

**FURTHERING OUR UNDERSTANDING OF ASEXUALITY: AN INVESTIGATION
INTO BIOLOGICAL MARKERS OF ASEXUALITY, AND THE DEVELOPMENT
OF THE ASEXUALITY IDENTIFICATION SCALE**

by

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Abstract

Human asexuality is defined as an absence of sexual attraction to anyone. Approximately 1% of the population is thought to be asexual. However, there has been a paucity of research into correlates of asexuality as well as into how asexuality is best conceptualized. This is in part due to logistical difficulties in recruiting and identifying representative samples of asexuals. Because of the low prevalence rate of asexuality, and the relatively recent emergence of asexual communities, many individuals who lack sexual attraction may not self-identify as asexual. Previous studies have recruited asexual participants via online web-communities, and relied on self-identification as asexual, which may result in non-representative sampling. The purpose of this study was two-fold. Firstly, in response to continuing debate as to whether asexuality is better understood as a sexual orientation or as a sexual dysfunction, Study 1 aimed to investigate the claim that asexuality would best be conceptualized as a sexual orientation in a large internet sample. Biological markers such as finger length ratios, handedness, and older siblings have may be related to prenatal development, and have been linked to sexual orientation. Asexual men and women were more likely to be non-right-handed than their heterosexual counterparts, and there were significant differences between sexual orientation groups on the number of older brothers and older sisters, and this differed depending on handedness. We found no significant differences between sexual orientation groups on measurements of 2D:4D ratio. However, this is likely due to the relatively small sample size. This is the first study to test and provide empirical support for an underlying biological etiology to account for the lack of sexual attraction characteristic of asexuality. Study 2 presents the development of a brief, self-report measure of asexuality. Initial testing of questionnaire items identified by an expert

panel was followed by a study aimed at further refining the questionnaire. Based on discriminant analysis as well as reliability and validity tests, a 10-item measure was identified, and was found to be able to distinguish between sexual and asexual individuals. This measure will be used to obtain more representative samples of asexuals in future research.

Preface

Notes on Authorship

I co-designed the studies, and played a central role in all aspects of carrying out this research, from recruiting subjects and managing the database to analyzing the data and writing manuscripts for submission to a journal. All procedures were approved by UBC's Behavioural Research Ethics Board (Certificate # H09-00671).

A version of Chapter 2 has been submitted for publication. Yule, M.A., Brotto, L.A. & Gorzalka, B.B. (Under Review). Biological markers of asexuality: Finger length ratios, handedness, and birth order in self-identified asexual men and women. I conducted all data collection, data analysis, and wrote most of the manuscript. I collaborated with my co-authors on the study design, and they assisted with writing the manuscript.

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Chapter 1: Introduction to asexuality

1.1 What is asexuality?

Human asexuality is generally defined as an absence of sexual attraction to anyone at all. According to the first empirical study of asexuality, approximately 1% of the population is thought to be asexual (Bogaert, 2004), and this estimate has been confirmed by a more recent study investigating the association between sexual attraction and mental health in a large sample of high school students (Lucassen et al., 2011). Other definitions of asexuality include: a lack of sexual behaviour (Rothblum & Brehony, 1993), a lack of sexual orientation (Storms, 1980), and a lack of sexual desire or excitement (Prause & Graham, 2007). Although asexuality has appeared sporadically throughout the scientific literature since Kinsey's *Sexual Behavior in the Human Male* was released in 1948 (Kinsey, Pomeroy & Martin, 1948), it only began to receive serious academic attention in 2004, when Bogaert published his analysis of individuals lacking sexual attraction within a large British probability sample (Bogaert, 2004). Early writing focused on conceptualizing and defining the construct (Bogaert, 2006; Brotto, Knudson, Inskip, Rhodes, & Erskine, 2010; Prause & Graham, 2007), and only very recently has there been any research specifically investigating physiological characteristics of asexuality (Brotto & Yule, 2011).

Similarly, the asexual community itself has only existed for the past decade or so, fuelled by the growth of the internet, and expanding from its original primary venue (the Asexuality and Visibility Education Network; AVEN, www.asexuality.org) to include a multitude of blogspots (e.g., www.asexualexplorations.net; www.asexualunderground.blogspot.com), YouTube videos (e.g., Hot Pieces of Ace YouTube channel) and dating websites (e.g., www.asexualitic.com) discussing individual's experiences of asexuality. The historical public invisibility of asexuality

may be due to a combination of factors. Asexuals in general do not participate in explicit sociosexual activities that draw attention to themselves and their atypical sexual behaviours. Further, lack of sexual orientation, attraction, or behaviour is not considered to be illegal or morally corrupt, and consequently asexuals have not been subjected to the legal scrutiny that has been directed toward other sexual minorities (Bogaert, 2004). Thus, the invisibility of asexuality was not due to a scarcity of asexuals themselves, but rather to the lack of a cohesive group or platform in which an asexual community could flourish and publicly self-identify as such.

The recent emergence of the asexual community, combined with the lack of empirical data on asexuality, have led to much discussion and speculation, not only within the social sphere, but within the clinical community, on how asexuality should be categorized. Asexuality has been defined as a lack of sexual attraction to anyone at all (Bogaert, 2004; Brotto et al., 2010; Jay, 2008), and is often conceptualized as a sexual orientation (Berkey, Perelman-Hall, & Kurdek, 1990; Brotto & Yule, 2011; Brotto et al., 2010; Storms, 1978). While this definition is the most widely endorsed among asexuals themselves, asexuality has also been described in terms of a lack of sexual behaviour (Rothblum & Brehony, 1993), as well as low sexual excitation (Prause & Graham, 2007), and even as a sexual dysfunction (Bogaert, 2004, 2006; Prause & Graham, 2007). More colloquially, there are pervasive stereotypes that assume all asexuals are aromantic (don't experience romantic attraction), non-male, afraid of sex, highly religious, are disabled, have experienced traumatic relationships or sexual experiences, or are making a conscious choice to be asexual (e.g., celibacy) (Neth, 2011; NextStepCake, 2011; Sloan, 2006; Walters & Geddie, 2006).

1.2 How should asexuality be conceptualized?

There is a significant amount of debate as to whether asexuality should be conceptualized as a sexual orientation, or as a sexual dysfunction. How asexuality is conceptualized has significant implications for how it is approached by researchers and clinicians in the future. This is a timely discussion, especially in light of the upcoming publication of the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). If asexuality is in fact a different construct than a sexual dysfunction such as hypoactive sexual desire disorder (HSDD), which is characterized as an absence of sexual fantasies and desire for sexual activity, this should be addressed in the DSM-5.

1.2.1 Sexual dysfunction

There has been speculation that asexuality may actually be a sexual dysfunction, such as HSDD (Prause & Graham, 2007) or sexual aversion disorder (SAD; Bogaert, 2004; Prause & Graham, 2007), or that asexual individuals, instead of targeting their sexual attraction towards another person, may in fact have a paraphilia, whose focus of attraction is non-human objects (Bogaert, 2004, 2006). Of these three disorders, HSDD, which is characterized by a distressing lack or absence of sexual fantasies and desire for sexual activity (American Psychiatric Association, 2000), is the most closely comparable to asexuality. Prause and Graham (2007) found that asexual individuals were not motivated by avoidance, providing evidence that they were unlikely to meet criteria for SAD. Bogaert (2004, 2006) pointed out that asexuals are unlikely to have paraphilias, as the majority of paraphilic individuals usually have some level of sexual attraction towards a human partner, even if they experience a strong attraction towards inanimate objects. Further, because asexuality appears to be more common in women (Bogaert,

2004), it is again unlikely to represent a paraphilia since the latter are more often experienced by men (Bogaert, 2004; Freund, 1994; Jay, 2008). Accordingly, Bogaert noted that the phenomenon of asexuality should not only be measured in terms of lack of attraction towards people, but also as a lack of attraction towards objects (Bogaert, 2004). In other words, asexuality is the lack of any sexual attraction at all.

How asexuality is conceptualized has important implications for how asexual individuals are cared for by health-care providers. An individual describing a lifelong lack of sexual desire who presents at a clinic - perhaps on the advice of a distressed or dissatisfied partner - might be assigned a diagnosis of HSDD and prescribed treatment: pharmaceutical or otherwise. However, asexuals do not experience distress in relation to their lack of sexual desire (Brotto et al., 2010; Pagan Westfall, 2004), making asexuality fundamentally different from HSDD, which requires marked distress or interpersonal difficulty for a clinical diagnosis (American Psychiatric Association, 2000).

HSDD has been officially recognized as a diagnostic category since 1980. In the DSM-IV-TR (American Psychiatric Association, 2000), an individual must experience “persistently or recurrently deficient (or absent) sexual fantasies and desire for sexual activity” as well as concomitant “marked distress or interpersonal difficulty” to qualify for a diagnosis of HSDD (Table 1). Subtypes include lifelong/acquired and situational/generalized, and it must not be exclusively due to a substance, a general medical condition, or be accounted for by another psychiatric disorder. The DSM definition of HSDD has been harshly criticized (Bancroft, Graham, & McCord, 2001; Basson et al., 2003; Brotto, 2010; Prause & Graham, 2007; Tiefer, 2001; Vroege, Gijs, & Hengeveld, 2001) due to its reliance on a linear model of sexual response,

and is currently facing a major overhaul for the upcoming issue of the DSM (DSM-5, due for publication in 2013). This will be discussed further in the final chapter of this thesis.

Under the current diagnostic criteria, it is possible that an asexual individual might receive a diagnosis of HSDD. Although asexuals would be unlikely to initiate treatment for their lack of sexual attraction on their own (Brotto et al., 2010), partner dissatisfaction in the instance of an asexual-sexual pairing might result in the partner's wish to pursue health professional attention. Discrepant levels of sexual desire can be problematic for couples (Davies & Katz, 1999; Donnelly, 1993; Rust & Golombok, 1988), and the resulting strain on a sexual/asexual relationship might generate the very kind of interpersonal distress that is required for a DSM diagnosis of a sexual disorder to be met. It seems inappropriate that if the lack of sexual attraction (and a resultant lack of desire for sex) experienced by asexuals is lifelong, intrinsic, and a fundamental aspect of the asexual's self – in the same way that same-sex attraction is lifelong, intrinsic, and a fundamental aspect of the homosexual's self - that he or she could be diagnosed with a “mental disorder” and treatment administered; however, in the current diagnostic system, such an outcome is possible.

An often-cited population-based survey estimated that 14-17% of men and 27-32% of women aged 19-59 lacked interest in sex (Laumann, Paik, & Rosen, 1999). The British National Survey of Sexual Attitudes (NATSAL) assessed lack of sexual interest, and concluded that in the previous year, 17.1% of men and 40.6% of women had experienced a lack of sexual interest lasting at least one month, but that these numbers dropped to 1.8% of men and 10.2% of women who experienced a lack of sexual interest lasting at least six months (Mercer et al., 2003). While these studies did not directly assess the prevalence of HSDD using the diagnostic criteria outlined above, they do suggest that low sexual desire in general is relatively common in the

general population. A more recent study that investigated HSDD in a large national sample of US postmenopausal women estimated that HSDD prevalence was somewhere between 9 - 26% of women (Leiblum, Koochaki, Rodenberg, Barton, & Rosen, 2006). These studies do not distinguish between a lifelong or acquired lack of sexual interest. However, it could be assumed, based on the NATSAL data, that less than 2% of men and 10% of women have low desire that can be considered as lifelong.

Some of the earliest literature on sexual dysfunction portrays asexuality and HSDD interchangeably. Helen Singer Kaplan, in her seminal work *Disorders of Sexual Desire*, describes individuals with Primary Hypoactive Sexual Desire as being asexual. In fact, in one of the earliest articles discussing hypoactive sexual desire, it is reported that a number of patients (those with “primary” hypoactivity) have never been interested in sex, report low rates of childhood masturbation and fantasy, and never develop sexual desire. Similarly, Lief noted that not all people with absent sexual desire, which he termed “Inhibited Sexual Desire,” are distressed (Lief, 1977). In brief, Kaplan and Lief very early on claimed that asexuality is undeniably a sexual disorder. This is problematic, as this concept seems to be based on the partner’s dissatisfaction with the “dysfunctional” individual’s lack of sexual interest, and not on any distress experienced by individuals with low sexual interest themselves. This historical conflation between asexuality and sexual dysfunction makes it more difficult today to disentangle the two concepts.

Certainly on validated measures of sexual functioning (e.g., Female Sexual Function Index; FSFI; Rosen et al., 2000; Wiegel, Meston, & Rosen, 2005), asexual women were found to have self-reported sexual desire, arousal, orgasm, and satisfaction scores comparable to women with sexual desire and arousal disorders (Brotto et al., 2010). While asexual men had erectile

functioning similar to those without erectile difficulties (Cappelleri, Rosen, Smith, Mishra, & Osterloh, 1999), they had similarly low desire scores on an equivalent measure (International Index of Erectile Function, IIEF; Rosen et al., 1997). Despite these low self-report sexual response scores, Brotto and colleagues emphasized that the large majority of their asexual sample did not experience sexual distress, and only 10% scored in the clinical range of the Female Sexual Distress Scale (FSDS; Derogatis, Rosen, Leiblum, Burnett & Heiman, 2002), which has been shown to reliably distinguish between women with and without sexual dysfunction. Thus, while the obvious similarity between those with HSDD and those with asexuality is their shared disinterest in sexual activity, there is also a fundamental difference—namely that those with HSDD continue to experience sexual attraction whereas asexual individuals do not. In fact, many participants in Brotto’s study qualitatively denied that they were experiencing a disorder of any kind, and felt that individuals with HSDD actually did experience sexual attraction for others, whereas asexual individuals did not (Brotto et al., 2010). Furthermore, it is asexual individual’s intrinsic lack of sexual attraction that may be at the center of their disinterest in sex, whereas for those with HSDD, their lack of interest in sex may be related to a multitude of factors (e.g., mood, relationship strain, fatigue, inadequate sexual arousal, medical factors, etc.).

In the context of the DSM, it is true that an individual who has never experienced sexual attraction (and thus might identify as asexual), might be likely to have a concurrent lack of sexual desire, and thus would meet diagnostic criteria for HSDD. While asexuals generally do not experience distress in direct relation to their lack of sexual attraction or desire, it could be a source of interpersonal distress, especially in the case of an asexual individual whose partner identifies as sexual. As stated above, this is of concern, as a growing body of evidence, both

anecdotal and scientific, suggests that asexuality is not a sexual dysfunction, but may in fact be better conceptualized as a sexual orientation, along with homosexuality, bisexuality, and heterosexuality.

1.2.2 Sexual orientation

The largest online web-community of asexual individuals, the Asexuality Visibility and Education Network (AVEN), describes asexuality as a sexual orientation or sexual identity, along with heterosexuality, bisexuality and homosexuality (Jay, 2008), rather than as a sexual dysfunction. This outlook has been supported by recent research by Brotto and colleagues in which asexual individuals expressed strong agreement that asexuality is best conceptualized as a sexual orientation, and that it is rooted in biology. In fact, members of the asexual community suggest that if asexuality were more accurately considered as a sexual orientation, this would decrease the stigma surrounding asexuality (Brotto et al., 2010).

Sexual orientation has recently been described in terms of sexual attraction, rather than sexual identity, sexual behaviour, or romantic attraction (Bailey, Dunne, & Martin, 2000; Bogaert, 2003b; Bogaert, 2006; Diamond, 2003; Money, 1988; Zucker, 1995). Thus, subjective sexual attraction is the fundamental psychological core of sexual orientation (Bogaert, 2003b), such that regardless of sexual behaviour, an individual who exclusively experiences sexual attraction to someone of the same sex would have a homosexual sexual orientation, an individual who experiences sexual attraction to both sexes would have a bisexual sexual orientation, and an individual who experiences sexual attraction exclusively to individuals of the opposite sex would have a heterosexual sexual orientation. It follows that the lack of subjective sexual attraction to anyone (or anything) at all would be categorized as an asexual sexual orientation. HSDD, on the

other hand, is based on low sexual desire, which is a concept separate from sexual attraction. People with HSDD are assumed to have an underlying sexual orientation, and thus some level of sexual attraction towards others; however, this assumption has never been investigated. It is possible that individuals with lifelong HSDD instead experience romantic attraction, rather than sexual attraction.

To make matters more complicated, the terms “attraction” and “desire” are often conflated when discussing asexuality and HSDD. This overlap in terminology can make discussions surrounding asexuality and HSDD complex, and we will attempt to disentangle the concepts here. Kaplan described sexual desire or libido to be experienced as sensations that motivate an individual to seek out sexual experiences (Kaplan, 1979). This is experienced as feelings of genital sensations, restlessness, or interest in sex, and ceases after sexual gratification. This clinical definition of sexual desire is similar to Levine’s behaviour-focused definition (Levine, 1987), which describes desire as a sum of forces that guide people toward or away from sexual behaviour (Levine, 2003), such that desire is synonymous with the term “motivation” for seeking out sexual behaviour (Levine, 2002). This definition is problematic, as there are many reasons that someone may or may not seek out sexual behaviour, and these reasons may or may not have to do with sexual desire (Cain et al., 2003; Meston & Buss, 2007). Levine notes that all humans occasionally experience sexual desire, and suggests a dimensional spectrum of the intensity of sexual desire; Aversion – Indifference – Interest – Need – Passion, which may fluctuate at different times in a person’s life (Levine, 2002). These discussions of desire, however, do not mention to whom the drive is directed toward, nor to whom someone is sexually attracted.

Sexual attraction is a person's sexual or erotic interest in another individual, and it has been described as a deeply stable, psychological component of psychosexual processing (Bogaert, 2003a). In a sexual person, sexual attraction and desire may be indistinguishable from one-another, such that being sexually attracted to someone necessarily precedes sexual desire for that person, and thus sexual attraction and desire are not easily identifiable as two separate concepts. However, this may not always be the case. A person may generally be attracted to another individual, but not experience sexual desire for them at all times. It follows that without sexual attraction, sexual desire would be unlikely to occur.

That asexuality is best conceptualized as a sexual orientation has been further supported by recent research suggesting no differences in physiological sexual arousal between asexual, heterosexual, lesbian, or bisexual women in response to viewing erotic films (Brotto & Yule, 2011). This is consistent with previous research on female sexual orientation where lesbian and heterosexual women showed the same degree of increase in physiological sexual arousal, regardless of their sexual orientation and regardless of whether the sexual stimuli employed were heterosexual, homosexual, or non-human primate (Chivers, Rieger, Latty, & Bailey, 2004; Chivers, Seto, & Blanchard, 2007). This "target non-specificity" appears to be a feature of all women, including those who are asexual, providing evidence that asexuality is unlikely to be a dysfunction of sexual arousal, and therefore might be better conceptualized as a sexual orientation, though evidence for the latter is weak to date.

As mentioned above, sexual orientation is currently defined in terms of sexual attraction, rather than sexual behaviour, underscoring the fundamental and intrinsic nature of sexual attraction (Bogaert, 2003b). Further, explanations such as prenatal hormone effects (Ellis & Ames, 1987), childhood development (Bem, 1996), and organization of brain structures (Le Vay,

1991) have been proposed to account for differences in attraction between individuals of different sexual orientation groups. Bogaert (2004) found evidence suggesting that biological pathways may play a role in the development of asexuality. Late menarche, shorter stature, and health problems in women, and shorter stature and health problems in men, were predictors of asexuality. Because of the growing body of evidence that the development of sexual attraction may be prenatally determined (Bogaert & Blanchard, 1996; Bogaert, 1998; 2003a), Bogaert concluded that asexuality may best be viewed as a sexual orientation (Bogaert, 2004).

There is a growing body of evidence implicating biological influences in the development of human sexual orientation (Mustanski, Bailey, & Kaspar, 2002), and three findings have repeatedly emerged in epidemiological studies of sexual orientation: (1) homosexuality is associated with specific finger length ratios, (2) homosexuality is associated with a higher incidence of non-right-handedness in both males and females, and (3) the presence of older brothers prenatally increases the odds of homosexuality in males. Because further evidence supporting the concept of asexuality as a sexual orientation might be found in biological markers linked to sexual orientation, the present study was designed to examine these markers of atypical prenatal development in asexuals. This will be described in more detail in Chapter 2.

1.3 Problems with measuring asexuality

One of the major obstacles to studying asexuality is the lack of a validated subjective measure that allows researchers to recruit a representative sample of asexuals. Asexuality has only very recently received any research attention, and previous research has employed subjective criteria such as self-identification or agreement with a statement such as “I have never felt sexually attracted to anyone at all” (Bogaert, 2004; Brotto et al., 2010). Due to limitations in

recruiting sufficiently large local samples, the majority of studies have relied on recruiting via online web-communities of asexual individuals, such as the Asexuality Visibility and Education Network (AVEN; asexuality.org; e.g., Brotto et al., 2010; Prause & Graham, 2007)). These methods are problematic in that they either limit the sample to individuals who have been recruited through established asexuality networks/communities, and may not be representative of the entire population of asexuals, or that the definition provided (e.g., “lack of sexual attraction”) may be ambiguous (Brotto & Yule, 2009; Hinderliter, 2009).

Because of the recent emergence of the asexual community, and most people’s limited exposure to asexual individuals, there are many people who have not heard the term “asexuality” or even been exposed to the idea that individuals can lack sexual attraction entirely. Thus, many asexual individuals likely did not identify as asexual before coming across asexuality in the media, and would not have been included in an asexual sample if they happened to be recruited for research focused on asexuality.

This problem is complicated by the difficulty of defining or understanding sexual attraction for those who may not have ever experienced it before, and is further complicated by the fact that asexuals may feel nonsexual types of attraction, such as romantic attraction (Brotto et al., 2010). It may be the case that those asexual individuals who are not recruited from asexuality websites do not distinguish between different types of attraction (Hinderliter, 2009). Thus, they may respond “heterosexual” or “homosexual” to a question about sexual attraction, when the attraction they are experiencing might be more accurately described as romantic attraction.

Ideally, quantitative analysis of asexuality would include data both from online asexual communities and those individuals who had not yet come across these online communities. The

best and only estimate of the prevalence of asexuality suggests that approximately 1% of the population is asexual (Bogaert, 2004). This, combined with the fact that many of these individuals, while they do not experience sexual attraction to anyone at all, may not have heard the term “asexuality,” makes it exceedingly difficult to recruit large enough sample sizes without the help of the online asexuality groups. This creates a difficult situation for researchers.

Without some sort of objective measure of asexuality that can identify a lifelong lack of sexual attraction in those individuals who have not heard the term asexuality, obtaining a representative sample of asexual individuals would be difficult if not impossible.

Brotto and colleagues (Brotto et al., 2010) noted that those asexuals belonging to AVEN may be a distinct group of asexuals, as they have already acknowledged their asexuality as an identity. They postulated that possible motivating factors for joining such an online community (such as distress) may have inflated some of the findings in their study (e.g., psychopathology scores), underscoring the importance of finding a way to access a more representative group of asexuals. In fact, research conducted via recruitment of asexual individuals from online asexual communities may not be representative of the asexual community as a whole. While the online community of asexuals that inhabits the AVEN website may be diverse (Brotto et al., 2010), it is almost certainly not representative of the entire population of asexual individuals that exists outside of this web-community. In order to fully understand this diversity, researchers require a tool that can objectively assess asexuality, regardless of whether or not a participant would self-identify as asexual.

Therefore, the second goal of this thesis was to develop a self-report questionnaire that assesses asexuality, in order that this might be used to identify asexual individuals who have yet to come across the term asexuality and/or online asexual communities. The goal of this

questionnaire was not for it to be used as a descriptive tool, but rather that it would be a tool to identify individuals who experience little or no sexual attraction (and thus would likely identify with an asexual identity), whether or not they have identified as asexual. Thus, the focus of the questionnaire development (described in more detail in Chapter 3) was to identify items that best differentiate asexual individuals from their sexual counterparts, and not merely to include items that best describe asexuality.

Chapter 2: Biological markers of asexuality

2.1 Introduction

There is a growing body of evidence implicating biological influences in the development of human sexual orientation (Mustanski et al., 2002), and three findings have repeatedly emerged in epidemiological studies of sexual orientation: (1) homosexuality is associated with specific finger length ratios, (2) homosexuality is associated with a higher incidence of non-right-handedness in both males and females, and (3) the presence of older brothers prenatally increases the odds of homosexuality in males. Because further evidence supporting the concept of asexuality as a sexual orientation might be found in biological markers linked to sexual orientation, the present study examined these markers of atypical prenatal development in asexual individuals.

If putative markers of prenatal development such as finger-length ratios, handedness, and number of older brothers co-vary with adult sexual identity, then this supports the notion that prenatal development is associated with these identities (Lippa, 2003b). To date, there are no published data on 2D:4D ratios, handedness patterns, or older siblings of asexual individuals. Thus, the current study compared asexual, non-heterosexual (bisexual and homosexual), and heterosexual individuals on these measures. Findings may have implications for how asexuality should be categorized. This will be discussed in more detail in the following sections.

2.1.1 Handedness

Handedness is a biological measure that reflects prenatal influences, and may differentiate sexual orientation groups. Aspects of cerebral lateralization, externally manifested as handedness, may be etiological factors accounting for homosexuality (Blanchard, 2008).

Homosexual men and women have atypical handedness patterns, with gay men exhibiting evidence of significant non-right-handedness (i.e., preferential use of the left hand, or equal use of both hands, in common tasks) (Bogaert, 2007). In a large meta-analysis, Lalumière, Blanchard and Zucker (2000) investigated associations between handedness and sexual orientation in men and women, concluding that homosexual individuals were more likely to be non-right-handed than heterosexual individuals. This finding was confirmed by Blanchard and Lippa (2007), who used data from the British Broadcasting Corporation (BBC) Sex Differences Survey (Reimers, 2007), which gathered 2D:4D data from over 255,000 participants, to conclude that non-right-handedness is associated with homosexuality in both men and women. Prenatal hormone theory posits that finger length, handedness, and sexual orientation are all linked to prenatal androgen levels, with higher androgen exposure linked to more male-typical patterns of development, including smaller 2D:4D ratios, and increased incidence of left-handedness. A large, widely-cited meta-analysis by Seddon and McManus (1991) concluded that men are significantly more likely to be non-right-handed than women, and this is attributable to elevated levels of prenatal testosterone.

2.1.2 Older siblings

Similarly, the number of older brothers has been associated with sexual orientation, such that a greater number of older brothers increases the probability of homosexuality in men (Blanchard, 2008). This pattern is not evident in women (Blanchard, Zucker, Siegelman, Dickey, & Klassen, 1998; Blanchard & Lippa, 2007; Bogaert, 1997), and may actually be limited to right-handed men (not non-right-handed men) (Blanchard, 2008). The fraternal birth order effect posits that increased number of older brothers increases the odds of homosexuality in men,

but not women (Blanchard & Bogaert, 1995), and this has been supported by a number of studies (Blanchard, 2008). Bogaert (2006) found that this effect was limited to the number of biological brothers, even if they were raised in separate households, whereas having step-brothers or adoptive brothers had no effect on sexual orientation, suggesting that the effect of older brothers on sexual orientation occurs prenatally. The maternal immune hypothesis (Blanchard & Bogaert, 1995) proposes that maternal antibodies to male-specific antigens (perhaps proteins or peptides) may affect the development of male but not female fetuses. The theory suggests that male fetal cells (or fragments of cells) enter the maternal circulation and are recognized as foreign by the mother's immune system, triggering the production of antibodies against them. During subsequent pregnancies in which the fetus is male, these anti-male antibodies cross the placental barrier, and act on the development of the fetal brain, diverting it from the male-typical developmental pathway, such that the individual will later experience sexual attraction to men rather than women. The strength of this maternal immunization is thought to increase with each subsequent pregnancy in which the fetus is male, and thus the probability of homosexuality increases with each older brother (Blanchard, 2008). The maternal immune hypothesis works in conjunction with Ellis and Ames' (1987) long-standing theory that sexual orientation in men is related to prenatal testosterone, proposing that the development of sexual orientation depends both on a main system driven by testosterone, and a supplementary system driven by male-specific proteins (Blanchard, 2008), as well as being influenced by other etiological factors such as atypical hormone levels at critical stages of fetal development (Mustanski, Chivers, & Bailey, 2002), and cerebral lateralization, which is thought to have a genetic influence (Geschwind, Miller, DeCarli, & Carmelli, 2002), and, as mentioned above, may be manifested in handedness.

Blanchard, and colleagues (Blanchard, Cantor, Bogaert, Breedlove, & Ellis, 2006) found that there was an interaction between handedness and number of older brothers in predicting homosexuality in men. Specifically, they found that the number of older brothers increased the probability of homosexuality only in men who reported being right-handed (not non-right-handed), and this finding was confirmed by Bogaert, Blanchard and Crosthwait (2007) and Blanchard and Lippa (2007). These findings are counter-intuitive in comparison with meta-analytic data that suggests non-right-handed men have a greater likelihood of homosexuality (Lalumière et al., 2000). However, there are alternative explanations for their apparent contradiction. For example, non-right-handed men with no older brothers might be more likely to be homosexual due to decreased lateralization of the brain. Non-right-handers may be less sensitive to maternal anti-male antibodies. Non-right-handedness may actually be a proxy for some feature of the mother that makes her less susceptible to developing anti-male antigens. Therefore, it is only among right-handers that the influence of the fraternal birth order effect is potent enough to influence sexual orientation. See Blanchard (2008) for an in-depth discussion of this topic.

2.1.3 Finger length ratios (2D:4D)

The ratio of the length of the index finger (2D) compared to the fourth finger (4D) is known as the 2D:4D ratio, and sex differences on this measure are thought to reflect a prenatal influence of androgens (Williams et al., 2000; See Manning, 2002 for a more detailed discussion). In women, the 2D is almost the same length as the 4D; in men, the 2D is typically shorter than the 4D. However, some studies show that lesbian women exhibit 2D:4D ratios more similar to heterosexual men, suggesting potentially greater prenatal exposure to androgens, and

that homosexual men show 2D:4D ratios more similar to heterosexual women, suggesting potentially lower prenatal exposure to androgens (McFadden et al., 2005). Because of contradictory evidence in the literature, it has been suggested that 2D:4D ratios may be indicators of sexual orientation only in men (Lippa, 2003a).

2.2 Methods

2.2.1 Participants

Twelve hundred and eight-four individuals between the ages of 19 and 72 participated in this study, including 315 men and 969 women. Participants were asked to select which option of four sexual orientation options best described them; heterosexual, homosexual, bisexual, or asexual, and there were 191 heterosexual, 64 non-heterosexual (homosexual and bisexual), and 60 asexual men, and 502 heterosexual, 202 non-heterosexual (homosexual and bisexual), and 265 asexual women. Participants were recruited through several separate and concurrent avenues, including postings on local websites (e.g., Craigslist), on the AVEN online web-community general discussion board, and through the University's human subject pool.

The average age of participants was 24.2 years for asexual women ($SD = 6.7$), 22.8 years for heterosexual women ($SD = 6.3$), and 29.1 years for non-heterosexual women ($SD = 9.4$), and there was a significant group difference in age, $F(2,971) = 56.83$, $p < .001$, with non-heterosexual women being significantly older than both asexual and heterosexual women. Asexual women were significantly older than heterosexuals. The average age of male participants was 26.9 years for asexual men ($SD = 10.5$), 25.2 years for heterosexual men ($SD = 8.5$), and 28.8 years for non-heterosexual men ($SD = 9.9$), and there was a significant group

difference in age, $F(2,312) = 3.758, p < .05$, with non-heterosexual men being significantly older than heterosexuals.

There were no significant group differences in highest level of education achieved, $\chi^2(2) = 3.10, p > .05$, with the majority of participants (88% asexual, 84% heterosexual, 87% non-heterosexual) having received at least some post-secondary education. Fourteen percent of asexual, 53% of heterosexual, and 57% of non-heterosexual individuals indicated that they were in a relationship, either committed or non-committed, and these proportions differed significantly, $\chi^2(2) = 164.07, p < .001$, with asexual participants being least likely to be in a relationship. The majority of participants identified themselves as Caucasian/White, with a large proportion (32%) of heterosexual participants identifying themselves as East Asian.

2.2.2 Procedure

The University's research ethics board approved all procedures. Data were collected between September and December 2010 via a web-based survey hosted by SurveyMonkey (Gordon, 2002). These data were collected amongst a questionnaire battery assessing physical and mental health, sexual functioning, and sexual behaviours, and the entire questionnaire battery took approximately 60 minutes to complete. The majority of asexual individuals were recruited from AVEN, while heterosexual and non-heterosexual participants were recruited via the authors' university's human subject pool, Craigslist and other targeted websites.

2.2.3 Measures

Demographic information

Participants reported their ethnicity (Caucasian/White, East Asian (Chinese, Japanese or Korean), South Asian, African American, First Nation, Hispanic, or 'other'). Table 2.1 presents

the ethnic breakdown of participants by sex and sexual orientation. Samples of asexual individuals included a relatively higher percentage of Caucasian participants than heterosexual or non-heterosexual samples, and the heterosexual samples had higher percentages of East Asian participants than did the non-heterosexual sample, and these differences were significant for both men and women ($\chi^2(10) = 38.108, p < .001$, and $\chi^2(12) = 186.487, p < .001$ respectively). Research has shown 2D:4D ratios to vary widely between ethnic groups (Manning, 2002; Manning, Churchill, & Peters, 2007).

Table 2.1 Ethnic composition of sample (percentages of entire sample that reported ethnicity)

n = number of participants in each group

	Asexual		Heterosexual		Non-Heterosexual	
	Male	Female	Male	Female	Male	Female
	(<i>n</i> =59)	(<i>n</i> =266)	(<i>n</i> =188)	(<i>n</i> =500)	(<i>n</i> =63)	(<i>n</i> =204)
Ethnicity						
Caucasian	88%	85%	53%	42%	59%	72%
East Asian	2%	3%	23%	35%	16%	11%
South Asian	2%	1%	9%	9%	5%	1%
African American	3%	1%	0%	1%	5%	1%
Hispanic	0%	3%	1%	3%	3%	1%
Other	5%	7%	14%	10%	12%	13%

Edinburgh Handedness Inventory (EHI)

The Edinburgh Handedness Inventory (Oldfield, 1971) is a measurement scale widely used to assess the dominance of a person's right or left hand in everyday activities ranging from writing to opening a box. This ten-item measure produces scores ranging from -100 for strong left-handedness to +100 for strong right-handedness, and a designation of left-handedness is usually assigned to those who score less than -40, ambidextrous to those who score between -40 and +40, and right-handed to those who score about +40 on this measure. The EHI has good test-retest reliability. Left-handed and ambidextrous participants were pooled together as non-right-handed, according to the widely accepted definition of handedness put forward by Rife (1940).

Finger length measurement

Finger lengths were self-measured following the methodology reported by Manning et al. (Manning, Scott, Wilson, & Lewis-Jones, 1998). Participants were provided with a link to an online ruler (<http://iruler.net>), and the instructions "Hold your right hand in front of you. Look at where your ring finger joins the palm of your hand. Find the bottom crease. Put the 0 of your ruler exactly on the middle of the bottom crease. Make sure the ruler runs straight up the middle of your finger. Measure to the tip of your finger (not your nail) in millimetres. It is important to do this as accurately as possible, every millimetre counts! Enter your finger-length measurements into the appropriate boxes below. Repeat for your right-hand index finger. Repeat measurements for the ring and index fingers of your left hand."

Number of older brothers and sisters

Participants responded to three questions that assessed their number of older brothers and sisters: “Do you have any biological siblings?” and “If you answered yes to the previous question, how many older brothers (sisters) do you have?”

2.2.4 Statistical analysis

Baseline group comparisons used analysis of variance (ANOVA) followed by the Tukey’s multiple comparisons test in cases of a significant overall effect. Given the significant age difference between groups, age was included as a covariate (ANCOVA) in all statistical analyses of demographic variables. Because 2D:4D finger-length ratios and handedness appear to be stable over time, and do not seem to be affected by postnatal variations in hormone levels (Manning, 2002), and because age did not affect 2D:4D ratios in men or women, we did not control for age in these analyses.

2.3 Results

2.3.1 Results for finger length ratios (2D:4D)

Finger length ratios can vary widely between ethnic groups, and research by Manning and colleagues showed there to be strong differences in mean 2D:4D ratios between populations (Manning et al., 2000). Thus to reduce variance, we restricted participants to those who self-identified as Caucasian/White in the following analyses. Further, while Caswell and Manning (2009) found self-report 2D:4D measurements to be a reliable method of digit-ratio measurement, they noted that future internet studies utilizing self-report 2D:4D measurements would show extreme values which should be removed. Accordingly, outliers were removed.

Following removal of outliers ($n = 36$; 1 asexual, 25 heterosexual, and 10 non-heterosexual), there were 639 participants (162 men – 42 asexual, 94 heterosexual, 26 non-heterosexual; 477 women - 193 asexual, 178 heterosexual, 106 non-heterosexual) who reported finger-length measurements allowing a calculation of 2D:4D (Table 2.2).

As expected, the mean (*SD*) 2D:4D ratio was greater for women than for men for both right-handed (.998 (.061) and .988 (.061) respectively), and left-handed (.989 (.056), .995 (.056) respectively) measurements; however, these differences were not significant, $t(605) = -1.661, p > .05$, and $t(605) = -1.031, p > .05$, for right-handed and left-handed measurements, respectively. This effect remained non-significant when sex differences in 2D:4D were compared between sexual orientation groups (Table 2.2).

The previous analyses showed that there was no significant difference in 2D:4D ratios between sexual orientation groups; however, they do not indicate whether there are differences in the length of 2D, the length of 4D, or the length of both fingers. We compared the absolute finger lengths for the 2D and 4D between sexual orientation groups for males and females, and there were no significant differences on measures of the length of 2D or 4D individually (Table 2.2).

Table 2.2 Finger length ratios for Caucasian participants by sexual orientation group

n = number of participants in each group, all p 's > .05

Variable	Asexuals	Non-Heterosexual	Heterosexuals	F
	Mean (SD)	Mean (SD)	Mean (SD)	
Women	($n=193$)	($n=106$)	($n=178$)	
Right 2D:4D	.996 (.063)	.997 (.049)	1.000 (.066)	$F(2,474) = .22$
Left 2D:4D	.992 (.054)	.996 (.062)	.996 (.056)	$F(2, 474) = .25$
Right 2D (mm)	71.68 (8.61)	72.21 (10.11)	72.49 (10.91)	$F(2,478) = .33$
Right 4D (mm)	72.06 (8.10)	72.65 (9.20)	72.49 (10.23)	$F(2,475) = .17$
Left 2D (mm)	71.71 (8.57)	72.24 (10.00)	72.18 (10.43)	$F(2,477) = .15$
Left 4D (mm)	72.34 (8.38)	72.60 (8.75)	72.83 (10.39)	$F(2,475) = .12$
Men	($n=42$)	($n=26$)	($n=94$)	
Right 2D:4D	.987 (.050)	.989 (.080)	.993 (.066)	$F(2,159) = .15$
Left 2D:4D	.995 (.053)	.986 (.069)	.990 (.055)	$F(2,159) = .20$
Right 2D (mm)	77.87 (9.45)	77.88 (11.03)	79.02 (12.24)	$F(2,159) = .20$
Right 4D (mm)	78.93 (8.62)	79.42 (14.11)	79.70 (12.09)	$F(2,159) = .06$
Left 2D (mm)	78.22 (9.68)	78.50 (10.87)	78.69 (12.28)	$F(2,159) = .03$
Left 4D (mm)	78.47 (8.84)	80.19 (13.44)	79.61 (12.47)	$F(2,159) = .21$

2.3.2 Results for handedness

There were 1280 participants who provided information on handedness (311 men; 60 asexual, 188 heterosexual, and 63 non-heterosexual, and 969 women; 265 asexual, 502 heterosexual and 202 non-heterosexual). Sex differences in handedness were examined for heterosexual participants alone, and there was no sex difference in handedness, $\chi^2(2) = 0.58, p > .05$. In contrast, non-heterosexual participants showed a sex difference in handedness, $\chi^2(2) = 3.82, p = .05$, with the percentage of non-right-handed non-heterosexual women (20%) being greater than the percentage of non-right-handed non-heterosexual men (9%). There were no sex differences in handedness among asexual participants alone, $\chi^2(2) = 0.14, p > .05$.

There was a significant difference in handedness frequencies between sexual orientation groups for all participants, $F(2, 1282) = 14.92, p < .001$, with 26% asexual, 12% heterosexual, and 18% non-heterosexual participants being non-right-handed. Asexual individuals were significantly more likely to be non-right-handed than both heterosexual, $p < .001$, and non-heterosexual groups, $p < .05$. However, there was no significant difference in handedness between non-heterosexual and heterosexual participants.

There was a significant difference in handedness frequencies between sexual orientation groups for women, $F(2, 966) = 12.23, p < .001$, with 25% of asexual women, 20% of non-heterosexual women, and 13% of heterosexual women being non-right-handed. Post-hoc tests showed asexual women to be significantly more likely to be non-right-handed than heterosexual women, $p < .001$. However, there was no significant difference between asexual and non-heterosexual women on this measure, $p > .05$. Non-heterosexual women were significantly more likely than heterosexuals to be non-right-handed, $p = .017$ (Figure 2.1).

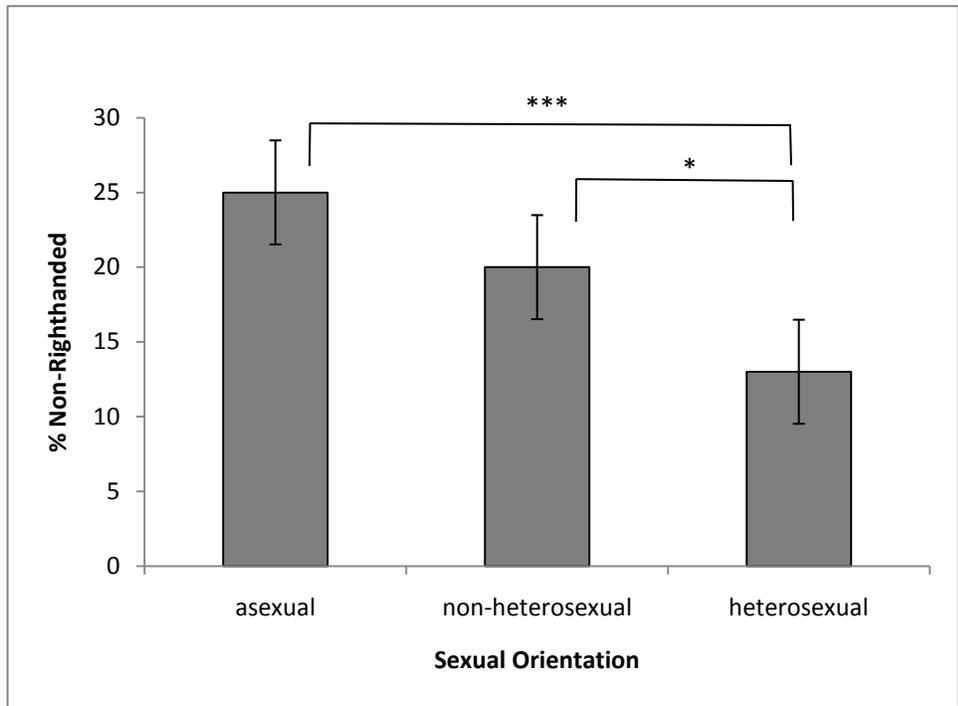


Figure 2.1 Percentage of non-right-handed participants by sexual orientation in women.

Significant group differences at *** $p < .001$, * $p < .05$

There was a significant difference in handedness frequencies between sexual orientation groups for men, $F(2,308) = 4.20$, $p = .016$, with 28% of asexual men, 10% of non-heterosexual men, and 13% of heterosexual men being non-right-handed. Post-hoc tests showed asexual men to be significantly more likely to be non-right-handed than both heterosexual and non-heterosexual men, both p 's $< .05$. Heterosexual men did not differ from non-heterosexual men on measures of handedness (Figure 2.2).

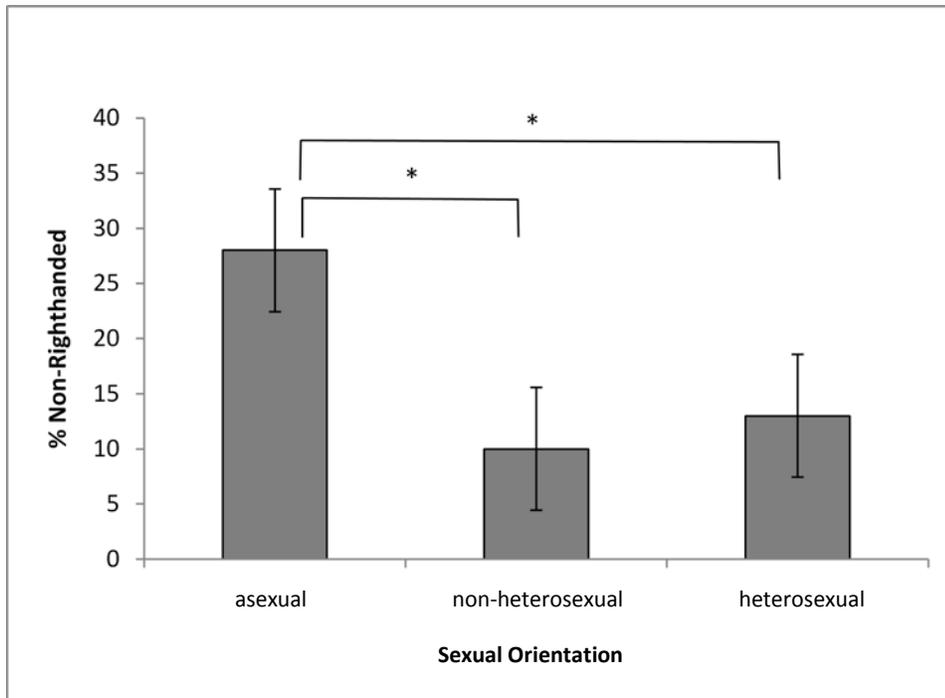


Figure 2.2 Percentage of non-right-handed participants by sexual orientation in men.

Significant group differences at * $p < .05$

2.3.3 Results for older siblings

There was a significant difference in number of older brothers between sexual orientation groups for men, $F(2,314) = 3.42, p < .05$. Post-hoc tests showed asexual men to be significantly more likely to have older brothers than their heterosexual counterparts, $p < .05$, (Figure 2.3a).

There was a significant difference between sexual orientation groups for right-handed men only, $F(2,261) = 5.39, p < .01$, but not for non-right-handed men only, $F(2,44) = 1.11, p > .05$ (Figures 2.3b and 2.3c). Post-hoc tests revealed right-handed asexual men to be significantly more likely to have older brothers than their heterosexual counterparts, $p < .01$ (Table 2.3).

There was a significant difference in number of older brothers between sexual orientation groups for women, $F(2,973) = 3.20, p < .05$. Post-hoc tests showed asexual women to be significantly less likely to have older brothers than their non-heterosexual counterparts, $p < .05$ (Figure 2.4a). There was no significant difference between sexual orientation groups for right-handed women, $F(2,799) = 1.15, p > .05$, but there was a marginally significant difference for non-right-handed women, $F(2,164) = 2.79, p = .06$ (Figures 2.4b and 2.4c). Post-hoc tests revealed non-right-handed asexual women to be significantly more likely to have older brothers than their heterosexual counterparts, $p = .05$ (Table 2.3).

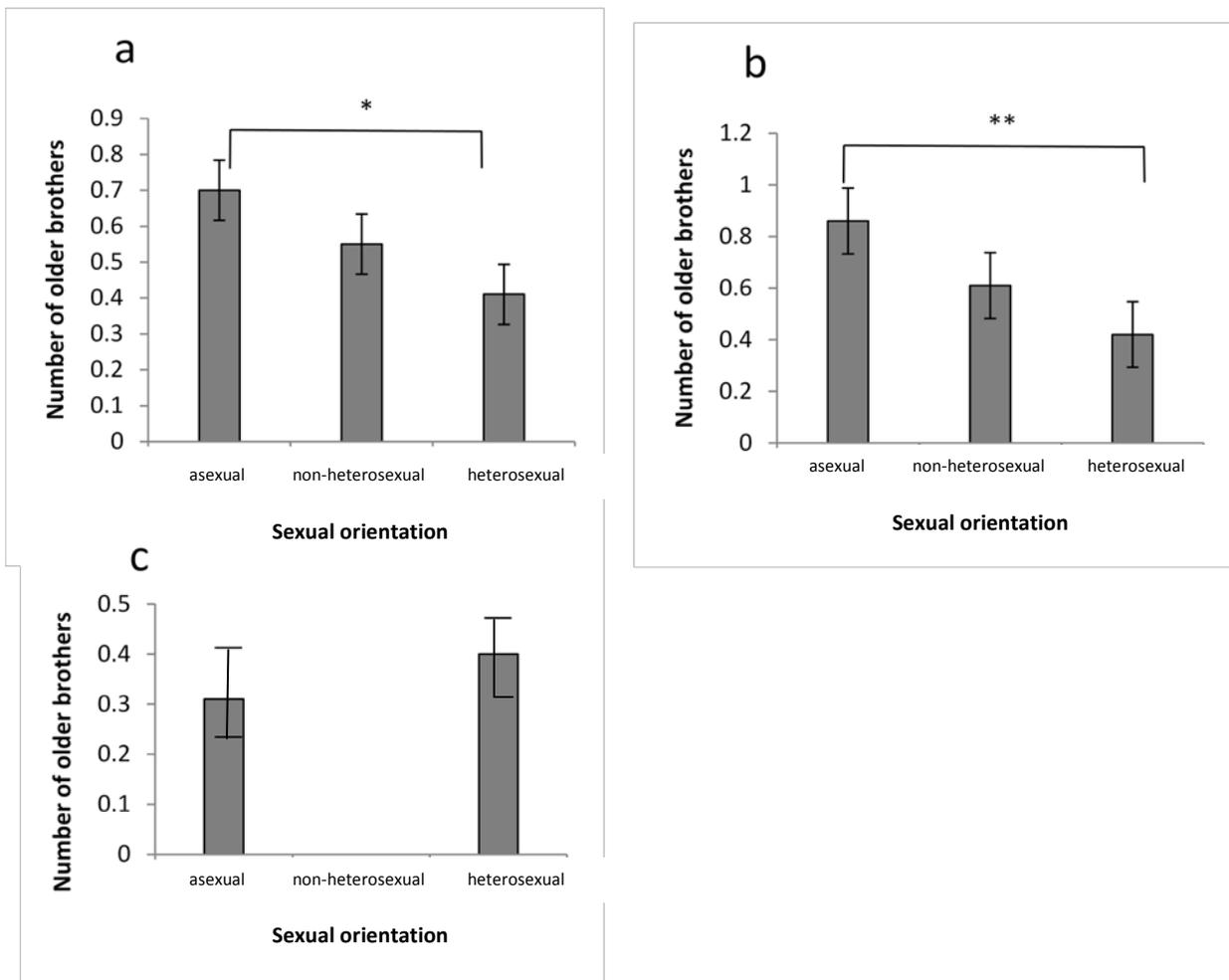


Figure 2.3. Number of older brothers by sexual orientation for a) all men, b) right-handed men only, and c) non-right-handed men only.

Significant differences at * $p < .05$, ** $p < .01$

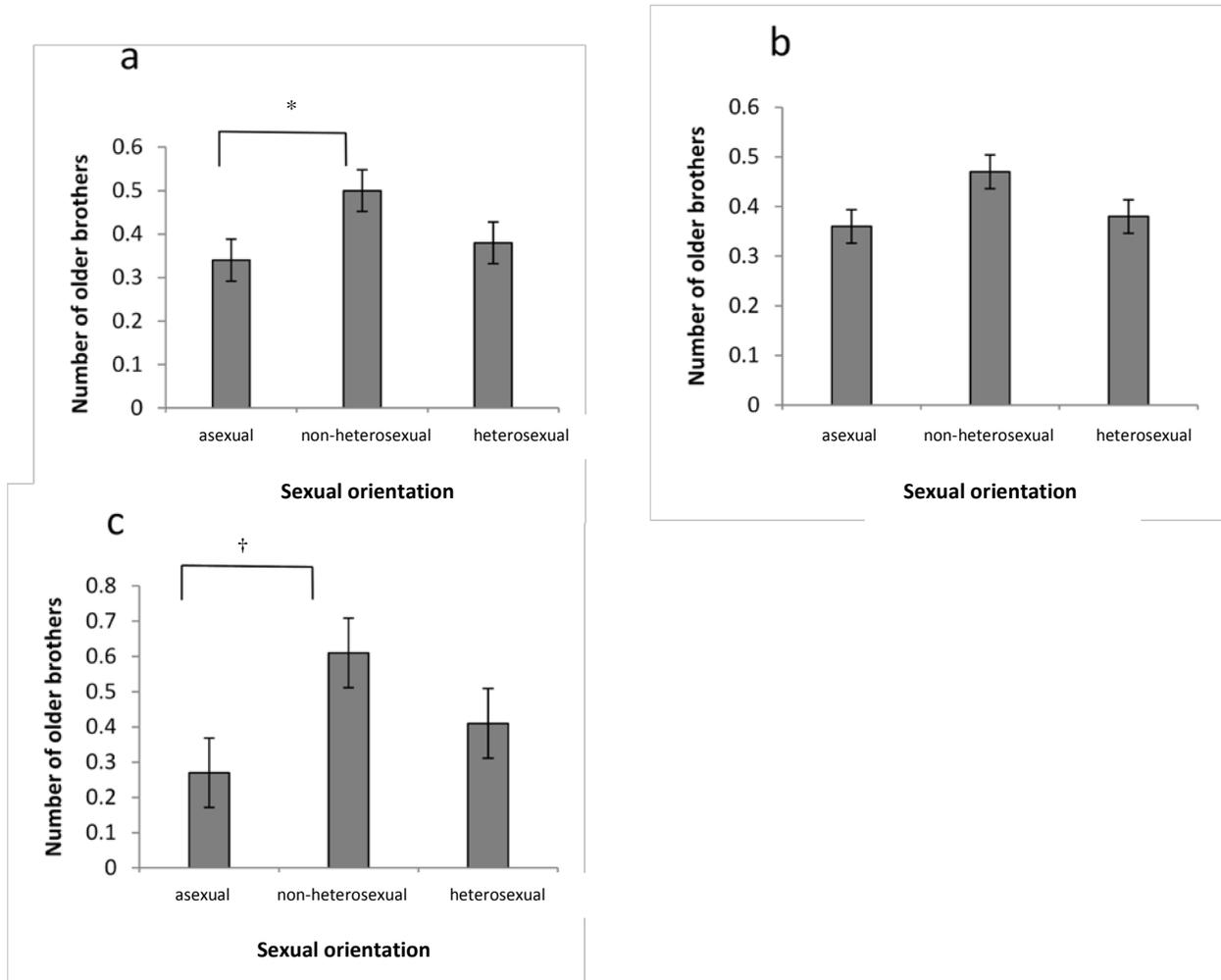


Figure 2.4. Number of older brothers by sexual orientation for a) all women, b) right-handed women only, and c) non-right-handed women only.

Significant differences at † $p = .06$, * $p = .05$

Table 2.3. Number of older brothers by sexual orientation for men and women

	Asexuals Mean (<i>SD</i>) (<i>n</i>)	Non-heterosexuals Mean (<i>SD</i>) (<i>n</i>)	Heterosexuals Mean (<i>SD</i>) (<i>n</i>)
All men*	.70 (.97) (<i>n</i> =61)	.55 (.94) (<i>n</i> =64)	.41 (.68) (<i>n</i> =192)
Right-handed men**	.86 (1.02) (<i>n</i> =44)	.61 (.98) (<i>n</i> =57)	.42 (.70) (<i>n</i> =163)
Non-right-handed men	.31 (.70) (<i>n</i> =16)	0 (<i>n</i> =6)	.40 (.58) (<i>n</i> =25)
All women*	.34 (.75) (<i>n</i> =268)	.50 (.77) (<i>n</i> =204)	.38 (.62) (<i>n</i> =504)
Right-handed women	.36 (.80) (<i>n</i> =198)	.47 (.69) (<i>n</i> =161)	.38 (.62) (<i>n</i> =443)
Non-right-handed women †	.27 (.59) (<i>n</i> =67)	.61 (1.05) (<i>n</i> =41)	.41 (.59) (<i>n</i> =59)

n = number of participants

Significant differences at * $p < .05$, ** $p < .01$, † $p = .06$

There was a significant difference in number of older sisters between sexual orientation groups for men, $F(2,314) = 7.89, p < .001$. Post-hoc tests showed non-heterosexual men to be significantly more likely to have older sisters than both their asexual and heterosexual counterparts, $p < .01$ and $p < .001$ respectively (Figure 2.5a). There was a significant difference in number of older sisters between sexual orientation groups for right-handed men, $F(2,261) = 6.48, p < .01$, but not for non-right-handed men, $F(2,44) = 1.37, p > .05$ (Figures 2.5b and 2.5c). Post-hoc tests revealed right-handed non-heterosexual men to have significantly more older sisters than their asexual and heterosexual counterparts, $p < .05$ and $p < .001$ respectively (Table 2.4).

There was a significant difference in number of older sisters between sexual orientation groups for women, $F(2,973) = 5.97, p < .01$. Post-hoc tests showed asexual women to have significantly fewer older sisters than both their heterosexual and non-heterosexual counterparts, $p < .05$ and $p < .01$ respectively (Figure 2.6a). There was a significant difference between sexual orientation groups for right-handed women, $F(2,799) = 6.06, p < .01$. Post-hoc tests showed right-handed asexual women to have significantly fewer older sisters than both their right-handed heterosexual and non-heterosexual counterparts, $p < .05$ and $p < .01$ respectively (Figure 2.6b). Finally, there was no significant difference in number of older sisters between sexual orientation groups for non-right-handed women, $F(2,164) = .58, p > .05$ (Table 2.4, Figure 2.6c).

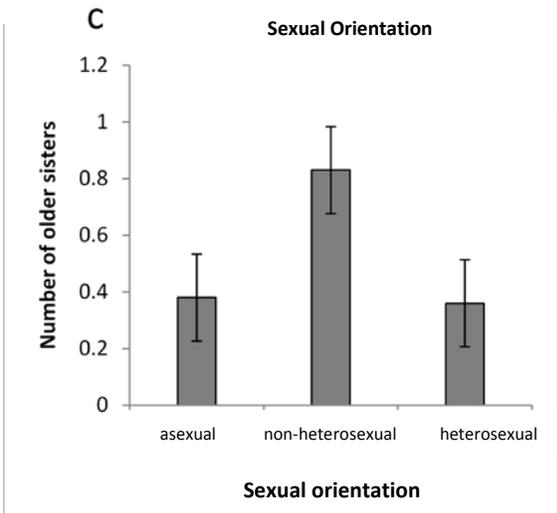
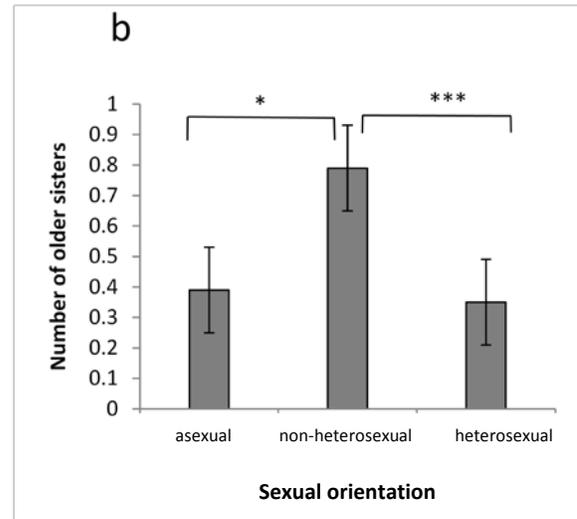
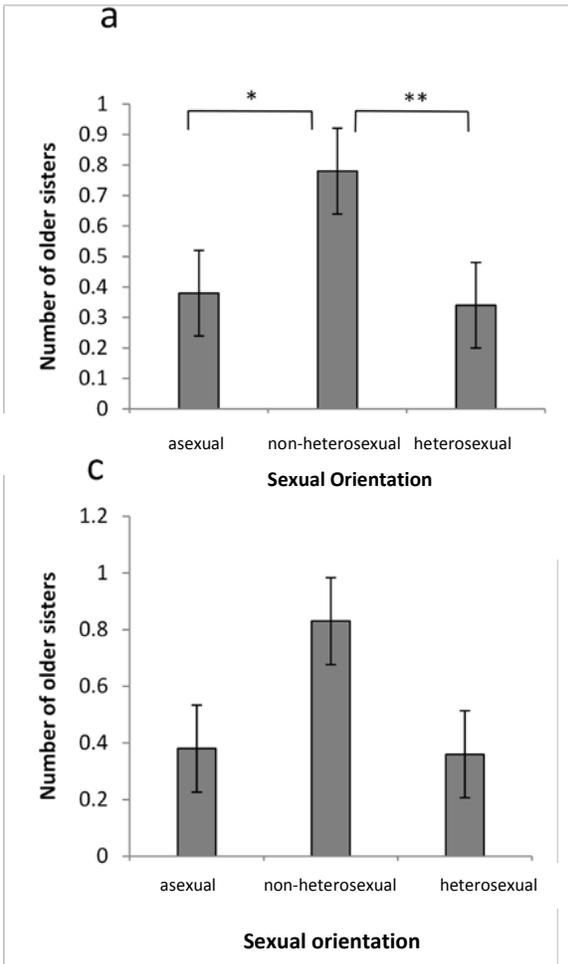


Figure 2.5. Number of older sisters by sexual orientation for a) all men, b) right-handed men only, and c) non-right-handed men only.

Significant differences at * $p < .05$, ** $p < .01$, *** $p < .001$

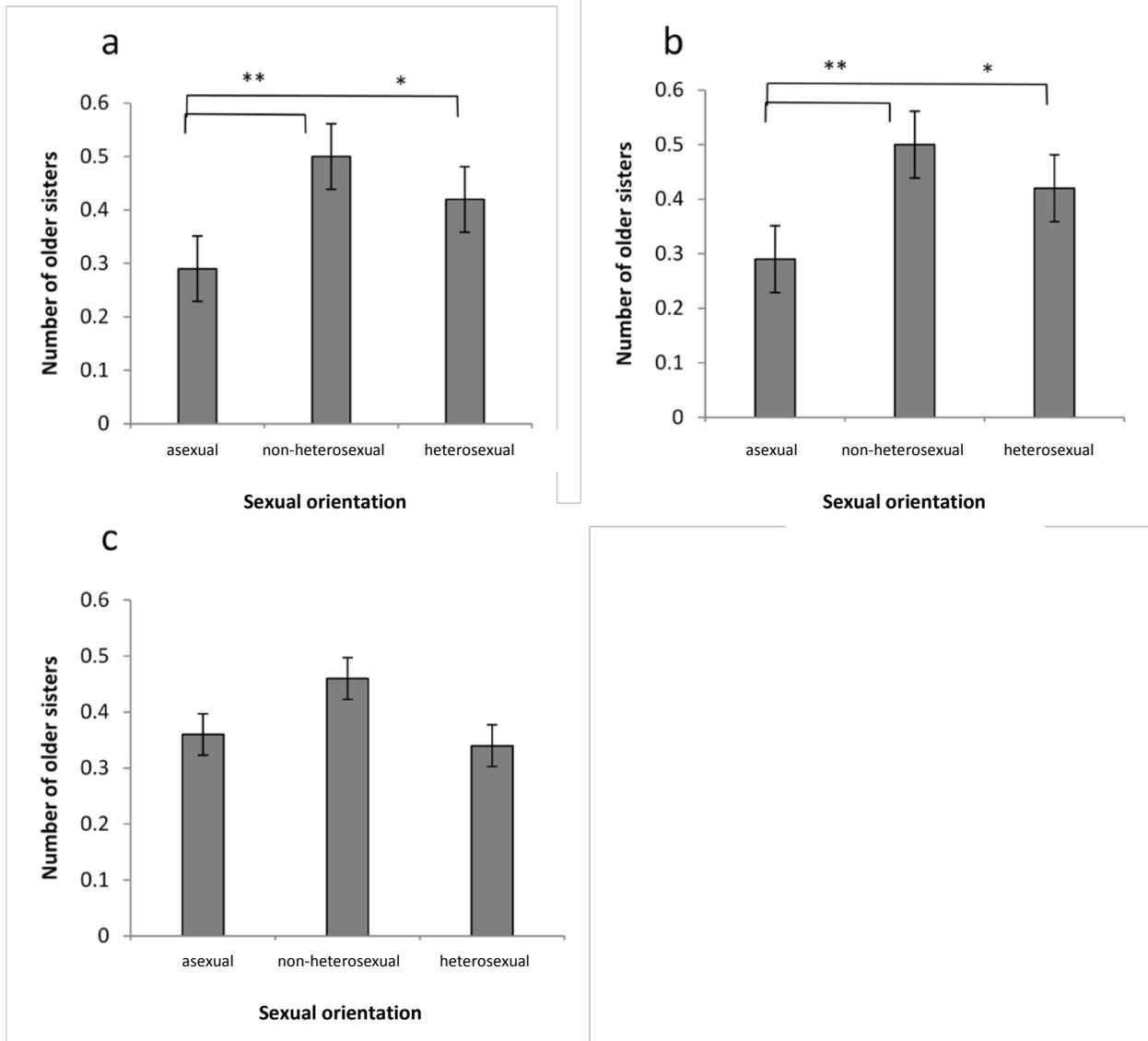


Figure 2.6. Number of older sisters by sexual orientation for a) all women, b) right-handed women only, and c) non-right-handed women only.

Significant differences at * $p < .05$, ** $p < .01$

Table 2.4. Number of older sisters by sexual orientation for men and women

	Asexuals Mean (<i>SD</i>) (<i>n</i>)	Non- heterosexuals Mean (<i>SD</i>) (<i>n</i>)	Heterosexuals Mean (<i>SD</i>) (<i>n</i>)
All men***	.38 (.73) (<i>n</i> =51)	.78 (1.10) (<i>n</i> =64)	.34 (.64) (<i>n</i> =192)
Right-handed men**	.39 (.78) (<i>n</i> =44)	.79 (1.14) (<i>n</i> =57)	.35 (.65) (<i>n</i> =163)
Non-right-handed men	.38 (.62) (<i>n</i> =16)	.83 (.75) (<i>n</i> =6)	.36 (.64) (<i>n</i> =25)
All women**	.29 (.64) (<i>n</i> =268)	.50(.73) (<i>n</i> =204)	.42 (.68) (<i>n</i> =504)
Right-handed women**	.27 (.66) (<i>n</i> =198)	.51 (.75) (<i>n</i> =161)	.44 (.69) (<i>n</i> =443)
Non-right-handed women	.36 (.59) (<i>n</i> =67)	.46 (.67) (<i>n</i> =41)	.34 (.54) (<i>n</i> =59)

n = number of participants

Significant differences at ***p* < .01, ****p* < .001

2.4 Discussion

2.4.1 Summary of findings

Asexuality is viewed by many in the asexual community as a sexual orientation (Brotto et al., 2010; Jay, 2008) and support continues to grow from the research community for a biologically-based theory of asexuality as a sexual orientation (Bogaert, 2006; Brotto & Yule, 2011). This study used three putative biological markers of sexual orientation to investigate these assertions; finger length ratios, handedness, and number of older siblings. This was the first study to associate handedness with asexuality, and asexual men and women were significantly more likely to be non-right-handed than their heterosexual counterparts. Also novel to this study, there were significant differences between sexual orientation groups on number of older siblings, both sisters and brothers, for male and female asexuals. There were no significant differences between sexual orientation groups on measures of finger length ratios in Caucasian participants, nor were there any differences in absolute finger lengths.

2.4.2 Discussion of handedness findings

There is considerable evidence for an association between non-right-handedness and homosexuality (Lalumière et al., 2000; Lippa, 2003b; Mustanski, Chivers et al., 2002; Rahman & Wilson, 2003), and some evidence that various indices of masculinity are linked to handedness in women, with this link being less empirically validated in men (Lippa, 2003b). The current results support previous findings (Lalumière et al., 2000; Lippa, 2003b; Mustanski et al., 2002) of an association between handedness and sexual orientation, with non-heterosexual women being significantly more likely to be non-right-handed than heterosexual women. We found non-heterosexual men not to differ on measures of handedness from their heterosexual counterparts;

however, this may be accounted for by our relatively small sample size of 60 non-heterosexual men. Importantly, and novel to this study, both asexual men and asexual women were significantly more likely to display non-right-handedness than their heterosexual counterparts. A large proportion of our asexual sample indicated that they were non-right-handed (25% of asexual women, and 28% of asexual men), a proportion that is much higher than the estimated incidence of non-right-handedness in the general population, which ranges from 9 to 11% (Corballis, 1991).

According to the linear prenatal hormone theory of sexual orientation, non-right-handedness is associated with hyper-androgenization in the prenatal environment. It follows that asexual individuals may have been exposed to higher levels of prenatal androgens, which would then be associated with their lack of sexual attraction. Further, it has been proposed that handedness is genetically determined (Klar, 2003; Rife, 1940), and thus may be independent from prenatal hormones. Hence, while the current study showed there to be a significant relationship between handedness and asexuality, the underlying mechanism remains unknown.

2.4.3 Discussion of older siblings findings

Previous research has consistently found that having a greater number of older brothers increases the odds of homosexuality in men, and this is known as the fraternal birth order effect (Blanchard & Lippa, 2007). This pattern is not observed for women, nor has it been shown true for number of older sisters, younger brothers, or younger sisters (Blanchard, 2004; Camperio-Ciani, Corna, & Capiluppi, 2004; Green, 2000). As discussed above, because the fraternal birth order effect holds true even for biological brothers raised in separate households, but not for step-brothers or adoptive brothers, it is hypothesized that it is due to effects of the prenatal

environment, and possibly to the progressive production by some mothers of anti-male antibodies in response to each successive male fetus, which then have an effect on the sexual differentiation of the male fetus (Blanchard & Bogaert, 1995).

Novel to this study was the finding of a significant relationship between number of older siblings, both sisters and brothers, with self-identification as asexual. Although our findings were not statistically significant for non-heterosexual men, the current findings support the observation (Blanchard & Lippa, 2007) that the effect of older brothers on sexual orientation is true for right-handed men only, and extends these findings to asexual men. We could speculate based on previous theories such as the maternal immune hypothesis that the prenatal environment is influenced by previous male siblings, and in turn influences the development of sexual attraction in the asexual male. However, as noted earlier, there are likely multiple influences on the development of sexual orientation, including asexuality. Further complicating matters, our unexpected finding that non-right-handed asexual women had significantly fewer older brothers than sexual women, as well as our finding of a significant relationship between older sisters and asexuality in both men and women makes it more difficult to speculate on a unified hypothesis as to the mechanism that might link number of older siblings with asexuality.

2.4.4 Discussion of finger length ratio findings

There are measurement concerns when utilizing techniques such as self-report 2D:4D measurements over the internet. Caswell and Manning (2009) noted that minor errors in self-measurement likely result in a reduction of effect size for both sexual dimorphism of 2D:4D and for correlations of 2D:4D with target variables, such as sexual orientation. They suggested the use of very large sample sizes, such as that used in the British Broadcasting Corporation (BBC)

Sex Differences Survey (Reimers, 2007), which had over 250,000 participants. While the BBC Internet Survey found significant sexual dimorphism in 2D:4D such that, as expected, males had lower 2D:4D than females, and significant differences were found between male sexual orientation groups, their self-report measures did have higher than expected mean 2D:4D and lower than expected effect sizes (Caswell & Manning, 2009; Manning et al., 2007). Because of the difficulty in sampling a sufficiently large asexual sample, and the necessity of using an internet-based methodology in finger-length measurement, it may be that the current sample was of insufficient size to detect variations in 2D:4D between sexual orientation groups. We suspect this to be the case in the current sample, as there was no evidence of sex differences, which is inconsistent with the majority of the existing literature (Manning, 2002). This problem is further compounded by the observed difference in finger lengths between ethnic groups (Manning, 2002; Manning et al., 2007), which necessitated the exclusion of a number of participants.

Internet surveys allow one to collect a large amount of data, and are particularly useful for the study of populations that are widely dispersed and may not otherwise be accessible, asexual individuals being a particularly good example of this. Thus, although using the internet to measure 2D:4D lengths is not without its limitations, it is an invaluable technique for collecting other, more reliable, data. Further, while there is some concern that internet surveys may result in repeat responses, non-serious participation, or maladjusted, socially isolated samples, these concerns have been waylaid by Gosling and colleagues (Gosling, Vazire, Srivastava, & John, 2004), who noted that internet methods could actually benefit researchers in that they can result in large and diverse samples with motivated respondents. Because of this, we believe that it is a valid method for gathering questionnaire data, in this case, handedness and older siblings.

2.5 Conclusion

This is the first study to test and provide empirical support for an underlying biological etiology to account for the lack of sexual attraction characteristic of asexuality. This is consistent with the previously demonstrated link between biological factors and sexual orientation more generally. It is unclear at this point, however, how this disposition arises, or at what stage in development it may occur. While there is a large amount of evidence suggesting that there is some prenatal influence on the development of sexual orientation, we simply do not yet have a clear and empirically supported model for what this looks like. In fact, even the most essentialist supporters of biological determinism of sexual orientation acknowledge the multifactorial and complex influences that likely lead to its development. Further research into genetic, hormonal, environmental, and social influences on asexuality is necessary, and additional large-scale studies are required to replicate the current findings on handedness and older siblings, and to gain insight into the true relationship between finger-length ratios and asexuality.

Chapter 3: Questionnaire development

3.1 Introduction

Asexuality has only very recently received any research attention, and previous research has identified asexual individuals using criteria such as self-identification or agreement with a statement such as “I have never felt sexually attracted to anyone at all” (Bogaert, 2004; Brotto et al., 2010). Due to limitations in recruiting sufficiently powered local samples, the majority of studies have relied on recruiting via online web-communities of asexuals, such as the Asexuality Visibility and Education Network (AVEN; asexuality.org; e.g., (Brotto et al., 2010; Prause & Graham, 2007)). These methods are problematic in that they either limit the sample to individuals who have been recruited through established asexuality networks/communities, or that the definition provided (e.g., “lack of sexual attraction”) may be ambiguous (Brotto & Yule, 2009; Hinderliter, 2009). Brotto and colleagues (Brotto et al., 2010) noted that those asexual individuals belonging to AVEN may be a distinct group of asexuals, as they have already acknowledged their asexuality as an identity. They postulated that possible motivating factors for joining such an online community (such as distress) may have inflated some of the findings in their study (e.g., psychopathology scores), underscoring the importance of finding a way to access a more representative group of asexuals. Further, it has been noted by members of the asexual community that the recognition of an asexual identity “enables asexuals to form a new self-image” (Radloff, 2008), suggesting that membership of such a community might influence or change the way that an individual lacking sexual attraction might respond to research questions.

In response to Prause and Graham’s (2007) finding that individuals who selected “asexual” from a multiple choice sexual orientation prompt (other options included

“Heterosexual/Straight,” “Homosexual/Gay,” and “Bisexual”), did not necessarily respond “asexual” to an earlier free-response question regarding sexual orientation (but rather wrote “heterosexual,” “mixed,” or “none”), Hinderliter (2009) noted that those individuals who did identify as “asexual” in the free-response item were likely recruited via asexuality.org. He went on to infer that those individuals who selected “asexual” from a multiple choice option, but did not indicate that they actively identify as asexual in an earlier free-response question on sexual orientation (instead writing “heterosexual” or “unsure”) were *not* recruited from asexuality.org. Hinderliter (2009) then made three suggestions; (1) those individuals who identify as asexual in a free-response query as to their sexual orientation will have spent more time thinking about asexuality and whether it is appropriate for them as a sexual identity, (2) asexual individuals recruited from asexuality.org will more closely fit the definition of asexuality as defined on AVEN, and (3) those asexuals recruited from online asexual communities will be strongly influenced by online discourses of asexuality, and the categories used to describe the experiences of asexuals. These suggestions raise serious concerns in regard to asexuality research conducted using only asexual individuals recruited from online web communities such as AVEN.

While the online community of asexuals that inhabits the AVEN website may be diverse (Brotto et al., 2010), it is almost certainly not representative of the entire population of asexuals that exists outside of this web-community. For example, there are likely a large number of asexual individuals without access to the internet, and these individuals may differ in age and/or socioeconomic status from those that are able to access the internet, and AVEN. Thus, research conducted on asexuals recruited using this recruitment method can only claim to represent online communities of asexual individuals, and not asexuals in general. It follows that conclusions

based on these studies may not take us any closer to fully understanding asexuality (Brotto & Yule, 2009).

This problem is compounded by the difficulty of defining or understanding sexual attraction for those who may not have ever experienced it before, and is further complicated by the fact that asexuals do feel nonsexual types of attraction, such as romantic attraction (Brotto et al., 2010). It may be the case that asexuals not recruited from asexuality websites do not distinguish between different types of attraction (Hinderliter, 2009). Thus, they may respond “heterosexual” or “homosexual” to a question about sexual attraction, when the attraction they are experiencing might be more accurately described as romantic attraction. This may be especially problematic when the study criterion for asexual classification relies on self-identification as asexual or the participant’s response to a single item, the method that has been employed to date. It follows that a larger number of items assessing concepts related to asexuality (in addition to sexual attraction) might be better able to identify asexuality.

Brotto and Yule (2009) noted that AVEN has been described as an important place in the identification process of asexual individuals, as it is a place where their experiences are validated, where they can discuss their lack of sexual attraction, and where they can find a sense of community. Very little is known, on the other hand, about the experiences of asexual individuals who have not yet “come out.” Very early asexuality research did not recruit from an online community of asexuals such as AVEN, and assessed asexuality based on the response “I have never felt sexually attracted to anyone at all” (Bogaert, 2004) to a question regarding sexual attraction, however it is unknown what proportion of these individuals might proceed on to self-identification as asexual, if they don’t already identify as such. It may very well be the case that those individuals who lack sexual attraction, but have never heard the term “asexuality” are more

isolated, distressed, or confused than those individuals who belong to an asexual community (Brotto & Yule, 2009). Because these two groups may differ from each other, and because research to date has focused solely on those who have already identified as asexual, our research findings thus far are skewed, and we cannot be certain that our prevalence estimates or correlates of asexuality are generalize to all asexual individuals (Brotto & Yule, 2009).

Ideally, research on asexuality would include individuals both from online asexual communities and those who had not yet come across these online communities. The best and only estimate of the prevalence of asexuality suggests that approximately 1% of the population is asexual (Bogaert, 2004). This, combined with the fact that many of these individuals, while they do not experience sexual attraction to anyone at all, may not have heard the term “asexuality,” makes it exceedingly difficult to recruit large enough sample sizes without the help of the online asexuality groups. This creates a difficult situation for researchers. Without some sort of objective measure of asexuality that can identify a lifelong lack of sexual attraction in those individuals who have not heard the term asexuality, it has thus far not been possible to study a representative sample of asexuals. Therefore, a second goal of this thesis was to develop a self-report questionnaire that assesses asexuality, in order that this might be used to identify asexual individuals who have yet to come across the term asexuality and/or online asexual communities. The goal of this questionnaire was not for it to be used as a descriptive tool, but rather that it would be a tool to identify individuals who experience little or no sexual attraction (and thus would likely identify with an asexual identity), whether or not they have identified as asexual. Thus, the focus of the questionnaire development described below was to identify items that best differentiate asexual individuals from their sexual counterparts.

This questionnaire was developed with the sole intent of differentiating asexual individuals from sexual individuals. It was not intended to provide any information about the phenomenon of asexuality itself, or to reveal anything about asexuals. Its intended use was as a tool to facilitate the attainment of more representative samples of asexuals, in order to allow researchers to more fully and effectively investigate asexuality. One of the difficulties in developing such a questionnaire would be to avoid assuming a strict gender binary (Hinderliter, 2009). In fact, asexual individuals may avoid identifying their sex as strictly “male” or “female,” and may not define their gender in terms of the traditional gender dichotomy. They may instead use terms such as “agendered,” “gender queer,” or “pan-asexual gender free” to label their gender (Brotto et al., 2010). Thus, we attempted to develop this questionnaire to be useful regardless of sex or gender identity, and included individuals who did not firmly identify as either “male” or “female.” We also hoped to make this questionnaire clear and understandable, and to be relatively simple to administer and score.

The questionnaire was developed in 4 Stages to be reported separately: Stage 1 – development and administration of open-ended questions, Stage 2 - development of initial multiple choice items, Stage 3 – administration and analysis of 111 items in order to determine which items to retain, and which to exclude, Stage 4 – administration and analysis of retained items

3.2 Methods

3.2.1 Stage 1 - Development and administration of open-ended questions

The initial open-ended item pool was generated through discussion between the graduate student (Morag Yule), who has extensive experience with asexuality research, and an experienced sex therapist and expert on sexuality and asexuality research, Dr. Lori Brotto, located in Canada, during July 2009. The goal of this discussion was to generate open-ended questions that would allow the gathering of the most useful information regarding how best to differentiate asexual individuals from sexual individuals. The resulting eight open-ended questions focused on definitions of asexuality, sexual attraction, sexual desire and romantic attraction, and included solicitations of the asexual individual's opinions on factors that initially led them to identify as asexual, how they distinguish asexuality from low sexual desire, how they might have described their sexuality before they came across the term 'asexual' and what questions they would use to identify an individual as asexual but has yet to come across the term. There were no space limitations, and participants were encouraged to answer in as much or as little detail as they felt necessary. See Appendix A for the initial open-ended item pool.

Participants

Two samples were used to assess themes in these eight open-ended questions. Asexual participants: One hundred thirty nine individuals who self-identified as asexual were recruited from the AVEN website during the months of August and September 2009 and presented with the eight open-ended questions developed above in an online survey. Age range of asexual participants was 18 – 56 years. The mean age was 27.29 ($SD = 2.8$) years. Thirty six

(25%) of asexuals were male, 89 (64%) were female, three (2%) reported selected “other” sex, and 11 (8%) gave no response.

Sexual participants: In order to differentiate how responses might differ between sexual and asexual participants, a modified version of these eight open-ended questions was administered to 66 sexual individuals (who self-identified as heterosexual, bisexual or homosexual) via online recruitment through Craigslist and Facebook. Age range of sexual participants was 18 – 75 years. The mean age was 25.95 (1.31) years. Seventeen (24%) of sexual participants were male, 51 (73%) were female, one (1%) chose “other,” and one (1%) did not answer.

3.2.2 Stage 2 - Development of initial multiple choice items

Responses to the open-ended questions in Stage 1 were examined to identify prevalent themes and ideas. Recruitment of additional participants was not necessary, as themes appeared to be saturated with the current sample. This information was used to generate 111 items (Asexuality Identification Scale – 111; AIS-111) addressing 15 Concepts. These included: 1 - Sexual Attraction/Desire (16 items assessing sexual attraction and sexual desire); 2 - Masturbation (5 items assessing desire to masturbate and pleasure obtained from masturbation); 3 - Sexual Fantasy (7 items assessing presence and frequency of sexual fantasy); 4 - Erotica (3 items assessing enjoyment and arousal derived from viewing erotic films); 5 - Distress (15 items assessing level of distress experienced in relation to the participant’s sexuality); 6 - Sexual Activity (15 items assessing enjoyment of sexual activity); 7 - Sexual Identity (9 items assessing how the participant’s sexuality is related to their identity); 8 - Disgust (4 items assessing repulsion or disgust of sexual activity); 9 - Physiological Sexual Arousal (5 items assessing physiological sexual arousal or sex drive); 10 - Inability to Relate to Other’s Sexuality (7 items);

11 - Disinterest in Sex (10 items); 12 - Religion (2 items assessing impact of religiosity on sexuality); 13 - Sexual Avoidance (2 items); 14 - Relationships (6 items assessing beliefs about sexuality within relationships); and 15 – Romantic Attraction and Intimacy (5 items assessing the belief of romantic and sexual attraction as distinct constructs). Each item was scored on a 5-point Likert scale, with several items that depended on sexual activity containing an opt-out alternative (ie. “I have never experienced sexual activity” See Appendix B). Concept names and numbers were retained throughout this process to ensure continuity and to simplify discussion.

3.2.3 Stage 3 - Administration and analysis of the Asexuality Identification Scale - 111

Administration of the Asexuality Identification Scale - 111

Study design

The initial items in the AIS-111 developed during Stage 2 were administered to 172 individuals who self-identified as asexual and 755 sexual individuals (who self-identified as heterosexual, bisexual or homosexual) in an online survey. Participants were recruited through several separate avenues, including postings on international websites (e.g., Craigslist), on the AVEN online web-community, through the university’s human subject pool, and through websites that host psychological online studies (e.g., Hanover College’s ‘Psychological Research on the Net website).

Participants

Asexual participants: Asexual participants ranged from 18 to 69 years old, with a mean age of 26.30 (.69) years. 82% noted that they were not in a relationship, and the majority (87%) had at least some post-secondary education. Most asexuals reported being Caucasian (85%). One

hundred five (61%) were female, and 35 (20%) were male. Twelve (7%) reported being transgender, and 20 (12%) selected “other” as their sex. Transgendered individuals were not included in the following analyses.

Sexual participants: Sexual participants ranged from 18 to 80 years old, with a mean age of 24.59 (.30) years. Six hundred and twelve self-identified as heterosexual, 98 were bisexual, and 45 were homosexual. 39% reported being single and the majority (85%) had at least some post-secondary education. A large proportion (52%) of participants reported being Caucasian or East Asian (28%). Four hundred ninety nine (66%) were female, and 246 (33%) were male. Five (0.7%) reported being transgender, and 5 (0.7%) selected “other” as their sex. Transgendered individuals were not included in the following analyses.

Analysis of the Asexuality Identification Scale - 111

A greater amount of information can be gained from questions without an opt-out choice (e.g., those questions that can be answered whether or not the participant has experienced sexual activity or masturbation). Therefore, most items that necessarily included an opt-out response were removed at this point, leaving 96 items. Items 9 and 10, which address the Concepts of Masturbation and Erotica, necessarily included an opt-out response, and were retained in the item pool as these items were deemed necessary to obtain a more accurate measure of these two Concepts.

Discriminant analysis

The item scores in each of the 15 Concepts were averaged and discriminant analysis was conducted in order to predict sexual or asexual group membership. Predictor variables were the

15 Concepts compiled in Stage 2. The goal of this discriminant analysis was to identify which Concepts best discriminate between sexual and asexual participants. Using this technique, it is possible to group sexual and asexual participants based on their responses to the items on the AIS-111. By generating a function from a sample in which group membership is known (as it is here via self-identification by sexuals and asexuals), this function can then be used in new samples where group membership is unknown (i.e., individuals in the general public who lack sexual attraction, where they may not have yet come across the term “asexual”). That is, knowing an individual’s score on a series of questions, we can use the discriminant function to determine whether that individual belongs in the sexual or the asexual group (Burns & Burns, 2008).

Significant mean differences between sexual and asexual groups were observed for all Concepts except Distress (Table 3.1). The discriminant function revealed a significant association between groups and all predictors, accounting for 71.91% of between group variability, although closer analysis of the unstandardized canonical discriminant function revealed three significant predictors, namely Sexual Attraction/Desire, Identity, and Distress (Table 3.2). This finding indicates that, controlling for all other variables, Sexual Attraction/Desire, Distress, and Sexual Identity predicted group membership.

Table 3.1 - Mean Concept scores for sexual and asexual participants for the Asexuality Identification Scale – 111

Concept	Mean Scores (SD)		<i>p</i>-value
	Sexual (n = 755)	Asexual (n = 172)	
1. Sexual Attraction/Desire	4.09 (.55)	2.46 (.29)	< .001
2. Masturbation	2.84 (1.32)	2.08 (1.25)	< .001
3. Fantasy	3.54 (.72)	2.06 (.51)	< .001
4. Erotica	3.68 (1.17)	2.03 (1.24)	< .001
5. Distress	2.06 (.72)	1.96 (.80)	.112
6. Sexual Activity	3.99 (.76)	1.90 (.55)	< .001
7. Sexual Identity	4.13 (.73)	2.16 (.45)	< .001
8. Disgust	4.38 (.80)	2.70 (1.24)	< .001
9. Physiological Sexual Arousal	3.23 (.62)	2.07 (.44)	< .001
10. Inability to Relate to Other's Sexuality	2.21 (.84)	4.03 (.63)	< .001
11. Disinterest in Sex	4.12 (.65)	2.26 (.58)	< .001
12. Religion	4.26 (1.14)	4.56 (.85)	.002
13. Sexual Avoidance	3.80 (.61)	1.93 (1.05)	< .001
14. Relationships	3.52 (.61)	1.91 (.61)	< .001
15. Romantic	2.91 (.63)	2.28 (.73)	< .001

Table 3.2 - Discriminant analysis output for the Asexuality Identification Scale - 111

Concept	Unstandardized Canonical Discriminant Function	Structure Matrix
1. Sexual Attraction/Desire	1.119	.748
2. Masturbation	-.034	.137
3. Fantasy	-.220	.511
4. Erotica	.120	.331
5. Distress	.758	.033
6. Sexual Activity	.202	.684
7. Sexual Identity	.848	.681
8. Disgust	-.016	.445
9. Physiological Sexual Arousal	-.052	.464
10. Inability to Relate to Other's Sexuality	-.053	-.538
11. Disinterest in Sex	.050	.693
12. Religion	-.198	-.065
13. Sexual Avoidance	-.062	.386
14. Relationships	.173	.624
15. Romantic	.058	.231

The high loading of Distress onto the canonical discriminant function is unexpected and challenging to interpret. In addition to the lack of significant difference between mean scores on the Concept of Distress between sexual and asexual participants (Table 3.1), lack of distress is fundamental to our current conceptualization of asexuality, such that asexual individuals do not generally experience distress in relation to their lack of sexual attraction (Brotto et al., 2010). Thus, we would expect Distress to load very weakly onto this model. Further, the structure matrix of the discriminant analysis placed distress as having a very small correlation (.033) with the discriminant function (Table 3.2). Many researchers use the structure matrix table in their discriminant analyses, as it is considered to be more accurate than the canonical discriminant function table (Burns & Burns, 2008; Stevens, 2002). The structure matrix table in this particular case is easier to interpret, however more information may be gleaned from the canonical discriminant function table.

Because the goal of this measure was to distinguish between asexual and sexual participants rather than describe or evaluate characteristics of asexuality, Distress was removed from further analyses, as there was no significant mean difference between groups for this Concept, and this seemingly aberrant finding was not replicated in a new sample. The other two high loading Concepts, Sexual Attraction/Desire and Identity, were retained, and all other Concepts discarded.

Reliability of Concepts

Using the Cronbach's alpha statistic, we next examined the reliability (internal consistency) of the two remaining Concepts (Sexual Attraction/Desire and Identity), as well as how well each individual item contributed to each Concept. Reliability of each Concept was

clearly demonstrated, with both Concepts having a high reliability of $\alpha > .85$ (Table 3.3). The majority of items contributed strongly to their Concepts.

Table 3.3 – Item and Concept reliability

Concept	Standardized Cronbach's alpha value	Item Number	Correlation with total	Cronbach's Alpha if Item Deleted
1. Sexual Attraction/Desire	.940	5 - I know what it is like to experience sexual attraction:	.833	.935
		6 - I have a difficult time defining sexual attraction	.497	.943
		33 - Compared to most people I know, I would describe my level of sexual desire as being	.757	.938
		35 - I experience sexual attraction towards other people	.878	.934
		36 - Compared to most people I know, I would describe my level of sexual attraction to others as being	.781	.937
		49 - I've never been sexually attracted to anybody at all	.845	.935
		45 - I find myself pretending to be sexually attracted to other people to avoid judgment	.379	.945
		72 - I used to experience sexual attraction, but I do not anymore	.181	.948
		73 - I have lost the feeling of sexual attraction towards others	.771	.937
		74 - I have lost the feeling of sexual desire towards others	.759	.937
		82 - I find other people to be sexually appealing	.829	.935
		83 - My level of sexual attraction towards others has changed over the years	.521	.943
		88 - I find myself experiencing sexual attraction towards another person:	.840	.936
		94 - I have never felt drawn toward another person sexually	.831	.935
		39 - I crave sexual activity with other people	.737	.938
7. Sexual Identity	.891	16 - I feel that my (lack of) sexual attraction is a part of my identity	.620	.885
		12 - I consider myself to be a sexual person	.623	.885
		26 - I feel disconnected from my sexuality	.534	.891
		50 - I don't feel that I fit the conventional categories of sexual orientations such as heterosexual, homosexual or bisexual	.797	.870
		42 - I feel as if my sexuality is different from most people's	.703	.878

Table 3.3, continued – Item and Concept reliability

Concept	Standardized Cronbach's alpha value	Item Number	Correlation with total	Cronbach's Alpha if Item Deleted
7. Sexual Identity continued		52 - I do not identify with most people's descriptions of their sexuality	.798	.870
		64 - I have difficulty figuring out which sexual orientation I belong to	.530	.891
		86 - I feel that I'm in a constant state of questioning my sexual orientation	.507	.893
		87 - The term 'non-sexual' would be an accurate description of my sexuality	.751	.874

Bolded items were retained

Selection of individual items

Individual items were selected based on how well they contributed to each Concept's reliability, while taking the wording of and similarity between items into account. For example, the item "I have lost the feeling of sexual attraction towards others ..." is highly similar to the item "I have lost the feeling of sexual desire towards others ..." (response options for both items include: completely true, somewhat true, neither true nor false, somewhat false, completely false)." Both items had high reliability ($\alpha = .771$ and $\alpha = .759$ respectively). The item addressing sexual desire was retained, while the item addressing sexual attraction was discarded. Because, as mentioned above, there is some difficulty distinguishing between the terms sexual attraction and sexual desire, the highest loading item containing the term "desire" item was retained in order to include at least two items that included the word "desire." The resulting version of the Asexuality Identification Scale (AIS-10) contained 10 items: Eight items from the Concept of Sexual Attraction/Desire (Items 5, 33, 35, 49, 74, 82, 88, and 94), and two items from the Concept of Identity (Items 50 and 87). Retained items are bolded in Table 3.3. Also see Appendix C.

3.2.4 Stage 4 – Administration and analysis of the Asexuality Identification Scale - 10

Study design

The 10 items (AIS-10) retained during Stage 3 were administered to 317 individuals who self-identified as asexual, and 927 sexual individuals (who self-identified as heterosexual, bisexual or homosexual) in an online survey. Participants were recruited through several separate avenues, including postings on international websites (e.g., Craigslist), on the AVEN online web-community, through the university's human subject pool, and through websites that

host psychological online studies (e.g., Hanover College's 'Psychological Research on the Net website). The current sample was comparable to the sample assessed in Stage 3 above with respect to proportion of participants recruited from each of these avenues.

Participants

Asexual participants: Asexual participants ranged from 18 to 72 years old, with a mean age of 24.74 (7.6) years. Sixteen percent noted that they were in a relationship, either committed or non-committed, and the majority (88%) had at least some post-secondary education. Most asexuals reported being Caucasian (84%). Sixty one (19%) asexuals were male, 253 (81%) were female, and 3 (1%) selected "other" as their sex.

Sexual participants: Sexual participants ranged from 18 to 69 years old, with a mean age of 25.04 (8.23) years. Six hundred and twenty self-identified as heterosexual, 138 were bisexual, and 130 were homosexual. Fifty five percent reported being in a relationship and the majority (86%) had at least some post-secondary education. A large proportion reported being either Caucasian (51%) or East Asian (26%). Two hundred fifty six (28%) were male, 669 (72%) were female, and two (.2%) selected "other" as their sex.

Statistical analysis

Significant mean differences between sexual and asexual participants were observed for both predictor variables (the Concepts of Sexual Attraction/Desire and Sexual Identity), as well as for the total score (Table 3.4), indicating that the AIS-10 was an appropriate tool for distinguishing between these two groups, and that each predictor variable did differentiate between the two groups.

Table 3.4 - Mean scores for sexual and asexual participants for the Asexuality Identification Scale - 10

Concept	Mean Scores (SD)		<i>p</i>-value
	Sexual (n = 927)	Asexual (n = 317)	
Sexual Attraction/Desire	4.13 (.61)	1.82 (.69)	< .001
Sexual Identity	4.29 (.86)	1.72 (.74)	< .001
Total Score	4.16 (.58)	1.80 (.61)	< .001

Reliability of items in the Asexuality Identification Scale - 10

Using the Cronbach's alpha statistic, we next examined the reliability (internal consistency) of the two Concepts (Sexual Attraction/Desire and Identity), as well as how well each individual item contributed to each Concept. Reliability of each Concept was clearly demonstrated. Sexual Attraction/Desire had a high reliability, while Sexual Identity was moderately reliable (Table 3.5). The majority of items in both Concepts contributed strongly. One item, "I have lost the feeling of sexual desire towards others", had a much lower reliability than the other items.

Table 3.5 – Item and Concept reliability for the Asexuality Identification Scale - 10

Concept	Standardized Cronbach's alpha value	Item Number	Correlation with total	Cronbach's Alpha if Item Deleted
Sexual Attraction/Desire	.940	I know what it is like to experience sexual attraction:	.857	.935
		Compared to most people I know, I would describe my level of sexual attraction to others as being	.768	.937
		I experience sexual attraction towards other people	.912	.934
		I have lost the feeling of sexual desire towards others	.368	.937
		I find other people to be sexually appealing	.814	.935
		I have never felt drawn toward another person sexually	.862	.935
		I find myself experiencing sexual attraction towards another person:	.867	.936
Sexual Identity	.702	The term 'non-sexual' would be an accurate description of my sexuality	.541	.874
		I don't feel that I fit the conventional categories of sexual orientations such as heterosexual, homosexual or bisexual	.541	.870

Creating a cut-off score for the Asexuality Identification Scale - 10

A threshold score of 25/50 on the total score of the AIS-10 was found to capture 89% of individuals who self-identified as asexual. That is, 89% of asexuals scored below 25 on this measure, while 97% of self-identified sexual participants scored above 25.

Validity

In order to demonstrate that the items on the AIS-10 were measuring what we believed them to be measuring (i.e., asexuality), and not some other construct, a series of validation techniques were conducted as follows:

1. Convergent validity: To assess whether the questionnaire correlates with a similar construct (i.e., sexual desire), the degree of association between summed AIS-10 Total scores and Dyadic and Solitary scores on the Sexual Desire Inventory (SDI; (Spector, Carey, & Steinberg, 1996)), a measure that attempts to capture a cognitive (rather than behavioural) aspect of sexual desire, was calculated by means of the Pearson product-moment correlation. Although the SDI was constructed to tap into the construct of sexual desire, rather than sexual attraction, these two concepts are very similar, and the terms are often conflated when discussing asexuality and desire disorders such as HSDD. Many of the items on the SDI refer to desire in response to an “attractive person,” or otherwise assume the presence of sexual attraction. Because an asexual’s lack of sexual attraction would very likely lead to a lack of sexual desire, we would expect a low score on the SDI (indicating low desire) to correspond with a low score on the AIS-10 (indicating asexuality) for asexual individuals. Specifically, we would predict that low scores on the Dyadic Scale of the

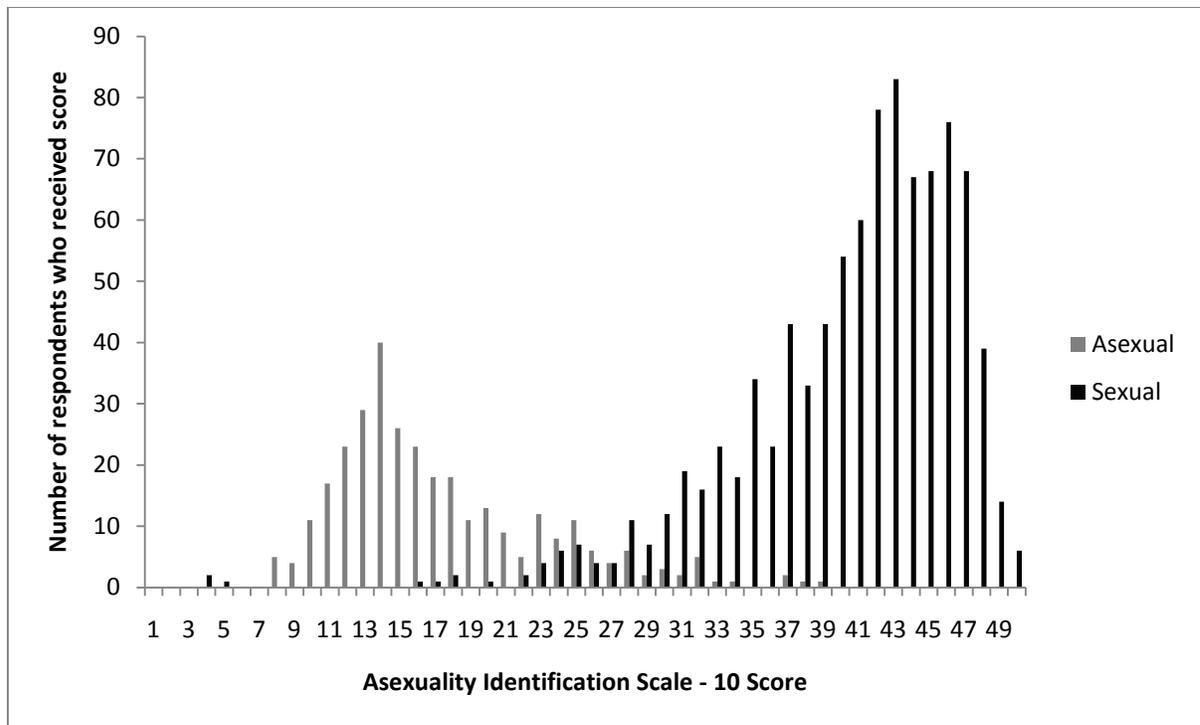


Figure 3.1. Distribution of total scores on the Asexuality Identification Scale – 10 for asexual and sexual participants.

SDI would correspond significantly with high scores on the AIS-10. We would not expect to see any strong correlation between the AIS-10 and Solitary Desire scores on the SDI, as most items on the AIS-10 pertain to interpersonal attraction/desire. As expected, the SDI Solitary subscale correlated only modestly ($\alpha = .383$) with total scores on the AIS-10. The SDI Dyadic subscale did have a strong correlation ($\alpha = .852$) with total scores on the AIS-10 (Table 3.6).

2. Incremental validity: In order to determine whether the instrument is a more accurate measure of asexuality than existing instruments might be, scores on the AIS-10 were compared with participant scores on the Klein Scale (Klein & Sepekoff, 1985), which traditionally measures several dimensions of sexual orientation, and was adjusted to include asexuality as a sexual orientation. The original Klein scale asks participants to select their “choice partner or associate” (in the past, in the present and their ideal partner) on a number of measures, including sexual attraction, sexual behaviour, sexual fantasies, emotional preference and social preference. Participants are given seven choices, ranging from “other sex only” to “same sex only.” An additional category was added to allow the selection of “neither sex” for these items. A second section of the Klein Scale asks participants about their “identity of lifestyle” (again past, present and ideal), including lifestyle preference, social identity and political identity. Participants are asked to select their choice of seven items, ranging from “heterosexual only” to “homosexual only.” In order to make these items accessible to asexual participants, we added options allowing participants to select an asexual identity for these three items. Incremental validity was good, as the AIS-10 correlated only weakly with the Klein scale (Table 3.6).

3. Discriminant validity: The Childhood Trauma Questionnaire (CTQ: (Bernstein & Fink, 1998; Bernstein et al., 1994)) was included to ensure that endorsement of items that may be construed to indicate asexuality are not, instead, an indicator of negative sexual experiences. The CTQ provides a brief, reliable, and valid assessment of a broad range of potentially traumatic experiences experienced in childhood. Subscales on the CTQ include: Emotional Abuse (EA), Physical Abuse (PA), Sexual Abuse (SA) and Physical Neglect (PN). Higher scores on the CTQ indicate higher rates of abuse. We predicted that scores on the AIS-10 would not be correlated with CTQ scores. Discriminant validity was as expected, as scores on the AIS-10 were only weakly correlated with the CTQ (Table 3.6).

Table 3.6 – Pearson product-moment correlation between the Asexuality Identification Scale

- 10 Total Score and other measures

	Pearson Correlation All participants
Convergent Validity	
SDI Solitary	.383**
SDI Desire	.852**
Incremental Validity	
Klein – Attraction	.279**
Klein – Behaviour	.227**
Klein – Fantasy	.198**
Klein - Emotional	-.114**
Klein – Social	-.040
Klein – Lifestyle	.119**
Klein – Identity	.128**
Klein – Political	.134**
Klein - Total	.230**
Discriminant Validity	
CTQ-EA	-.137**
CTQ-PA	-.024
CTQ-EN	-.211**
CTQ-PN	-.139**
CTQ-SA	-.046
CTQ-Total	-.157**

3.3 Discussion

The objective of the present study was to develop a brief, valid, and reliable self-report measure of asexuality, which could be easily administered to individuals across a wide age-range and self-identified sex and gender. The AIS-10 (hereafter referred to as the AIS) was designed to be used as an objective tool to distinguish asexual individuals from sexual individuals.

The AIS was developed in a series of stages, including development and administration of open-ended questions to sexual and asexual individuals, development of initial multiple choice items, and analysis of these items to facilitate selection of final items. Based on discriminant analytic methods, ten items were retained and included in the final questionnaire. The total score of this questionnaire was found to distinguish between sexual and asexual participants with high statistical significance. Further, a cut-off score of 25/50 was found to identify 89% of self-identified asexuals, while excluding 97% of sexual individuals. This suggests that the AIS is a useful tool for identifying asexuality, and could be used in future research to identify individuals with a lack of sexual attraction.

Psychometric validation of the 10-item AIS was conducted in two major areas: (a) construct validity and (b) test reliability. Specifically, the total score of the AIS showed excellent ability to distinguish between asexual and sexual subjects (discriminant validity), while showing only moderate correlations with a previously established measure of sexual orientation (incremental validity).

When compared to an existing measure of sexual desire, the AIS was found to highly correlate with Dyadic sexual scores on the Sexual Desire Inventory, but not with Solitary sexual desire scores. This relationship demonstrates the previously recognized and

considerable overlap between the constructs of sexual attraction and sexual desire. This strong correlation between the SDI Dyadic subscale with the AIS also confirms previous research suggesting that asexuals have significantly lower scores on measures of sexual desire than non-asexuals (Brotto et al., 2010). More specifically, Brotto and Yule (2011) found that while asexuals differed significantly from their sexual counterparts on the SDI Dyadic subscale, there was no significant difference between groups on the SDI Solitary subscale. As discussed above, because of the difficulty disentangling sexual attraction and desire, and the assumption of some level of sexual attraction implied by many items in the SDI, we would expect low scores on the SDI (indicating low sexual desire) to be correlated with low scores on the AIS (indicating asexuality) for asexuals if the AIS is indeed assessing a lack of sexual attraction. This raises the question of whether the AIS is adding any information to that which might be gained by utilizing the SDI itself to assess asexuality (i.e., whether it has incremental validity). The items on the SDI focus on desire for sexual behaviour, rather than on level of sexual attraction. This may make the AIS more accessible to individuals who lack sexual attraction than the SDI might be. Further, several of the items on the SDI are worded such that they assume some level of attraction to other individuals (i.e., “When you first see an attraction person [...]”). Also, a number of items address solitary sexual desire, which is not relevant to assessing asexuality. Asexual individuals, for example, have been found to have similar rates of masturbation to sexual individuals (Brotto et al., 2010; Prause & Graham, 2007), thus items assessing desire for masturbation on the SDI (or other components of solitary sexual desire) would not be useful for differentiating sexuals from asexuals.

There has been previous speculation that asexual individuals may not experience sexual attraction due to history of childhood trauma or sexual abuse (Brotto et al., 2010; Jay, 2008). In order to ensure that the AIS was not tapping into some level of negative sexual experiences, we compared AIS total scores to scores on the Childhood Trauma Questionnaire. The AIS did not correlate with the CTQ, indicating that it was not tapping into childhood trauma.

3.4 Conclusion

The AIS, a 10-item questionnaire, has been developed as a brief, valid, and reliable self-report instrument for assessing asexuality. It is psychometrically sound, easy to administer, and has demonstrated ability to discriminate between sexual and asexual individuals. The questionnaire was developed to allow researchers to recruit samples of asexuals from a wider range of avenues than has previously been possible. This may lead to more representative samples of asexuals, allowing us to further increase our understanding of asexuality. The further use of the AIS in these areas remains to be investigated; however this measure has the potential to significantly improve the quality of asexuality research in the future.

Chapter 4: Conclusion

4.1 Summary of findings

This Master's thesis consisted of two separate sections: a study on biological markers of asexuality, and the development of a questionnaire to identify asexuality. Three putative biological markers of sexual orientation were used to investigate the assertion that asexuality may be best conceptualized as a sexual orientation; finger length ratios, handedness, and number of older siblings. This was the first study to associate handedness with asexuality. Asexual men and women were significantly more likely to be non-right-handed than their heterosexual counterparts. Also novel to this study, there were significant differences between sexual orientation groups on number of older siblings, both sisters and brothers, for male and female asexual participants. However, there were no significant differences between sexual orientation groups on measures of finger length ratios in Caucasian participants, nor were there any differences in absolute finger lengths. This research project also presented the development of the Asexuality Identification Scale (AIS), a 10-item, objective measure of asexuality for use in future asexuality research.

4.2 Biological etiology of sexual orientation and asexuality

There is a substantial body of research implicating biological influences in the development of human sexual orientation (Mustanski, Chivers et al., 2002), and the three biological markers investigated in the present study have been linked repeatedly to sexual orientation in large epidemiological studies; finger-length (2D:4D) ratios, handedness, and older siblings. Homosexuality is associated with specific finger length ratios as well as a higher incidence of non-right-handedness in both males and females, and having a greater

number of older brothers increases the odds of homosexuality in males. These markers are thought to reflect differences in prenatal development, perhaps due to prenatal hormone levels or genetic influences (see Blanchard, 2008; Bogaert et al., 2007; Lalumière et al., 2000; McFadden et al., 2005) for more a detailed description).

This large, online study investigating these putative biological markers of sexual orientation in asexuality compared 2D:4D ratios, handedness, and older siblings between sexual orientation groups (asexual, heterosexual, non-heterosexual (bisexual and homosexual)). Asexual men and women were found to be significantly more likely to be non-right-handed than their sexual counterparts. There were also significant group differences between sexual orientation groups on number of older siblings, both sisters and brothers, for male and female asexuals. No significant differences were found between sexual orientation groups on measures of 2D:4D ratios. These data add to existing evidence (Bogaert, 2004) of an underlying biological etiology to account for the lack of sexual attraction observed in asexuality, in a manner similar to the demonstrated link between biological factors and sexual orientation more generally. Bogaert found height, age of menarche, and health variables to predict asexuality. Bogaert concluded that biological pathway(s) might contribute to the development of asexuality (Bogaert, 2004) and that these biological correlates of asexuality suggested a prenatal origin of the lifelong lack of sexual orientation (Bogaert, 2004, 2006).

Handedness

The prevalence of non-right-handedness in the general population ranges from 9 to 11% (Corballis, 1991; Perelle & Ehrman, 1983; Rife, 1940). The current study found 25% of

asexual women, and 27% of asexual men to be non-right-handed. Both environmental and biological models have been proposed to explain the etiology of handedness, and these include prenatal testosterone, prenatal stress, genetics, environment, and cultural explanations (Lalumière et al., 2000; Perelle, 1994; Perelle & Ehrman, 1982). According to the linear prenatal hormone theory of sexual orientation, non-right-handedness is associated with hyper-androgenization in the prenatal environment. It follows that asexual individuals may have been exposed to higher levels of prenatal androgens, which would then be associated with their lack of sexual attraction. Non-linear prenatal hormone theories, however, posit that androgens may masculinize structures up to a certain point, but once androgens reach a critical threshold, they then lead to feminization of these same structures (Lippa, 2003a). It has also been theorized that the effects of prenatal androgens are dependent on the timing of surges and declines of androgen levels, and/or the individual's ability to utilize these androgens (Berenbaum, 2002; D. McFadden, 2002). Further, it has been proposed that handedness is genetically determined (Klar, 2003; Rife, 1940), and thus may be independent from prenatal hormones. Hence, while the current study showed there to be a significant relationship between handedness and asexuality, the underlying mechanism remains unknown.

Older siblings

Previous research has found a greater number of older brothers to be linked with homosexuality in men (Blanchard & Lippa, 2007). This is known as the fraternal birth order effect, and has been explained in terms of the maternal immune hypothesis, in which the prenatal environment is influenced by number of older siblings, which in turn influences the

focus of sexual attraction in the unborn child. As mentioned in Chapter 2, the maternal immune hypothesis (Blanchard & Bogaert, 1995) proposes that maternal antibodies that develop in response to male-specific antigens may affect the development of male but not female fetuses. The theory suggests that fragments of male fetal cells enter the maternal circulation through the placental barrier and are recognized as foreign by the mother's immune system, triggering the production of antibodies against them. During subsequent male pregnancies, these anti-male antibodies cross the placental barrier, and act on the development of the fetal brain, diverting it from the male-typical developmental pathway, such that the individual will later experience sexual attraction to men rather than women. The strength of this maternal immunization is thought to increase with each subsequent male pregnancy, and thus the probability of homosexuality increases with each older brother (Blanchard, 2008). The maternal immune hypothesis works in conjunction with Ellis and Ames' (1987) long-standing theory that sexual orientation in men is related to prenatal testosterone, proposing that the development of sexual orientation depends both on a main system driven by testosterone, and a supplementary system driven by male-specific proteins (Blanchard, 2008), as well as being influenced by other etiological factors such as atypical hormone levels at critical stages of fetal development (Mustanski, Chivers et al., 2002), and cerebral lateralization, which is thought to have a genetic influence (Geschwind et al., 2002), and, as mentioned above, may be manifested in handedness.

It has also been suggested that both left-handedness and homosexuality might be correlated with stressful pre-natal conditions in general (Lalumière et al., 2000). The maternal immune hypothesis implies pre-natal stress, and this may be an explanation for the association between handedness, birth order, and sexual orientation. It has been

hypothesized that because later-born children are likely born to older mothers, they may have been exposed to prenatal stressors related to their mother's age (Bogaert, 2003a). While there is ample evidence that the number of older sisters does not impact on sexual orientation, it may be that the current findings are due to number of older siblings in general, which may be a proxy for maternal age or other prenatal stressors.

Our finding that asexuality is related to the number of older brothers and older sisters implicates the prenatal environment in the development of (lack of) sexual orientation, however the exact mechanism of how sexual attraction is related to older siblings cannot be understood from this study alone. However, this finding indicates that the lack of sexual attraction present in asexual individuals is indeed due to a prenatal influence, and again links asexuality with previous sexual orientation research. Further research is needed to elucidate the exact relationship between asexuality, older siblings and the prenatal environment.

Finger-length ratios

The current study did not find any relationship between finger-length ratio and sexual orientation. 2D:4D ratios are thought to be a reflection of prenatal androgens (Manning, 2002; Williams et al., 2000), and have been linked to sexual orientation, especially in men, in a number of large epidemiological studies (Lippa, 2003a; McFadden et al., 2005). The lack of significant relationship between 2D:4D ratios and asexuality in this study may not necessarily be an indicator of a lack of relationship between these two variables. As mentioned in Chapter 2, methodological issues with measuring 2D:4D ratios via the internet necessitate the use of a very large sample in order to find any significant patterns within the data. The current study sample size was relatively small compared to that recruited for

internet research studies investigating finger length ratios, and this sample may have been too small. This study should be replicated in a much larger sample in order to determine whether or not there truly is a lack of association between 2D:4D ratios and asexuality.

The current study strongly suggests that asexuality should be conceptualized as a sexual orientation, and not as a sexual dysfunction. This has significant implications for how individuals with a lifelong lack of sexual attraction - and the likely concomitant lack of sexual desire – are approached by clinicians and health care professionals. Under the current model of disorders of low sexual desire, an asexual individual could very likely be assigned a diagnosis of hypoactive sexual desire disorder. In light of the current findings, such a diagnosis would be highly inappropriate and perhaps reminiscent of the historical diagnosis of homosexuality as a mental health disorder until 1980.

The diagnosis of HSDD and other sexual dysfunctions are increasingly recognized as problematic, both by some academics (e.g., Tiefer, 2001) and increasingly by clinicians (e.g., Prause & Graham, 2007). In response to some of these concerns, a new diagnostic category for women, Sexual Interest/Arousal Disorder (SIAD), has been proposed for the upcoming DSM, due to be published in 2013 (see Brotto, 2010 for a complete discussion). This proposed diagnosis is based on a polythetic diagnostic approach, such that (likely) three out of six proposed indicators must be satisfied to meet diagnostic criteria. These six criteria include: (1) absent/reduced frequency or intensity of interest in sexual activity; (2) absent/reduced frequency or intensity of sexual/erotic thoughts or fantasies; (3) absent or reduced frequency of initiation of sexual activity and is typically unreceptive to a partner's attempt to initiate; (4) absent/reduced frequency or intensity of sexual excitement/pleasure during sexual activity on most sexual encounters; (5) sexual interest/arousal is absent or

infrequently elicited by any internal or external sexual/erotic cues (e.g., written, verbal, visual, etc.), and (6) absent/reduced frequency or intensity of genital and/or nongenital sensations during sexual activity on most sexual encounters (*DSM-5 development: Sexual Interest/Arousal disorder*, 2011). The SIAD diagnosis retains the subtypes Lifelong vs. Acquired and Generalized vs. Situational, as well as introducing the specifiers: (1) partner factors (partner's sexual problems, partner's health status); (2) relationship factors (e.g., poor communication, relationship discord, discrepancies in desire for sexual activity); (3) individual vulnerability factors (e.g., poor body image, history of abuse experience) or psychiatric comorbidity (e.g., depression or anxiety); (4) cultural/religious factors (e.g., inhibitions related to prohibitions against sexual activity) and (5) with medical factors relevant to prognosis, course, or treatment. According to the proposed criteria, distress will remain as a diagnostic requirement, such that the disturbance must cause "clinically significant distress or impairment," however the "interpersonal difficulties" component of the distress criterion utilized in the DSM-IV-TR diagnostic criteria of HSDD would now be included under the "relationship factors" specifier in SIAD (*DSM-5 development: Sexual Interest/Arousal disorder*, 2011; Brotto, 2010). Hypoactive sexual desire disorder will remain as a diagnostic category exclusively for men in the DSM-5, and the proposed diagnostic criteria remains unchanged from the DSM-IV-TR (*DSM-5 development: Hypoactive sexual desire disorder in men*, 2011).

It may be true that an asexual individual could still be diagnosed with a sexual dysfunction under the proposed diagnostic criteria for SIAD. A person with a lifelong lack of sexual attraction could easily meet the diagnostic criteria (1), (2), (3), (4) and/or (5). Distress, likely secondary or interpersonal, could also be established, which might lead to a

potentially erroneous diagnosis of SIAD. While “interpersonal distress” would be included under the specifier “relationship factors” under the DSM-5 diagnostic criteria, this may still result in a diagnosis of SIAD. Further, an asexual individual may experience distress not only interpersonally, but in the face of negotiating their lack of sexual attraction in a highly sexualized society. Thus, in an asexual/sexual relationship, it is entirely possible that the asexual partner may: experience absent/reduced frequency of interest in sexual activity (criterion 1), have an absence or reduced frequency of sexual/erotic thoughts and fantasies (criterion 2), have absent or reduced frequency of initiation of sexual activity as well as being unreceptive to their partner’s attempts to initiate sex (criterion 3), have absent or reduced frequency or intensity of sexual excitement/pleasure during sexual activity (criterion 4), and have sexual interest/arousal that is absent or infrequently elicited by an internal or external sexual/erotic cue (criterion 5). This, combined with resulting interpersonal distress caused by strain on the relationship between the asexual/sexual couple, might warrant an SIAD diagnosis by a clinician who is unaware (or disbelieves in the concept) of asexuality.

Because of the possible overlap between a diagnosable low level of sexual desire and a lifelong lack of sexual attraction, it may be unavoidable that if desire disorders continue to be included in diagnostic manuals such as the DSM, asexuality could be diagnosed as a mental health disorder. Aside from removing sexual desire disorders altogether (and this has been suggested under the New View of women’s sexual problems (Tiefer, 2001; Tiefer & Hall, 2010)), it seems that the best way to avoid pathologizing asexuality would be to include a rule-out specifier in the DSM that describes asexuality and requires that the presenting lack of sexual desire not be due to a lifelong lack of sexual attraction. The current findings provide strong support for the inclusion of such a qualifier.

It would be helpful to be able to compare the data in the current study to research investigating potential biological markers of HSDD. However, such studies have yet to be undertaken. There is some evidence that genetic (Ben Zion et al., 2006; Burri, Cherkas, & Spector, 2009) and hormonal factors (Shifren et al., 2006) have an impact on human sexual desire. However, it is unclear how these findings may or may not be related to the lifelong lack of sexual interest observed in asexuality. Further research should focus on potential biological underpinnings of both asexuality and sexual dysfunctions in order to elucidate how these two conditions are different from one another.

4.3 Asexuality Identification Scale

Part of the current thesis focused on the development of the Asexuality Identification Scale (AIS), a short, reliable survey developed to distinguish between sexual and asexual individuals for research purposes. One of the challenges of asexuality research thus far has been the lack of an accessible, representative sample of asexuals. The large majority of research to date has recruited asexuals from online asexuality communities. While this recruitment method has thus far been necessary, and provided some very important preliminary data on the definitions and correlates of asexuality, it necessarily excludes those asexuals who are not part of these online communities, and thus may have vastly different experiences of their lack of sexual attraction. The AIS will allow researchers to recruit more representative samples of individuals who lack sexual attraction, and could be an invaluable tool for asexuality research in the future.

4.4 **Limitations and future directions**

This study has some limitations that must be addressed. As discussed in detail in Chapter 3, our use of an asexual sample recruited from the online community AVEN may not be sufficiently representative of the asexual community in general (Brotto & Yule, 2009). Because asexual individuals recruited via online communities may differ from asexual individuals recruited via other sources, we cannot be certain that any asexuality research conducted thus far generalizes to the entire asexual community. We hope to address this limitation using the AIS developed in Chapter 2 in future research. By including the AIS in similar studies, and recruiting very large internet samples, we hope to gain a more representative sample of asexual individuals. This will allow us to be more confident that our future findings in asexuality research are more generalizable.

Further, a number of participants recruited from asexuality websites may avoid identifying their sex as either strictly “male” or “female,” opting instead to use terms such as “androgynous,” “female bodied non-woman,” or “gender neutral.” These participants were excluded from data analysis for the biological markers portion of this research. It would be interesting to investigate further the basis of this non-dichotomous identification among asexual individuals.

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Appendix A: Initial open-ended item pool

1. How would you define/describe asexuality?
2. How would you define/describe sexual attraction?
3. How would you define/describe sexual desire?
4. How would you define/describe romantic attraction?
5. What are some factors that initially led you to consider yourself as an asexual?
6. How would you distinguish asexuality from a sexual dysfunction such as sexual desire disorder?
7. How might you describe your sexuality BEFORE you came across the term 'asexual'?
8. What questions would you use (without describing or using the term 'asexual') to identify an individual who might be asexual but has not yet come across the term?

Appendix B: Items included in the Asexuality Identification Scale - 111, sorted by Concept

1. Sexual Attraction/Desire

- 5. I know what it is like to experience sexual attraction:
- 6. I have a difficult time defining sexual attraction
- 29. I have lost the feeling of sexual attraction towards others. **Opt-out**
- 33. Compared to most people I know, I would describe my level of sexual desire as being
- 35. I experience sexual attraction towards other people
- 36. Compared to most people I know, I would describe my level of sexual attraction to others as being
- 45. I find myself pretending to be sexually attracted to other people to avoid judgment
- 49. I've never been sexually attracted to anybody at all
- 63. I do not feel that my low level of sexual attraction could be 'cured' or 'treated'. **Opt-out**
- 72. I used to experience sexual attraction, but I do not anymore
- 74. I have lost the feeling of sexual desire towards others
- 73. I have lost the feeling of sexual attraction towards others
- 82. I find other people to be sexually appealing
- 83. My level of sexual attraction towards others has changed over the years
- 88. I find myself experiencing sexual attraction towards another person:
- 94. I have never felt drawn toward another person sexually

2. Masturbation

- 8. I find masturbation enjoyable. **Opt-out**
- 10. I find masturbation to be sexually pleasurable. **Opt-out**
- 23. I find masturbation to be sexually pleasurable. **Opt-out**
- 37. I prefer to relieve sexual tension by masturbating rather than engaging in sexual activity with another person. **Opt-out**
- 40. I crave sexual activity with myself (masturbation)

3. Fantasy

- 20. I have sexual fantasies
- 43. I find it difficult to imagine being sexually intimate with someone
- 58. I dream about sex while sleeping
- 67. I fantasize about sexual activity, but become disappointed when actually engaging in sexual activity
- 92. I fantasize about engaging in sexual activity with other people when I masturbate . **Opt-out**
- 103. I find myself fantasizing sexually about other people
- 105. When I have sexual fantasies, they are about another person/people . **Opt-out**

4. Erotica

- 9. I find erotic films enjoyable. **Opt-out**
- 104. I find erotic films to be sexually arousing
- 106. When I watch erotic films, I am able to identify with the actor(s). **Opt-out**

5. Distress

- 3. My level of sexual attraction is something that bothers me whether or not it bothers the other person I'm involved with
- 4. My level of sexual desire is something that bothers me whether or not it bothers the other person I'm involved with
- 41. I worry about my level of sexual attraction towards other people
- 60. My level of sexual attraction towards others causes me psychological distress
- 61. My level of sexual desire causes me psychological distress
- 62. My sexuality causes me to have low self-esteem
- 70. My level of desire for sex causes me psychological distress
- 71. I have low self-esteem when it comes to sexual matters
- 75. I am distressed about my level of sexual attraction towards other people
- 76. I am embarrassed by my sexual problems
- 77. I am dissatisfied with my sex life
- 78. I am bothered by my level of sexual attraction towards other people
- 79. I am bothered by my level of sexual desire
- 81. I feel inferior to others because of my level of sexual attraction to others
- 84. I am embarrassed by my lack of sexual attraction . **Opt-out**

6. Sexual Activity

- 7. I find sexual activity enjoyable . **Opt-out**
- 11. Even though I have had sexual experiences, I do not find the prospect of sexual activity interesting . **Opt-out**
- 15. I engage in sexual activity mainly to please my partner (or for other reasons unrelated to my desire for sex)
- 17. I would prefer to be sexually inactive
- 21. I believe that sexual activity is an important part of a relationship
- 22. I find sexual activity to be sexually pleasurable . **Opt-out**
- 27. I lack interest in sexual activity
- 30. I do not need sexual activity to be satisfied
- 47. I prefer hugging and cuddling to sexual activity
- 48. I could easily go without sexual activity for a long period of time
- 65. I have never enjoyed sexual encounters with a partner
- 66. I find sexual activity pleasant
- 89. I have never wanted to engage in sexual activity with another person
- 95. I would be relieved if I was told that I never had to engage in any sort of sexual activity again
- 97. Sexual activity seems like a chore

7. Sexual Identity

- 16. I feel that my (lack of) sexual attraction is a part of my identity
- 12. I consider myself to be a sexual person
- 26. I feel disconnected from my sexuality
- 50. I don't feel that I fit the conventional categories of sexual orientations such as heterosexual, homosexual or bisexual
- 42. I feel as if my sexuality is different from most people's
- 52. I do not identify with most people's descriptions of their sexuality
- 64. I have difficulty figuring out which sexual orientation I belong to
- 86. I feel that I'm in a constant state of questioning my sexual orientation
- 87. The term 'non-sexual' would be an accurate description of my sexuality

8. Disgust

- 18. I am repulsed by sex
- 51. The thought of sexual activity repulses me
- 59. I find the idea of exchanging bodily fluids through sexual activity disgusting
- 85. I am embarrassed by my revulsion towards sexual activity . **Opt-out**

9. Physiological Sexual Arousal

- 31. I feel sexually frustrated
- 32. I find my sex drive to be annoying/awkward
- 34. I experience physical sexual arousal
- 38. I experience physical urges for sexual release
- 39. I crave sexual activity with other people

10. Inability to relate to other's sexuality

- 25. I can't relate when others talk about sex
- 54. I don't understand why people make such a big deal about sex
- 55. I find it hard to understand or relate to terms such as 'hot' or 'sexy'
- 90. I am confused by how much interest and time other people put into sexual relationships
- 98. I feel that other people think about sex much more than I do
- 99. I find it hard to relate to sexual jokes
- 107. I believe that my friends/peers place too much emphasis on sexuality

11. Disinterest in Sex

- 13. I find sex boring
- 14. I have always found sex boring
- 19. I find sex interesting
- 24. I enjoy talking about sex
- 44. I have had 'crushes' on another person
- 46. I would be content if I never had sex again
- 53. I rarely notice physical attributes of another person
- 93. Sex has no place in my life

96. I find the idea of sex to be more interesting on an intellectual level than actually engaging in sexual activity is
108. I feel that my lack of interest in sex frees up time for other, more important things .

Opt-out

12. Religion

91. My religious beliefs influence my level of sexual desire
109. My religion has a significant impact on how I feel about sexual activity

13. Sexual Avoidance

57. I go to great lengths to avoid situations where sex might be expected of me
100. I try to avoid situations in which I might be approached for sex

14. Relationships

28. Given the choice between being in a sexual relationship and not being in a sexual relationship, I would prefer to NOT be in a sexual relationship
56. My ideal relationship would not involve sexual activity
68. I like to touch or be touched by my romantic partner
69. I can love someone but not want to have sex with them
80. I am unhappy with my sexual relationship with my partner
102. When I have engaged in sexual activity with a partner, I feel that it is a compromise to make my partner happy . **Opt-out**

15. Romantic Attraction & Intimacy

1. I believe that there is a distinction between romantic attraction and sexual attraction
2. I experience romantic attraction without sexual attraction
101. I believe that sexual activity and intimacy are separate things
110. I experience romantic attraction in the absence of sexual attraction
111. I only experience sexual attraction to someone after I experience romantic attraction to them

Appendix C: Asexuality Identification Scale

Please select the best answer for the following questions

1. I know what it is like to experience sexual attraction
 - Completely false
 - Somewhat false
 - Neither true nor false
 - Somewhat true
 - Completely true

2. The term “non-sexual” would be an accurate description of my sexuality
 - Completely true
 - Somewhat true
 - Neither true nor false
 - Somewhat false
 - Completely false

3. Compared to most people I know, I would describe my level of sexual desire as being
 - Very low
 - Low
 - Average or normal
 - High
 - Very high

4. I experience sexual attraction towards other people
 - Completely false
 - Somewhat false
 - Neither true nor false
 - Somewhat true
 - Completely true

5. I have lost the feeling of sexual desire towards other people
 - Completely true
 - Somewhat true
 - Neither true nor false
 - Somewhat false
 - Completely false

6. I find other people to be sexually appealing
 - Completely false
 - Somewhat false
 - Neither true nor false

- Somewhat true
- Completely true

7. I don't feel that I fit the conventional categories of sexual orientations such as heterosexual, homosexual, or bisexual

- Completely true
- Somewhat true
- Neither true nor false
- Somewhat false
- Completely false

8. I have never felt drawn towards another person sexually

- Completely true
- Somewhat true
- Neither true nor false
- Somewhat false
- Completely false

9. I find myself experiencing sexual attraction towards another person:

- Never
- Rarely
- Sometimes
- Often
- Always

10. I've never been sexually attracted to anyone at all

- Completely true
- Somewhat true
- Neither true nor false
- Somewhat false
- Completely false