antigay behaviors. *Journal of Interpersonal Violence*, *10*, 354–366.

Pazhoohi, F., Macedo, A.F., Doyle, J.F., and Joana, A. (2020). Waist to hip ratio as supernormal stimuli: Effect of contrapposto pose and viewing angle. *Archives of Sexual Behaviour*, *49*, 837–847. DOI: https://doi.org/10.1007/s10508-019-01486-z

Peletz, M.G. (2009). *Gender pluralism: Southeast Asia since early modern times*. Taylor & Francis.

Perkins, A. and Roselli, C.E. (2007) The ram as a model for behavioral neuroendocrinology. *Hormones and Behavior, 52*, 70–77.

Petterson, L.J., Dixson, B.J., Little, A.C., & Vasey, P.L. (2016). Reconsidering male bisexuality: Sexual activity role and sexual attraction in Samoan men who engage in sexual interactions with *Fa'afafine. Psychology of Sexual Orientation and Gender Diversity*, *3*(1), 11–26. DOI: http://dx.doi.org/10.1037/sgd0000160

Petterson, L.J., and Vasey, P.L. (2021a). Samoan Men's Sexual Attraction and Viewing Time Response to Male-to-Feminine Transgender and Cisgender Adults. *Archives of Sexual Behaviour*, *50,* 873–884

Petterson, L. J., & Vasey, P.L. (2021b). Canadian undergraduate men's visual attention to cisgender women, cisgender men, and feminine trans individuals. *Scientific reports*, *11*(1), 388. https://doi.org/10.1038/s41598-020-79870-2

Petterson, L.J., & Vasey, P.L. (2022) Men's sexual interest in feminine trans individuals across cultures. *The Journal of Sex Research*. DOI: 10.1080/00224499.2021.2013429

Poushter, J., & Kent, N.O. (2020). The global divide on homosexuality persists. *Pew Research Center*.

Price, E.O. et al. (1988) The relationship of male–male mounting to the sexual preferences of young rams. *Applied Animal Behavior Science, 21*, 347–355.

Rahman, Q., Xu, Y., Lippa, R.A., & Vasey, P.L. (2019). Prevalence of sexual orientation across 28 nations and its association with gender equality, economic development, and individualism. *Archives of Sexual Behavior*, *49*(2), 595–606. https://doi.org/10.1007/s10508-019-01590-0

Reback, C.J., Kaplan, R.L., Bettcher, T.M., & Larkins, S. (2016) The role of the illusion in the construction of erotic desire: Narratives from heterosexual men who have occasional sex with transgender women. *Culture, Health & Sexuality*, *18*(8), 951–963. DOI: 10.1080/13691058.2016.1150515

Reback, C.J., & Larkins, S. (2006). *Once in a blue moon: Toward a better understanding of heterosexually identified men who have sex with men and/or preoperative transgender women*. Los Angeles, CA: City of Los Angeles, AIDS Coordinator.

Reback, C.J., & Larkins, S. (2010). Maintaining a heterosexual identity: Sexual meanings among a sample of heterosexually identified men who have sex with men. *Archives of Sexual Behavior, 39*, 766–773.

Reback, C.J., Larkins, S., & Clark, K. (2019). Motivations for a casual or occasional sexual encounter with a man and/or transgender woman among heterosexual men: Toward a better understanding of atypical sexual partnering**.** *Sexuality and Culture, 23*, 359–374.

Reinhardt, K. et al. (2007) Female-limited polymorphism in the copulatory organ of a traumatically inseminating insect. *The American* Naturalist, *170*, 931–935.

Reisner, S. L., Mimiaga, M., Bland, S. E., Driscoll, M. A., Cranston, K., & Mayer, K. H. (2012). Pathways to embodiment of HIV risk: Black men who have sex with transgender partners, Boston, Massachusetts. *AIDS Education and Prevention*, *24*(1), 15–26. https://doi.org/10.1521/aeap. 2012.24.1.15

Rieger, G., Cash, B.M., Merrill, S.M., Jones-Rounds, J., Dharmavaram, S.M., and Savin-Williams, R.C. (2015). Sexual arousal: The correspondence of eyes and genitals. *Biological Psychology*, *104*, 56–64. DOI: https://psycnet.apa.org/doi/10.1016/j.biopsycho.2014.11.009

Rieger, G., Rosenthal, A.M., Cash, B.M., Linsenmeier, J.A.W., Bailey, J.M., & Savin-Williams, R.C. (2013). Male bisexual arousal: A matter of curiosity? *Biological Psychology*, *94*, 479–489

Rieger, G., and Savin-Williams, R.C. (2012). The eyes have it: Sex and sexual orientation differences in pupil dilation patterns. *PLoS One, 7(8): e40256.* DOI: https://doi.org/10.1371/journal.pone.0040256

Robins, R.W., Fraley, R.C., Roberts, B.W., & Trzesniewski, K.H. (2001). A longitudinal study of personality change in young adulthood. *Journal of personality, 69*(4), 617–640. https://doi.org/10.1111/1467-6494.694157

Rodriguez, F. (1996) Understanding Filipino male homosexuality. *Journal of Gay & Lesbian Social Services*, *5*(3), 93–114, DOI: 10.1300/J041v05n02_05

Rosenthal, A.M., Hsu, K.H., & Bailey, J.M. (2017). Who are gynandromorphophilic men? An internet survey of men with an interest in transgender women. *Archives of Sexual Behaviour*, *46*, 255–264.

Saum, C.A., Surrat, H.L., Ciardi, J.A., & Bennett, R.E. (1995). *The Prison Journal,* 75(4), *413–440.*

Scheim, A.I. & Bauer, G.R. (2017). Sexual inactivity among transfeminine persons: A Canadian respondent-driven sampling survey. *Journal of Sex Research, 56*, 264–271. DOI: https://doi.org/10.1080/00224499.2017.1399334

Schifter, J., & Madrigal, J. (1997). *The transvestite's lover: Identity and behavior. (V.L.* Bullough & J. Elias, Eds.). Prometheus Books.

Schmitt, D.P. (2005). Sociosexuality from Argentina to Zimbabwe: A 48-nation study of sex, culture, and strategies of human mating. *Behavioural and Brain Sciences, 28*, 247–311.

Schmitt, D.P. (2007). Sexual strategies across sexual orientations. *Journal of Psychology & Human Sexuality*, 18(2–3), 183–214, DOI: 10.1300/J056v18n02_06

Schmitt, D.P., Realo, A., Voracek, M., & Allik, J. (2008). Why can't a man be more like a woman? Sex differences in big five personality traits across 55 cultures. *Journal of Personality and Social Psychology, 94*(1), 168–182.

Semenyna, S.W., VanderLaan, D.P., & Vasey, P.L. (2017). Birth order and recalled childhood gender nonconformity in Samoan men and *fa'afafine. Developmental Psychobiology, 59(3*), 338–347. doi:10.1002/dev.21498

Semenyna, S. & Vasey, P.L. (2016). The relationship between adult occupational preferences and childhood gender nonconformity among Samoan women, men, and *fa'afafine. Human Nature, 27*, 283-295.

Sheldon-Scott, L.A.J., Carey, K.B., Cunningham, K., Johnson, B.T., & Carey, M.P. (2016). Alcohol use predicts sexual decision-making: A systematic review and meta-analysis of the experimental literature. *Aids and Behavior, 20,* 19–39. DOI: 10.1007/s10461-015-1108-9

Shine, R., et al. (2003) Confusion within 'mating balls' of garter snakes: does misdirected courtship impose selection on male tactics? *Animal Behavior, 66*, 1011–1017 .

Singh, D. (1993). Adaptive significance of female physical attractiveness: Role of waist-to-hip ratio. *Journal of Personality and Social Psychology, 65*(2), 293–307. DOI: https://doi.org/10.1037/0022-3514.65.2.293

Singh, D., Dixson, B.J., Jessop, T.S., Morgan, B., & Dixson, A.F. (2010). Cross-cultural consensus for waist–hip ratio and women's attractiveness. *Evolution and Human Behavior*, *31(3)*, 176–181. DOI: https://doi.org/10.1016/j.evolhumbehav.2009.09.001

Spiering, M., & Everaerd, W. (2007). The sexual unconscious. In E. Janssen (Ed.), The psychophysiology of sex (pp. 166–184). Bloomington: Indiana University Press.

Steinhauer, S.R., Siegle, G.J., Condray, R., & Pless, M. (2004) Sympathetic and parasympathetic innervation of pupillary dilation during sustained processing. *International Journal of Psychophysiology, 52*, 77–86. DOI: 10.1016/j.ijpsycho.2003.12.005

Stewart-Williams, S., & Thomas, A.G. (2013). The ape that kicked the hornet's nest: response to commentaries on "The ape that thought it was a peacock." *Psychological Inquiry*, 24(3), 248–271, DOI: 10.1080/1047840X.2013.823831

Stief, M.C. (2017). The sexual orientation and gender presentation of *hijra*, *kothi*, and *panthi* in Mumbai, India. *Archives of Sexual Behavior, 46*(1), 73–85. doi:10.1007/s10508-016-0886-0

Strasburger, H., Rentschler, I., & Jüttner, M. (2011). Peripheral vision and pattern recognition: A review. Journal of Vision, 11(5):13, 1–82, DOI: 10.1167/11.5.13.

Strassberg, D.S. & Lowe, K. (1995). Volunteer bias in sexuality research. *Archives of Sexual Behaviour, 24*, 369–382. DOI: https://doi.org/10.1007/BF015 41853

Symons, D. (1995). Beauty is in the adaptations of the beholder: The evolutionary psychology of human female sexual attractiveness. In P. R. Abramson & S. D. Pinkerton (Eds.), *Sexual nature sexual culture* (pp. 80–118). Chicago, IL: The University of Chicago Press.

Thibos, L.N., Cheney, F.E., & Walsh, D.J. (1987). Retinal limits to the detection and resolution of gratings. *Journal of the Optical Society of America A*, *4*(8), 1524–1529. DOI: https://doi.org/10.1364/JOSAA.4.001524

Trivers, R. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man: 1871–1971* (pp. 136 179). Chicago: Al- dine.

Tybur, J.M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology, 97*(1), 103.

VanderLaan, D.P., Gothreau, L.M., Bartlett, N.H., & Vasey, P.L. (2011). Recalled separation anxiety and gender atypicality in childhood: a study of Canadian heterosexual and homosexual men and women. *Archives of Sexual Behavior*, 40(6), 1233–1240. http://dx.doi.org/10.1007/s10508-010-9695-z Medline:21063904

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(3)*, 495–503. http://dx.doi.org/10.1007/s10508-009-9576-5 Med- line:20039114

Vasey, P. L., & VanderLaan, D. P. (2007). Birth order and male androphilia in Samoan fa'afafine. *Proceedings of the Royal Society of London, Series B: Biological Sciences, 274*, 1437–1442.

Vasey, P. L., & VanderLaan, D. P. (2014). Evolving research on the evolution of male androphilia. *Canadian Journal of Human Sexuality, 23(3),* 137–147.

Vasey, P. L. & VanderLaan, D. P. (2021). *Fa'afafine*. In T. K. Shackelford & V. A. Weekes-Shackelford (eds.), *Encyclopedia of evolutionary psychological science*. NY: Springer.

Vasey, P.L., VanderLaan, D.P., Gothreau, L.M., & Bartlett, N.H. (2011). Traits of separation anxiety in childhood: a retrospective study of Samoan men, women, and fa'afafine. *Archives of Sexual Behavior*, *40(3)*, 511–517. http://dx.doi.org/10.1007/s10508-009- 9589-0 Medline:20013150

Vukasović, T., & Bratko, D. (2015). Heritability of personality: A meta-analysis of behavior genetic studies. *Psychological Bulletin, 141*(4), 765–785. https://doi.org/10.1037/bul0000017

Wellings, K., Collumbien, M., Slaymaker, E., Singh, S., Hodges, Z., Patel, D., & Bajos, N. (2006). Sexual behaviour in context: A global perspective. *The Lancet*, *368*(9548), 1706–1728.

Weinberg M.S., & Williams, C.J. (2010) Men sexually interested in transwomen (MSTW): Gendered embodiment and the construction of sexual desire, *Journal of Sex Research*, *47*(4), 374–383, DOI: 10.1080/00224490903050568

Wenzlaff, F., Briken, P., & Dekker, A. (2016) Video-based eye tracking in sex research: A systematic literature review. *The Journal of Sex Research, 53*(8), 1008–1019. DOI: 10.1080/00224499.2015.1107524

Whitam, F. (1983). Culturally invariable properties of male homosexuality: Tentative conclusions from cross-cultural research. *Archives of Sexual Behavior, 12(3)*, 207–226.

Whitam, F.L. (1987). A cross-cultural perspective on homosexuality, transvestism and trans-sexualism. In: G. D. Wilson (ed.), *Variant sexuality* (pp. 176–201). London, UK: Croom Helm.

Whitam, F. L. (1992). Bayot and callboy in the Philippines. In S.O. Murray (Ed.), *Oceanic Homosexualities* (pp. 231–248). New York: Garland.

Whitam, F., & Dizon, M.J. (1979). Occupational choice and sexual orientation in cross-cultural perspective. *International Review of Modern Sociology*, *9(2)*, 137–149.

Whitam, F. L., & Mathy, R. M. (1986). *Male homosexuality in four societies: Brazil, Guatemala, the Philippines, and the United States*. New York: Prager.