Modern technological environments and individual differences in attractiveness perceptions from physical characteristics

A thesis submitted for the degree of Doctor of Philosophy (PhD)

by

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1 July 2022

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I, Jordan Rae Sculley, hereby certify that this thesis submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy (PhD), Abertay University, is wholly my own work unless otherwise referenced or acknowledged. This work has not been submitted for any other qualification at any other academic institution.

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Acknowledgements

First, I would like to thank my supervisors, Dr Christopher Watkins and Dr Clare Cunningham. The PhD process is tough, and I would not have been able to complete this document without their help. Thank you for keeping me grounded and on track. Secondly, I would like to thank Dr Martinez, DASH Lab, and Dr Bodner at Portland State University for believing in me, encouraging me, and giving me opportunity to pursue higher education. Thank you to all my participants for sparing me their time, photos, and GDPR protected data. This PhD and the furthering of science would not exist without those who volunteered to participate, so again thank you.

Special thanks to my family and friends who kept me sane and for letting me talk them into assisting me. Thank you to Jamie Sculley for checking in on me, helping me make a dress out of my conference poster, and for being my go to layman. I look forward to my thesis dress, which might need to be pleaded more than a kilt to contain all the fascinating words I have written. Thank you to Alexander Tawns for assisting me and graphically designing my participant request posters and Chapter 1 images. Thank you to Dr David Moulds for going through the Abertay graduate program with me. Having someone understand the highs and lows of this journey was immensely valuable.

Thank you also to Ronnie Smith and Chey Anne Marsh for locking me away to finish my edits.

Lastly, thank you to those who read and review my thesis, your interest in my work means the world to me.

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General Abstract

The Coolidge effect is a phenomenon in biology where exposure to novel mates increases mating motivations, usually among nonhuman males, and with some corresponding 'Coolidge-like' effects observed in human men. Online environments facilitate access to many novel social, romantic, and sexual partners, potentially generating what social psychologists refer to as an 'assessment mindset', where a large pool of online dating options orient daters towards novel mates in the hopes of finding an optimal partner, rather than committing to a current partner or romantic prospect. Chapter 2 in this thesis directly tests Finkel and colleagues' theory of an 'assessment mindset' by adapting an experimental design examining 'Coolidge-like' effects in human mate preference, which measures the attractiveness of familiar faces on second viewing and the attractiveness of these faces relative to novel faces, all after activating an experimental context related to the ability to choose between items (romantic dates or deserts). Findings in Chapter 2 suggest that this choice context alters social and romantic attraction to others, which may be relevant in the design of and experience with online dating sites. Further theories presented in a 2012 popular TEDx talk have hypothesised that the Coolidge effect explains men's responses to pornography, where a plethora of novel erotic stimuli influence men to prefer novel mates, which like the 'assessment mindset' in dating apps may affect the quality of their sexual and romantic relationships offline. Using the same experimental design with a different manipulation (pornographic images), we were able to directly test the claims in Wilson's TEDx talk in Chapter 3. In sum, our findings in Chapter 3 demonstrate that visual exposure/sexual arousal moderates attractiveness perceptions, however, greater nuance is required considering earlier claims. Testing these claims is important as

choice and socializing are vital to a person's well-being, physical and psychological health, adjustment, and happiness (Chapter 1). Discussion and directions for further research, such as diversifying stimuli and participant samples, are then discussed (Chapter 4).

Parts of this thesis are adapted from the following publications:

Sculley, J. R., Ritchie, K. L., & Watkins, C. D. (2021). Having options alters the attractiveness of familiar versus novel faces: Sex differences and similarities. *Computers in Human Behavior*, *124*, 106937.

Sculley, J. R. & Watkins, C. D. (in press). The Great Porn Experiment V2.0: Sexual arousal reduces the salience of familiar women when heterosexual men judge their attractiveness. *Archives of Sexual Behavior*.

Table of Contents

List of Tables

List of Figures

Chapter 1.

Intimate Connections: Theories, attraction, and modern technology

Chapter 1. Intimate Connections: Theories, Attraction, and Modern Technology

1.1. Modern technology is widely used

Modern technology is defined here as the use of the internet, mobile devices (e.g., cell phones), applications (app/s), and websites (e.g., Tinder). Modern technology and computers can facilitate human socializing. In 2019, DataReportal and partners stated that more than 4.5 billion people (nearly 60% of the world's population) use the internet, with the average user spending about six hours and forty-five minutes online daily (GlobalWebIndex, 2019). According to the Pew Research Center, 81% of adult Americans self-report going online daily, while 28% report being online 'almost constantly' (Perrin & Kumar, 2019). Of those users, mobile device users are more likely to be online, with 92% online daily and 32% online 'almost constantly' (Perrin & Kumar, 2019). In addition, young adults aged 18–29 are more likely to be online than adults aged 65 years and older (46% versus 35% are online multiple times a day, and 48% versus 7% are online almost constantly), regardless of the device used (Perrin & Kumar, 2019). Regardless of age, 97% of internet consumers accessed a social media network in the past month (GlobalWebIndex, 2019). Social media usage accounted for a third of users' allocated internet consumption, confirming that "being an internet user means being a social media user" (GlobalWebIndex, 2019). People are using modern technology heavily to socialize; however, socializing and social networks have long preceded modern technology. Therefore, this next section will examine how social networks function and why they matter.

1.2. How social network function, why they are important, and their size limits

Social networks, and the support people receive from members of those networks, can be critical for well-being, health, happiness, and longevity (e.g., Diener & Seligman, 2002; Fowler & Christakis, 2008; Haidt, 2006; Zhu et al., 2013; see also Cacioppo & Patrick, 2008; Holt-Lunstad et al., 2010). For example, the Belongingness Hypothesis proposes that humans need to form

social attachments and maintain existing bonds as a “fundamental human motivation”; when the need to belong is not met, health and well-being suffer (Baumeister & Leary, 1995). Partly corroborating this hypothesis, those who have satisfying social and/or romantic connections experience less physical illness and recover quicker from those illnesses (Cohen et al., 1998; Kiecolt-Glaser et al., 2005). Similar results have also been supported for mental illness (Cacioppo et al., 2002). They also live longer (Gallo et al., 2003; Holt-Lunstad et al., 2010) and are happier (Diener & Seligman, 2002; Fowler & Christakis, 2008) than those who lack social support or connections.

As important as social connections are, establishing and maintaining them can be challenging as they are dynamic over time. The individuals within our social networks provide different levels of connection and support which can vary throughout a person’s lifetime. While family networks usually remain stable, other social networks vary in members, numbers, and relevance (Wrzus et al., 2013). A person’s social network volume increases around adolescence and young adulthood and then steadily decreases thereafter, when peripheral relationships within a network decline in favour of closer relationships (see Wrzus et al., 2013 for a meta-analytic review). Such age-related changes in network size and composition corroborate socioemotional selectivity theory. Socioemotional Selectivity Theory is when different time periods in a human life involve different social goals and relationships that evolve based on the requirements and foci at different ages (Carstensen, 1995). For instance, adolescents’ and young adults’ goal is information acquisition: they pursue knowledge about a variety of topics from large and diverse social networks (see Wrzus et al., 2013 for a meta-analytic review). Adolescent networks may be formed, in part, based on similarity (e.g., in educational attainment, Goodreau et al., 2009). Networks among adolescents and young adults also appear to predict social outcomes, such as education. For example, social networks predict optimism and lower stress among college students (Brissette et al., 2002), good educational attainment, and positive attitudes towards school (e.g., Baldwin et al., 1997; Ladd et al., 1996; Ryan, 2001). Post young adulthood, close relationships are emphasized, and social networks decrease in size in favour of stronger bonds, leading to the goal of emotional regulation (see Wrzus et al., 2013 for a meta-analytic review).

Besides goals, other social network attributes change as well. Individual networks have layers based on function and closeness (Pollet et al., 2011a). Internal support from intimate connections (e.g., close friends and family) will be referred to as internal/core networks and outer support from acquaintances and less intimate connections (e.g., co-workers and friends of friends) will be referred to as external/outer networks. The size of these social network layers may differ based on the layers importance and personal traits such as extraversion (e.g., extraverts have larger networks than introverts, Pollet et al., 2011a). An individual's closeness to and time allocated towards different members may also differ (Roberts et al., 2009; see also Dunbar, 2014 for a review). Friendships facilitate cooperation (Curry et al., 2013) but require more social effort to maintain than relationships with kin (Roberts & Dunbar, 2011a). Friendships appear to be maintained by factors such as frequency of contact (Roberts & Dunbar, 2011b), geographical proximity (Eagle et al., 2009; Liben-Nowell et al., 2005), and similarity/homophily (e.g., Curry & Dunbar, 2013). As previously stated, the strength and number of one's social ties influence our well-being, health, and happiness (e.g., Diener & Seligman, 2002; Fowler & Christakis, 2008; Haidt, 2006; Zhu et al., 2013; see also Holt-Lunstad et al., 2010 for a review). However, our social network capacity is limited.

Regardless of how many network groups (e.g., private, educational, work) a person participates in, there is a limit to the number of social connections a person's neocortex (where the brain stores social memory) can maintain (see Dunbar, 1993). Robin Dunbar suggested that the number is approximately 150 or between 100 and 200 (e.g., Dunbar, 1993; Hill & Dunbar, 2003; see Dunbar, 2014 for discussion). For example, to measure social network size, Hill and Dunbar (2003) observed Christmas card exchanges between individuals. The maximum number of cards exchanged was 153.5, with a mean of 124.9 cards exchanged (Hill & Dunbar, 2003). Dunbar (2016) supported that his approximate number (150, or 100–200) also is consistent with social media networks, where the average number of friends was 155.2 and business contacts was 182.8. Theories on brain development have suggested that the reason primates and humans have unusually large brains to body size is to maintain social demands (Dunbar, 1998; Dunbar, 2009). Species that pair-bond have the biggest brains (Dunbar, 2009) which Dunbar

(1993) contributed to be more efficient for processing social bonding and to acquire language skills that promote efficient social bonding. The restriction of the 150 by the neocortex might be due to human social brains developing during the time of villages were the populations were around 100–200 in size (Dunbar, 1993). As the modern world develops and socializing networks expand, human brains might as well, but at the current time Dunbar's number holds true.

Modern technology can also be used to infer network size and the nature of behaviours with our social connections. Tracking mobile phone usage has revealed patterns in behavioural data through calling habits and proximity to infer friendship (Eagle et al., 2009). For example, calling patterns of twenty million people over a nineteen-month period with seven hundred million connections demonstrated that for 90% of participants, social ties are continually activated and deactivated at similar rates (Miritello et al., 2013). This means that most people maintained a consistent number of contacts, adding a new contact when communication stopped with an old contact (Miritello et al., 2013).

Even though there may be different layers to a social network with different depths and qualities (i.e., ranging from close relationships to acquaintances), each layer has similar restrictions on its size both on- and off-line/in-person (Dunbar, 2016). In addition to the neocortex's restriction on network size, other factors contribute to the size and quality of a person's social connections. As previously stated, one of the factors for maintaining a connection is frequency of contact (Roberts & Dunbar, 2011b). Time limitations restrict a person's ability to contact each individual member in their social network. For example, women with larger social networks take longer to correspond with each of their friends and family members, with friendships deteriorating much faster than family ties (Roberts & Dunbar, 2011a). As social connections deteriorate, social and emotional loneliness increases, which happens more often for those trying to maintain a larger social network (Binder et al., 2012). Due to their deeper intimacy and emotional supportive function, this phenomenon mainly affects internal/core networks as external/outer networks have a different function (Binder et al., 2012). Larger external/outer networks can have benefits for psychological health and lower emotional

loneliness, when a person maintains a smaller amount of internal/core ties as well (Binder et al., 2012). These external social links are also important as they benefit members by linking them to groups they may not have otherwise associated with (Granovetter, 1973). For example, some researchers view external networks as informational gateways that help people find job offers (Corcoran et al., 1980; Granovetter, 1995; Rees, 1966) and romantic partners (Rosenfeld & Thomas, 2012). Even though external network ties have value, an additional strong internal tie has greater value over an additional weak external tie (Gee et al., 2017; Kramarz & Skans, 2014).

However, how people maintain and create their networks ties varies. Three communication strategies were revealed by Miritello and colleagues (2013):

- *Balanced* represents a continuous activation and deactivation of social ties by people who, on average, maintained 75% of their connections in a seven-month period.
- *Social keepers* keep stable social connections by focusing more on their current networks and less on activating new social ties, maintaining up to 90% of their connections.
- *Social explorers* focus on activating more new social ties while maintaining, on average, 52%.

Miritello and colleagues (2013) also showed similar connection and maintenance strategies for social media users on Facebook. These technologies have changed how social connections within networks are formed and maintained (see, e.g., Waytz & Gray, 2018 for discussion).

1.3. How technology might influence behaviour within social networks (e.g., sociability)

When the internet was first used as a social tool, most interactions happened in chat rooms and bulletin boards where user information was limited or non-existent (e.g., Rheingold, 1995; Surratt, 1998; Turkle, 1995). Users could easily experiment with alternate online identities (for anonymity, self-expression, fantasy, and/or deceit), relationships, virtual sexual encounters, and other virtual activities (e.g., gaming) without the expectation of in-person involvement

(e.g., Rheingold, 1995; Surratt, 1998; Turkle, 1995; Whitty & Gavin, 2001). While people can still interact anonymously on the internet today (e.g., Reddit), socializing on various technological platforms has evolved from anonymous text-based chat rooms and bulletin boards to relatively visible internet profiles on social media platforms (e.g., Instagram, Facebook, Realme, Snapchat, TikTok). These social media profiles follow a more "show rather than tell" approach to presenting users (i.e., photos and friends/followers, Zhao et al., 2008). However, even though these visible profiles are a better representation of users' offline personas, online social media and dating profiles are still user-managed identities representing the users' "ideal selves" (see Ellison et al., 2006 for discussion).

Individuals typically establish online networks for dating (e.g., Tinder, OKCupid, Plenty of Fish) and friendships (e.g., MeetUp, Facebook, Instagram, TikTok) through applications/apps (e.g., software, usually on a mobile device, such as Tinder) and websites. These websites/apps may use location information provided by a mobile phone or other electronic device (e.g., Global Positioning System a.k.a. GPS). These applications and devices link users to other users in the same proximity and/or through established connections. People engage with social networking sites, in part, based on the perception that such engagement will bring them enjoyment and pleasure (Sledgianowski & Kulviwat, 2009). They believe they will be joining an established critical mass of users who have already adopted the technology (Sledgianowski & Kulviwat, 2009). Creating social capital online is also associated with self-esteem, where users with lower self-esteem gain more from using Facebook than users with higher self-esteem with similar Facebook usage (Steinfield et al., 2008). This may be because low-self-esteem individuals, such as plus-sized teens, are less involved in in-person social activities, such as sports and clubs, and are more engaged in solo activities, such as television viewing (Strauss & Pollack, 2003). Even though plus-sized teens have the same number of close relationships as slender teens, they are missing out on the opportunity to form and develop new close and external connections in-person afforded their slender counterparts (Strauss & Pollack, 2003). Although it may be assumed that online connections could substitute or compensate for fewer in-person social ties, face-to-face interactions are important in maintaining relationships (Dunbar, 2016). Indeed,

increasing online network size does not increase offline network size or improve the closeness of relationships away from the internet (Pollet et al., 2011b). Recent studies have supported a mix response in the relationship between social media and feelings of closeness to one's networks. How one associates feelings of closeness with their network through internet usage was contributed to being person specific (Pouwels et al., 2021a; Winstone et al., 2021). Using social media improved closeness to friends for only 1% to 6% of adolescents, regardless of their social wealth (Pouwels et al., 2021b).

The relationship between internet use and sociability is complex. Technology has costs and benefits to an individual's capacity and tendency to be sociable with different people. Sociability is more than just talking online and/or using the internet (Waytz & Gray, 2018). Sociability includes empathy, emotional intelligence, perspective taking, and emotion recognition (Waytz & Gray, 2018). It has been proposed that sociability is enhanced by technology when it complements offline engagements or when offline engagements are more difficult to obtain. However, sociability may be diminished when superficial online interactions displace deeper face-to-face interactions. These ideas need to be tested more directly in the future (Waytz & Gray, 2018 for discussion). Further, Jean Twenge has stated that longitudinal studies support that online socializing harms social lives by leaving users lonely and dislocated (2017a). However, Jean Twenge also stated users have connected over awareness and tolerance leading to further acceptance of sexual identities, LGBTQ+ rights, races, ethnicities, equality, and mental health (2017b). Other research has supported a correlated negative relationship between empathy and internet participation (e.g., Hampton et al., 2011; Klinenberg, 2013; Konrath et al., 2011; Lofland, 1998; Putnam, 2001; Waytz & Gray, 2018). However, this negative relationship started before the internet and social media became widespread (Waytz & Gray, 2018) and has been linked to other causes: increased individualism (Santos et al., 2017), political partisanship (Andris et al., 2015), and changes in parenting/family practices and societal expectations of success towards more individualistic gains (Konrath et al., 2011). Nonetheless, these three factors are correlated with internet usage (e.g., Bail et al., 2018; Eastin, 2005; Waytz & Gray, 2018; Wellman et al., 2003). Waytz and Gray (2018) take the argument further by saying that using technology is not uniformly positive

or negative but dependent on “whether it allows a deeper understanding of other minds.” The separating factor between positive and negative internet usage is when users improve and aid their sociability or reduce their individualist and antisocial practices (Waytz and Gray, 2018).

The theory and evidence discussed thus far suggest that modern technology gives us the potential to broaden our social networks. Although, there are clear constraints in terms of the time and effort we can devote to members of our social networks from inner to outer layers. It is possible that technology may impact upon closeness within even the innermost layers of our network, namely, within our romantic and sexual relationships.

1.4. Technology’s impact on human sexuality

In recent history, pornography consumption has increased in developed nations, as the internet has afforded easy access to cheap content that has increased in number and diversified thematically (reviewed in Ogas & Gaddam, 2011). Online pornographic content reflects the key themes of group sex, non-heterosexual sex, and paraphilic content across genders and sexual orientations (Hald & Štulhofer, 2016). However, there are separate categories of ‘female specific’ for heterosexual men and non-heterosexual women only, and ‘non-ejaculatory’ for heterosexual women only (Hald & Štulhofer, 2016). Ogas and Gaddam (2011) compared pornography preferences to food tastes. When it comes to taste, there are only five perceptual dimensions (i.e., sweet, salty, sour, savoury, and bitter) that adapt and amalgamate to interpret a large variety of taste cues; they suggest that this is the case for sexual cues as well (Ogas & Gaddam, 2011). In other words, although there are many responses to and preferences for pornographic content, including general sex differences, pornography consumers have a lot of commonalities when it comes to tastes and preferences. For example, out of fifty-five million searches for sexual content, twenty categories represented 80% of searches, and thirty-five categories represented 90% of searches (Ogas & Gaddam, 2011, see Table 1.1 below). Further research could look into the categorization and the effect of outside influences (e.g., past experience and mood) on these porn preferences proposed by Ogas and Gaddam (2011).

Table 1.1. Ogas and Gaddam's (2011) top ten sexual search categories and data on the percentage of total searches for sexual content.

Rank	%	Sexual Search Category		Rank	%	Sexual Search Category
1	13.54	Youth		6	2.82	Vaginas
2	4.70	Gay		7	2.41	Penises
3	4.27	MILFs		8	2.36	Amateurs
4	3.95	Breasts		9	2.11	Mature
5	3.37	Cheating Wives		10	2.11	Animation

Forty-six percent of men and sixteen percent of women report using pornography (e.g., on a weekly basis, Regnerus et al., 2016). This may be driven in part by sex differences in dyadic and solitary sexual desires (Dosch et al., 2016; Hald, 2006). Men primarily consume pornography for masturbation while women primarily consume pornography as part of lovemaking with their partner (Bridges & Morokoff, 2010; Vaillancourt-Morel et al., 2017). Men are also far more likely to pay for access to pornographic content than women, with only 2% of credit card pornography subscriptions registered to a woman's name (Ogas & Gaddam, 2011). Indeed, some research suggests that men are also more likely than women to watch pornography at work. Many high-status and government organizations (i.e., the National Science Foundation, The Securities and Exchange Commission, The Pentagon, and The Minerals Management Service) have resorted to internal investigations looking into stolen work hours due to pornography consumption by male employees at all organizational ranks (Ogas & Gaddam, 2011). Men who consume pornography are particularly oriented towards amateur content, while women who consume pornography are particularly oriented towards content involving more than two people (Hald & Štulhofer, 2016). Moreover, women prefer textual erotica involving relationships and romance that they can discuss (Ogas & Gaddam, 2011; Salmon & Symons, 2001). Whereas men prefer visual erotica with minimal plot development that focuses on sex acts and displaying female bodies exhibiting focus on women's faces, breasts, and genitals (Ogas & Gaddam, 2011; Salmon & Symons, 2001). Further, written erotica is not

centralized around sex but around love as the hero/heroine overcomes obstacles to further their romance and familiarity with their intimate partner (Salmon & Symons, 2001). Sex differences in pornography consumption may be explained both by biological predispositions and social learning. For example, males are more visually stimulated than their female peers, which is evidenced by empirical evidence on their habits around pornography (Hamann et al., 2004, Ogas & Gaddam, 2011). The amygdala and hypothalamus (i.e., brain areas that regulate emotion and mediate sexual/reproductive behaviour) in men are more active than in women, even when women report greater arousal (Hamann et al., 2004). This shows a greater biological and neural response in men than women. For example, even male rhesus macaques are motivated to "pay" to view visual erotica, allocating more attention to this stimulus than faces of high-status members (Deaner et al., 2015). This indicates that the biological and neural response is inherent enough to cross to similar species.

Exposure to erotic content is accompanied by both positive and negative emotions among partnered individuals, such as arousal and a desire to be close to one's partner, but also negative affect, guilt, and anxiety (Staley & Prause, 2013). Correlates of pornography consumption, in addition to being male, include being younger, politically liberal, non-religious, unpartnered or in an unhappy marriage, having paid or been paid for sex, having committed adultery, and having a relatively good knowledge of computers (Stack et al., 2004). Excessive use of pornography may also be correlated with poor psychosocial functioning and covary with excessive gambling, and use of alcohol, cannabis, and video games (Harper & Hodgins, 2016). In sum, various demographic and behavioural characteristics are correlated with pornography consumption.

Users of pornography may differ in their sexual behaviours and preferences from those who are less inclined to view pornography. For example, pornography consumption is correlated with sexual activity (Stack et al., 2004), number of sexual partners and frequency of casual sex (Braithwaite et al., 2015), and risky sexual behaviours (Prause et al., 2015; Træen et al., 2015). With this latter outcome (i.e., risky sexual behaviours) moderated by early exposure to pornography and preferences for sexual sensation seeking (Sinković et al., 2013), and the extent to which individuals perceive pornography

as providing useful sexual information (in a non-monogamous sample of Germans; Wright et al., 2018b). There may be benefits to pornography consumption (Hald & Malamuth, 2008; Miller et al., 2018), such as improving one's sexual knowledge (Hesse & Pedersen, 2017), and how couples communicate, experiment, and feel comfortable during sex (Kohut et al., 2017). Communication between partners was the largest mediator between positive and negative effects of pornography for couples, more communication more positive effects (Newstrom & Harris, 2016). Indeed, qualitative data from large samples suggests that 'no negative effects' is the most common response when investigating the effects of pornography on relationships (Kohut et al., 2017). According to Hald and Malamuth (2008), overall moderate positive effects were reported by both men and women, with men reporting significantly more positive effects of pornography on aspects of sexuality than women. This included pornography usage being positively associated with users' sexual knowledge, attitudes towards sex, feelings towards the opposite sex, quality of sex life, and quality of life based on interviews (Hald and Malamuth, 2008). Thirty-five in-depth interviews of male college students also demonstrated that pornography consumption had educational benefits regarding their sexual desires, understanding their sexual identities, and developing new sexual techniques (McCormack & Wignall, 2017). Frequent consumption of pornography contributes to an accurate knowledge of sexual anatomy, physiology, and behaviour (Hesse & Pedersen, 2017). It is also generally regarded as having a positive versus negative effect on one's life (Hesse & Pedersen, 2017). Other qualitative research suggests that pornography may be an outlet for young people to develop tastes in pornography, sex lives, sexual imagination, sexual identities and relationships, and a form of sexual leisure and play (Attwood et al., 2018). In sum, there are potential benefits to pornography consumption.

In contrast to the evidence presented above, research focussed on mainstream and legal pornography in non-clinical populations does however suggest some negative implications for intimate relationships and sexuality (reviewed in Döring, 2009). For example, there is no evidence that viewers prefer aggressive pornography or these themes have increased in content over time (Hald & Štulhofer, 2016; Shor & Seida, 2019). However, pornography

consumption may interact with personality traits to predict behaviours such as hostility or sexism towards women, such as when less agreeable men report feeling sexually aroused in general (Hald & Malamuth, 2015; Hald et al., 2013). Indeed, the user's traits may distinguish negative from average users more generally (Malamuth et al., 2012). Although people tend to attribute negative effects of pornography on other people's behaviour versus their own, pornography consumption may also lead to some sexual or body-related insecurities (reviewed in Döring, 2009). For example, while many sexual concerns are observed independent of pornography consumption, it is related to stronger performance expectations of one's partner among women and the likelihood of mental distractions related to men's sexual performance (Goldsmith et al., 2017). Although, there is little consistent evidence for negative effects of pornography on heterosexual men's sexual *functioning* (Landripet & Štulhofer, 2015). Nonetheless, some survey research suggests that women report some negative consequences after viewing pornography: poorer body image, perceiving their partner as unsatisfied with their body, feeling pressure to perform pornographic sex acts, and having less sex in general (Albright, 2008). Men reflect the concerns of women by also reporting being unsatisfied with their partners' bodies and being less interested in sex after viewing pornography (Albright, 2008). This may, in part, be due to the presentation of pornographic actresses who are nearly underweight relative to the average American (52kg versus 71kg; Ogas & Gaddam, 2011). These social consequences have been directly linked to pornography consumption. As usage increases, men reported being more likely to imitate pornography, rely on mental images of pornography during dyadic sex to maintain arousal, and have self-doubt about their sexual abilities and attraction levels (Sun et al., 2014).

Complementing this research, pornography may impact on aspects of relationship quality. For example, pornography viewing has a curved negative relationship on sexual satisfaction that is stronger for men than women, unpartnered versus partnered individuals, and religious versus non-religious individuals (Wright et al., 2018a). Large scale social survey data from representative samples suggests that declines in sexual *frequency* over time and between younger versus older generations are not accounted for by

pornography consumption (Twenge et al., 2017). However, where general declines in sexual activity are actually greater among those who abstain from pornography (Twenge et al., 2017). Indeed, declines in sexual activity according to this data may be attributable to increased singlehood rather than pornography consumption, where usage is positively correlated with sexual activity between couples (Twenge et al., 2017). Independent of sexual satisfaction, pornography consumption has a longitudinal effect on marital quality among a representative sample of American couples (Perry, 2017), which is negative for men and positive for women. These findings further highlight the importance of considering the individual, context, and the specific predictor and outcome variables under study, alongside other important moderators such as sexual arousal (Brand et al., 2011; Laier et al., 2013) and qualitative factors (i.e., in a therapeutic context; Gola et al., 2016). Indeed, some consumers of pornography indicate a preference for reliable and high-quality educational resources alternate to pornography when learning about sex (Hare et al., 2015). Some interview research suggests that adolescent men are poorly informed about sexual health due to lacking such resources or because they find certain sources of information embarrassing or unreliable (Litras et al., 2015). Schemes in America like Pornography Literacy Education (PLE, Knerr & Philpott, 2011) appear to be useful in improving safe sex and wellbeing related to sex. A large-scale research of adolescents and young adults demonstrated a longitudinal decline in the relationship between viewing explicit material and viewing women as sex objects because of the PLE intervention (Vandenbosch & van Oosten, 2017). Collectively, pornography exposure is related to aspects of sexual relationship functioning, even if the relationship is more complex than a simple stimulus-response model, as implied by ‘media effects theories’ (see, e.g., Ferguson et al., 2017 for a meta-analytic review and discussion of non-pornographic sexual media and adolescent behaviour).

The evidence discussed thus far suggests that modern technology may influence aspects of both our social and intimate relationships. One major area in which modern technology could impact our personal relationships is its effect on how we find and select a romantic partner. Thus, the next section will examine the extent to which modern technology has impacted the process of

courtship and mate choice, drawing upon an influential review paper and the underpinning theory.

1.5. Modern technology's impact on human mate choice

Online dating is becoming more popular. In 2013, Pew Research Center found that 5% of Americans reported meeting their partners online or through apps, while 11% of adults reported using online dating services (Smith & Duggan, 2013). By comparison, data from the Pew Research Center in 2019 found that 12% of Americans reported meeting their partners online or through apps, while 30% of adults reported using online dating services (Anderson et al., 2020). Younger adults (18–29-year-olds: 48%, 30-49: 38%, 50-64: 19%, and 65+: 13%) and non-heterosexual (55%, heterosexual: 28%) daters are more likely to use online dating sites and apps (Anderson et al., 2020). Online dating sites and apps are used equally across gender and ethnicity (Anderson et al., 2020). However, other reports have listed various gender ratios, some very heavily imbalanced, based on which dating app and country the user is accessing (Netimperative, 2019). Usage differs by educational status, with the majority of users having at least some college experience (no college experience: 22%, some college: 35%, college graduates: 35%; Anderson et al., 2020). Given the widespread use of online dating, understanding how dating apps function is important for users, potential users, and non-users whose social environment (knowing people who use online dating services) has been influenced.

How do dating apps work?

Before presenting the literature on the costs and benefits of dating apps, it is important to make sure the user experience and interaction with dating apps is understood. The following section will cover two popular online dating interfaces (OkCupid and Tinder) and explain how they work. Tinder is the most used internet dating site/app (Statista Research Department, 2022a), and many other dating sites and apps have been influenced by its mechanics, mainly its swipe mechanic. Tinder was bought by Match Group, which is sometimes referred to as a monopoly because they also own over forty-five dating brands, including Match.com, OkCupid, Hinge, and PlentyOfFish, which represents

25% of the market share (Lin, 2019). The second largest online dating company is eHarmony, which owns 12% of the market share (Lin, 2019).

OkCupid – Web-Based Dating – Pre Dating App Introduction

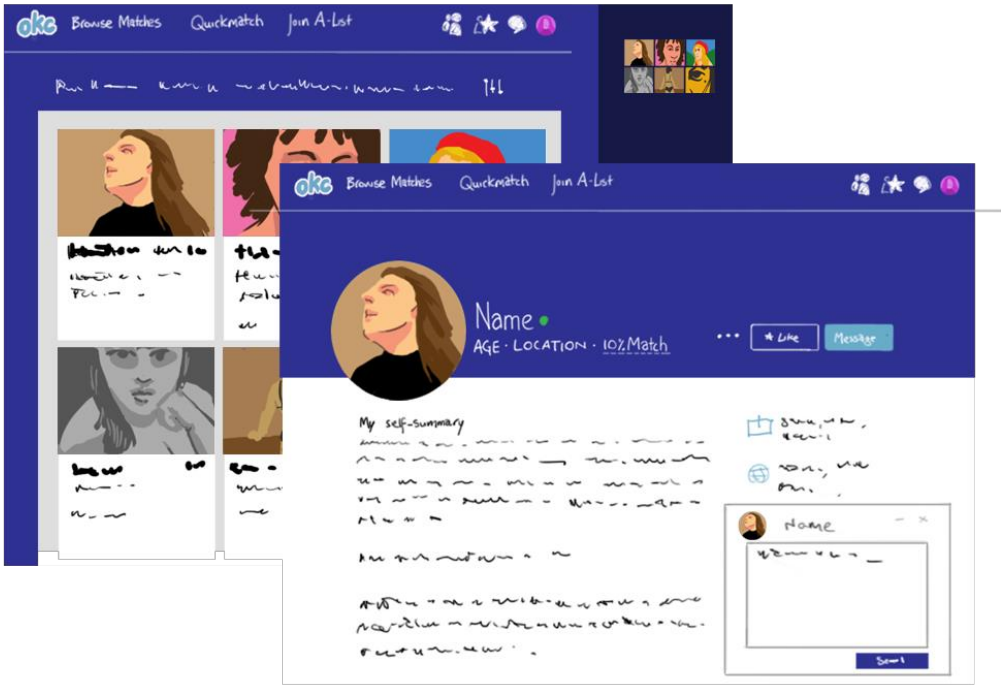

Figure 1.1. Example of an online dating website page (Tawns, 2021a).

Early online dating sites were typically highly text based with a single profile photo, similar in style to newspaper personal ads (Please see Figure 1.1 for an example). Users were able to link to others by algorithmic suggestion, manually browsing profiles, and by providing various general topics of their own personal interest. As OkCupid and Tinder are currently owned by the same company (Match Group, originally Match.com), they have also added a swipe feature and app accessibility, but the site is not solely swipe based like Tinder. OkCupid and other early online dating sites are intended to be accessed by a computer, but some have added mobile access, similar to OkCupid.

Tinder – Mobile Phone App-Based Dating – Post Dating App Introduction

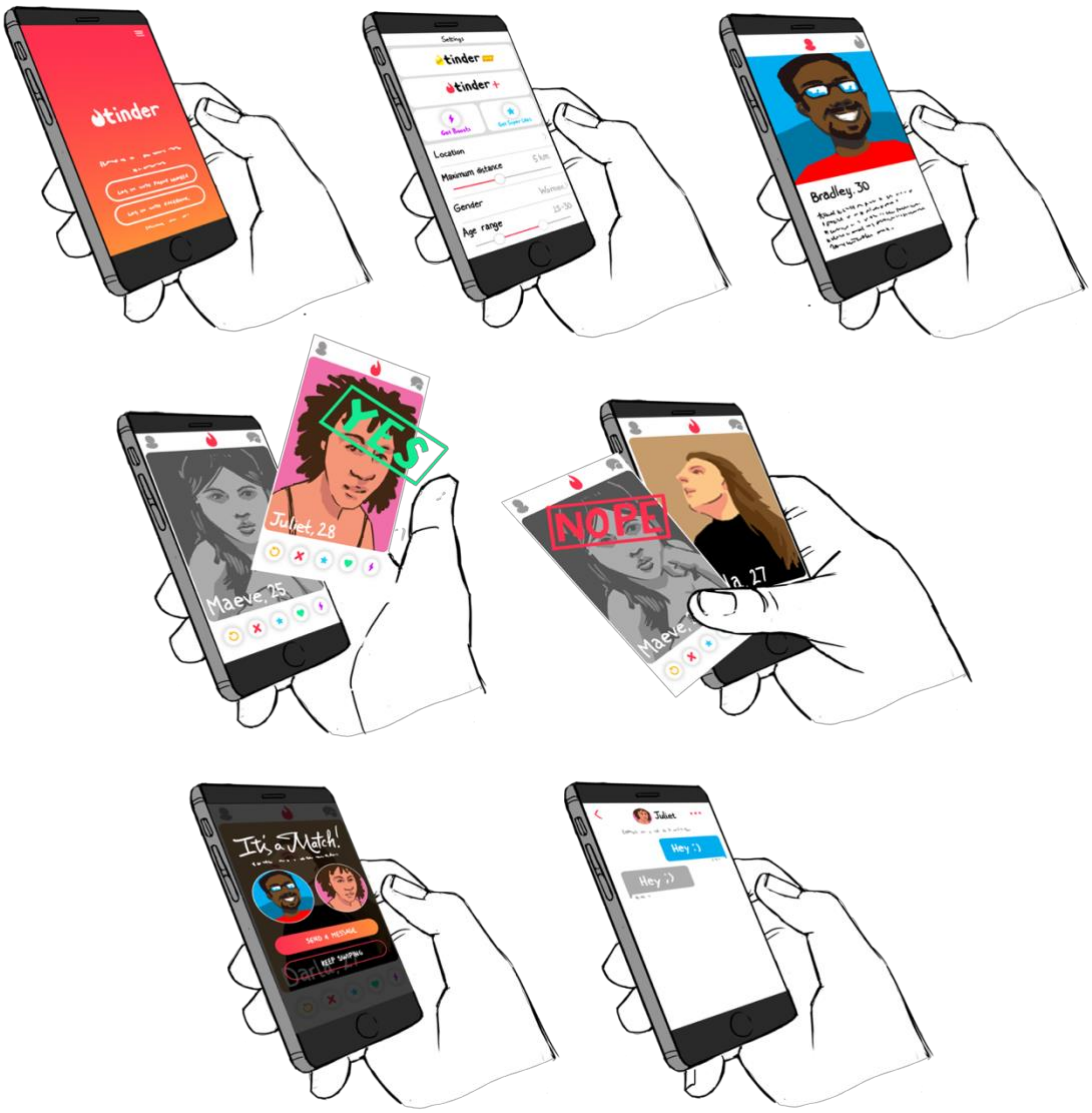

Figure 1.2. Example of how to use a mobile phone dating app (Tawns, 2021b).

Tinder was designed to be accessed solely on mobile devices; however, computer access via a website has been developed since Tinder was acquired by the Match Group. One of the main problematic issues with dating sites/apps is the perceived authenticity of users by other users (e.g., Duguay, 2017). To counter this issue, the user is asked to link their Tinder account to an established social media account, such as Facebook, a personal email, and/or a mobile phone number when registering (e.g., Duguay, 2017). Tinder has also introduced a 'blue tick' feature where users can self-authenticate by taking a

real time photo that is compared to the photos already uploaded to the profile. After the photos are verified as similar, the profile displays a blue checkmark to indicate to other users that this person is physically who they show to be. Once login details have been registered, the user then enters their demographic information and dating preferences, which include the user's age, physical location, gender, and their preferred match gender for potential mates (Please see Figure 1.2 for an example). The user can also purchase additional features, such as visibility of potential matches who have already expressed interest by swiping right on them, change of location to view potential mates outside their physical region, and unlimited swipes per day. These premium algorithm features are purchased by millions of users and have earned dating app companies billions of dollars (Rowan, 2011). The next step is to set up a profile, which consists of one to six photos and a short text paragraph of up to five hundred characters of the user's choice. On average, participants have 5.62 photos and 31.75 text characters in their paragraphs, although around one-quarter of profiles do not include any profile text (LeFebvre, 2018).

After the user profile is established, the user can then begin the selection process. When choosing who to date, the user is initially presented with profiles of potential matches near their location. These users are represented by a photo, their first name, their age, and sometimes their occupation/place of employment or student status/institution. The user then has the option to click/tap on the main profile photo to see other photos and text, if available. The user then swipes either left to reject or right to accept the potential match (Please see Figure 1.2 for an example). Swiping is anonymous until two users have both swiped right and accepted the match, unless a user has paid to see their potential matches ahead of time with a premium account or uses a feature such as a super like. When a user uses a 'super like,' they swipe up and the potential match is instantly informed of their interest instead of waiting for a mutual match. Each user can use one free super like per day but can purchase more if they want. Other modern dating apps/sites that have adapted Tinder's swipe feature follow similar mechanics. Once matched users can text each other directly using the app's chat feature. When communication has started the matched pair may discuss how/if they will pursue the match and possibly meet in-person. Users can also choose to unmatch at any time which

permanently halts communication between the previously matched pair on the app. When interacting with others online, users may be likely to engage with certain individuals more so than others.

Who uses online dating sites?

People who use dating websites and apps may differ from non-users. For example, in terms of the Big-Five personality dimensions, Tinder users are more extraverted and open to new experiences than non-users, while non-users are more conscientious than users, with no differences on the remaining dimensions (Timmermans & De Caluwé, 2017). Users are also more likely to be non-heterosexual, low in dating anxiety, and high in sexual permissiveness compared to non-dating app users (Sumter & Vandenbosch, 2019). Despite these differences, relationship ideals, such as trust, honesty, and commitment, are equally important online as they are offline to daters; however, what social cues and how they are interpreted can vary significantly (Whitty & Gavin, 2001). For example, perceiving an increase in online intimacy through text-based communication did not always end up with a face-to-face meeting, which left dating app users feeling disappointed (Whitty & Gavin, 2001). However, regardless of the distinguishing traits between dating app users and non-users, the number of online dating participants increases each year, and more non-users are becoming users (Statista research Department, 2021).

Changing how online dating is viewed by society and personal experience has an impact on user uptake. Societal views are evolving, users are now judged to be less desperate and online dating is increasingly seen as a viable option for finding a mate (e.g., Donn & Sherman, 2002; Madden & Lenhart, 2006; Sautter et al., 2010). Indeed, many perceive that a better match may be possible online because users can diversify and increase their dating volumes (Madden & Lenhart, 2006). Individuals' impressions of online dating tend to become more positive as they become more familiar with the topic through personal use or knowing someone who has used dating apps (Donn & Sherman, 2002; Madden & Lenhart, 2006). For example, in a study investigating perceptions about dating sites, one group was given minimal information about dating sites, while a second group was given first-hand exposure (Donn & Sherman, 2002). The group who had more experience with

the site expressed neutral impressions, while the less-exposed group expressed negative impressions (Donn & Sherman, 2002). Positive opinions about online dating are also correlated with overall internet literacy (Sautter et al., 2010).

Furthermore, economic pressures may be responsible for the increase in mean age of first marriage, as people delay dating to prioritize their education and/or careers (Sautter et al., 2010). This prioritization can also cause a person to leave their kin networks to travel to other locations for school and work, where they may turn to online dating to bridge social capital in their new locations (Sautter et al., 2010). The next section will examine whether online dating can meet relationship goals similarly or possibly even better (as online dating companies promise and users perceive) than offline dating.

Is online dating fundamentally different (and superior) to offline methods for finding a romantic partner?

As previously stated, relationships are important for our overall health and well-being (i.e., Baumeister & Leary, 1995), and finding good intimate relationships is important (e.g., Cohen et al., 1998, Diener & Seligman, 2002, Finkel et al., 2012). Loneliness, unhappy marriages, and divorce are leading reasons for reduced overall well-being, physical health, mental health, and work productivity (e.g., Cacioppo et al., 2002; Cohen et al., 1998; Kiecolt-Glaser et al., 2005; … please refer to section 1.2, please also see Forthofer et al., 1996) and why people seek out counsellor-lead therapy (Hubbard et al., 2018; Veroff, 1981). The above reasons are why dating apps being a successful mate finding tool would be important. At this time, and as a motivator for the initial research in this thesis, there are no clear scientific findings that support the claims of superiority made by dating sites and apps based on their own 'research.' However, there are benefits/pros and costs/cons to these unique services; the literature relevant to three key areas of online versus offline dating is reviewed below.

Finkel and colleagues made two key proposals in their 2012 review article. First, online dating is fundamentally different from conventional offline dating, differing in three key aspects—access, communication, and matching—each of which has costs and benefits relative to traditional offline dating.

Second, online dating may or may not promote better romantic outcomes than conventional offline dating, based on these three unique aspects of online dating and the empirical evidence produced thus far within behavioural science. Finkel and colleagues (2012) claim that the “important” advantages over offline dating are the level of potential matches a user has access to, computer-mediated communication (CMC) to gain a better sense of compatibility before face-to-face dating even occurs, and the algorithm collecting data can facilitate better matches and possibility eliminate bad matches. However, Finkel and colleagues (2012) also state that these services, as implemented by the dating sites, do not always improve romantic outcomes and can even undermine them. The evidence related to these three key features will now be examined.

Mediating communication via a computer. Online CMC offers users the opportunity to converse remotely with potential partners prior to meeting in person. Online dating takes an information-first approach that allows users to connect instantaneously with multiple users at the same time (Finkel et al., 2012). In contrast to offline dating, where people meet first and then gain information second from one potential partner at a time (Finkel et al., 2012). Timmermans and Courtois (2018) found that CMC on Tinder is generally required to lead to an in-person meeting: the likelihood of starting a conversation on Tinder is increased by a user’s expectation of a potential sexual encounter (20%) and/or relationship (17%). For example, CMC on Tinder led to approximately 50% of users meeting offline, and of those users, more than a third reported having casual sex and more than a quarter agreed to be in a committed relationship (Timmermans & Courtois, 2018). The likelihood of meeting in person increases when the user is female, users are 18–29 years of age, accounts are on the app/website for a longer period of time, users have had sexual intercourse in the past, and users are looking for a relationship or social connection (Timmermans & Courtois, 2018). Using CMC for a short period before meeting in person creates positive feelings (McKenna et al., 2002; Ramirez & Zhang, 2007). However, if the communication continues for a longer period of time (i.e., about 6 weeks or more), the in-person meeting is much less likely to live up to inflated expectations (Ramirez & Zhang, 2007), especially when textual information can be easily misrepresented or

misinterpreted (e.g., Caspi & Gorsky, 2006; Cornwell & Lundgren, 2001; Whitty, 2002). Most daters are not willing to start or maintain an exclusive text-based relationship without the expectation of in-person interactions (Whitty & Carr, 2006).

Taking advantage of online matching algorithms. Matching through third party services is not a new phenomenon of the digital age; however, not all dating services take advantage of computer algorithms. Instead, they rely on human matchmakers or users to manually browse through potential mates with no external filtering, as was the case before computer algorithms were developed (please see, e.g., Adelman & Ahuvia, 1991; Ahuvia & Adelman, 1992; Eastwick & Finkel, 2008; Finkel et al., 2007; and Woll & Cozby, 1987 for discussion). Offline dating through third parties leverages broad social networks of mutual acquaintances (Ahuvia & Adelman, 1992). Ideal match criteria is based on strong opinions within the networks about what types of people belong together and the willingness of couples to adhere to those strong opinions (Ahuvia & Adelman, 1992). Pre-app dating services did not have wide community uptake, except in a select few cultures (e.g., Chinese, Xia & Zhou, 2003; Indian, Bhandari, 2018; Jewish, Rockman, 1994) where human matchmakers are a social norm (see Finkel et al., 2012 for discussion).

The first computer algorithm to match couples was created in 1959. Two Stanford undergraduates created Happy Families Planning Service for their final class project and matched up forty-nine couples using an IBM model 650 computer. The algorithm used a questionnaire that matched couples based on the highest number of matching answers to a variety of questions; one marriage resulted from the project (Gillmor, 2007). Subsequently, several other corporate enterprises started implementing computer algorithm dating that matched couples using the Happy Families Planning Services model. However, unlike modern dating apps, the process was neither instantaneous nor easy to set up for users or developers. Participants had to fill out and mail in questionnaires, which in many cases would overload the 1960–70s computers' processing capabilities, as they were unable to handle large amounts of data. Despite their limitations, however, these dating computer algorithm services did lead to

several marriages before they were shut down (Leonhardt, 2006; Mathews, 1965).

Once computer technology advanced in the 1980s, users turned to online bulletin boards and chat rooms (prior to the development of algorithms), as previously mentioned, to find social connections and intimate relationships (e.g., Rheingold, 1995; Surratt, 1998; Turkle, 1995; Whitty & Gavin, 2001). However, Finkel and colleagues (2012) emphasize that these services were only used by a small audience, as internet users needed to be "tech-savvy" and the communities were "niche". The first modern dating site, Match.Com (now known as the Match Group), was launched in 1995, but was originally a personal advertisement site and did not initially use algorithms. The first site to use algorithms was eHarmony (launched in 2000, eHarmony, 2021), which claimed to offer "science-based" online matching that was based on self-reported data, similar to the Happy Families Planning Service model (Finkel et al., 2012). Subsequently, many other companies began using algorithms, including Match.com (Gelles, 2011). Some sites even included non-self-reported data, such as: genetic, immunological, or biological compatibility (Frazzetto, 2010; McGrane, 2009).

In 2008, Apple Inc. allowed independent developers to create apps (software programs) for mobile phones. Many established dating websites then created apps to coincide with their websites. In 2009, Grindr was launched specifically to serve the male queer community and was the first dating app created exclusively for mobile use. This was followed by Tinder in 2012 and many other dating apps since (e.g., Hinge, Bumble).

Dating apps increase in success, compared to their web-based predecessors, can be partially ascribed to an increase in positive attitudes towards online dating (e.g., Anderson, 2005; Darden & Koski, 1988; Goodwin, 1990; Harmon, 2003; Paumgarten, 2011; Smaill, 2004; Wildermuth & Vogl-Bauer, 2007). The increase in online dating is also attributed to the development of technological advances that allow for instant data processing and profile construction, the advertising of successful relationships that began through dating sites, and first- and second-hand usage driving the popularity of these apps/sites within personal social networks (please see Christakis & Fowler, 2009; Finkel et al., 2012 for discussion). Modern dating apps and sites

also attribute their growth to the promotion of their matching algorithms, however, the true benefits of these algorithms to the users of these apps and sites remain unclear.

In fact, no empirical tests have yet demonstrated any benefit to online dating users (Finkel et al., 2012). This is problematic as many dating websites have made exorbitant claims about their algorithms and promote them as unique services their users should pay for. The importance of testing these claims was one of the main motives of Finkel and colleagues (2012) in writing their review article. Most of the algorithms are based on matching users in terms of similarity, and while there is a scientific link between similarity and relationship success, long-term compatibility cannot be predicted by matching algorithms that are based on similarity alone (Finkel et al., 2012). Short-term compatibility and long-term compatibility have different variables for success, for example, long-term success is based on mutual growth, positive responses to life-events, and dynamics that promote the relationship, these items currently cannot be predicted by short-term success variables like similarity (Finkel et al., 2012). In the 1970s, “Project Cupid” was funded to create a non-profit dating computer algorithm service, and the trustees turned to leading relationship psychologists (e.g., George Levinger, Elaine Hatfield, Zick Rubin) to review and improve the product. However, George Levinger reported that the current methods inspired little confidence in their ability to create satisfactory matches, and the team of psychologists were not ready to promise that their expertise could improve the matches (Finkel et al., 2012). The project was shut down.

New algorithms have been created since Finkel and colleagues’ 2012 article, such as the Elo rating system. The Elo rating system ranks users based on how much interest their profile receives, then introduces users with similar ratings more often (Tiffany, 2019). In the case of Tinder, the interested is based on right swipes which indicate a user wanting to connect; meaning users will be shown other users who have similar right swipe rates. The Elo algorithm is now considered “old news” by Tinder as their mass data collection from a numerous amount of users has allowed them to develop other algorithms (Tiffany, 2019). However, transparency to what those “new” algorithms do has not being released to consumers. The article by Kaitlyn Tiffany (2019) for Vox speculates that the new algorithms can predict a user’s interest based on user history and

matching users to profiles similar users have shown interest. While new algorithm development is great, transparency with consumers and fellow researchers remains an issue. This lack in transparency doesn't allow for consumers and peer review to evaluate algorithms from dating apps. Therefore, more empirical work and transparency needs to be done to evaluate if dating algorithms are successful.

Accessing a wider pool of potential dates/romantic partners. Offline access to potential mates is usually limited by a person's mutual acquaintances. In contrast, online dating extends beyond the limits of a user's social circle to anyone using the app/site, giving users the opportunity to evaluate a large number of potential mates (Finkel et al., 2012). Before online dating, dates were usually procured through third party social connections (Coontz, 2006; Granovetter, 1973). As a dating tool, the internet has surpassed traditional third-party influences (family, schools, neighbourhoods, friends, and the workplace), especially for groups that have had difficulties accessing mates in the past, such as queer daters and middle-aged heterosexuals (Rosenfeld & Thomas, 2012). According to self-reported data from dating app users, 46.6% believed dating apps increased their access to potential mates, 29.1% felt there was no difference in access between on- and offline dating, and 24.3% believed their access to potential mates was worse online than offline (LeFebvre, 2018). Access to potential mates is essential for users' ability to choose a potential partner.

Choice, novelty, and its relationship to human mate choice

Having choice is important. For example, in an experiment involving care home residents, the group that was given the freedom to make choices (i.e., self-determination) showed significant improvement in alertness, active participation, and general sense of well-being compared to the group whose decisions were made exclusively by staff (Langer & Rodin, 1976). This experiment supports that like socializing (i.e., Baumeister & Leary, 1995), choice has implications for happiness and health. A follow-up study supported Langer and Rodin's (1976) claim and looked into the after-effects of the post-experimental intervention. Compared to residents who received random or no

visitation, residents who were given choice or predicted social visitation benefited the most during the study, but subsequently experienced the greatest declines in their health and "zest" for life when the visitations ended (Schulz & Hanusa, 1978). These studies demonstrate that choice and socializing are important to humans' physical and psychological well-being and that the absence of both may have important consequences for the individual.

When a person feels they are in control of their choices, they tend to have higher expectations for their success and future outcomes compared to when they do not feel in control (Rotter, 1966). An individual with a strong belief in their own control/choice will be more alert to useful information in their environment, work to improve their environment, place a greater value on their skills and achievements, be more attuned to their successes over their failures, and be more likely to resist subtle attempts to influence them (Rotter, 1966). For example, when giving participants the ability to choose three out of six puzzles versus the experimenter assigning them three puzzles, participants in the choice condition performed better and showed increased intrinsic motivation (Zuckerman et al., 1978). Another study found that individuals have bias towards their ability to choose/be in control when responding to negative, ambiguous, or unsupportive feedback (Taylor & Brown, 1988). Those with a positive sense of self, belief in their own personal efficacy, or/and optimistic views of their future control/choice were happier, more caring, and more productive than those who perceived the information more accurately and integrated the feedback into their view of themselves, the world, and the future (Taylor & Brown, 1988). This experiment supports that positive biases and illusions of control/choice can have real-world benefit over accurate negative biases. Choosing or the illusion of choice is important for one's physical and mental health, happiness, overall well-being, and ability to succeed in the future. However, too much choice can have the opposite effect.

Having more choice increases interest but decreases commitment and the intrinsic motivation to choose. For example, consider the following three experiments by Iyengar and Lepper (2000):

- In the first experiment, when twenty-four (high choice condition, H) or six varieties (low choice condition, L) of jam were presented at a tasting booth, the percentage of customers stopping by the booth was greater

for the higher choice condition (H: 60%, L: 40%). However, the proportion of customers who purchased jam was greater for the lower choice condition (H: 3%, L: ≈30%). There was no significant difference in the number of jams sampled per customer between conditions (1–2 jams sampled).

- In the second experiment, when thirty (H) or six choices (L) of extra-credit essay topics were presented to an introductory social psychology class, the percentage of participation was greater for the higher choice condition (H: 60%, L: 74%). However, the quality of the essays was greater for the lower choice condition (H: 7.79/10, L: 8.13, slight but significant difference). There was no significant difference in the students' overall class performance between conditions and for those who did not participate.
- In the third experiment, when thirty (H) or six varieties (L and control, C, choice selected for them from six options) of chocolate were presented, choosing time (H: 24.36 seconds, L: 8.91 seconds), perception of choices (H: too many, L: about right), overall satisfaction (H: 5.46/7, L: 6.28, C: 4.92), and purchase behaviour (choosing a box of chocolates for compensation instead of $5 USD, H: 12%, L: 48%, C: 10%) differed between conditions. The act of choosing was considered to be more enjoyable (as more choice increases interest) but also more frustrating (as more choice decreases a consumer's ability to commit to one item) for the higher choice condition.

The findings of these three experiments support the choice overload hypothesis, which states that increasing the number of options can lead to a decrease in both motivation to choose and satisfaction with the final choice (see Scheibehenne et al., 2010 for variance in the effect across studies).

In a meta-analysis of sixty-three conditions from fifty experiments, choice overload hypothesis showed a mean value close to zero (Scheibehenne et al., 2010). However, there was a large variance between studies showing some strong reliable cases where choice overload occurs and other cases where no effects were found (Scheibehenne et al., 2010). One factor that can lead to choice overload is being unfamiliar with a product. For example, in some experiments where choice overload was supported, such as those conducted

by Iyengar and Lepper (2000), the sample consisted of unfamiliar products to deter users from picking a product they were familiar with (Scheibehenne et al., 2010). In studies that involve familiarity, a large number of options can lead to an increase in satisfaction (Mogilner et al. 2008). A second factor leading to choice overload is not knowing the domain of the options. When a person is aware of all the options, choosing becomes easier regardless of sample size (Dhar, 1997; Dhar & Nowlis, 1999; Hsee & Leclerc, 1998; Redelmeir & Shafir, 1995). A third factor of choice overload depends on a person's ability to perceive the value of the choice. In cases where choice overload occurs, participants are less likely to be able to differentiate between the attractiveness of the options (Fasolo et al., 2009; Timmermans, 1993) and were concerned that they would not choose optimally (Iyengar et al., 2006; Schwarts, 2004). A fourth factor of choice overload is that large samples can over-inflate a person's expectations, which can lead to dissatisfaction when expectations are not met (Diehl & Poynor, 2007; Schwartz, 2000) and be cognitively exhausting when a person must filter out numerous unattractive options (Kahn & Lehmann, 1991). These effects of choice overload may also be relevant to how large pools of dating options affects a dater's ability to choose a satisfactory mate.

These large choice sets in a dating context influence daters to be more selective and base their decisions on superficial (Lenton & Francescioni, 2010) and/or minimal cues (see Finkel et al., 2012 for discussion). For example, female speed-daters are less likely to say yes to a potential partner in a larger group compared to a smaller group (Fisman et al., 2006). Similar findings are observed on choice set size and general consumer decision-making, where more options decreases people's motivation to buy (Iyengar & Lepper, 2000) and lowers their satisfaction with their eventual decision ('The Choice Overload Hypothesis', e.g., D'Angelo & Toma, 2017; see Scheibehenne et al., 2010 for variance in the effect across studies). For example, D'Angelo and Toma, (2017) followed the same model as Iyengar and Lepper's (2000) jam jar experiment for online dating and found it supported the choice overload hypothesis. When online daters had the choice between twenty-four (High) or six (Low) potential dates, daters from the high choice set were less satisfied with their final choice and more likely to exchange their choice for another dating option one week later (D'Angelo & Toma, 2017). Collectively, having access to a large amount

of potential partners in an online dating context may lead daters to have an 'assessment mindset' which undermines their willingness to commit or stay committed to a romantic partner at different levels of dating (Finkel et al., 2012). An 'assessment mindset' is where a large pool of online dating options orient daters towards novel mates in the hopes of finding an optimal partner, rather than committing to a current partner or romantic prospect (Finkel et al., 2012).

While the evidence discussed in this section suggests that there is a potential cognitive basis ('Choice overload') to a social phenomenon (picking and choosing romantic partners in the context of online dating), there may also be a biological basis to this process if the presence of novelty is a relevant factor in courtship. Attraction to novel mates over familiar mates is a phenomenon known as The Coolidge Effect (Wilson et al., 1963). Various nonhuman species, particularly males, decrease their mating effort towards familiar mates when novel mates are present; this trade off may maximize fitness and genetic diversity of offspring ('The Coolidge Effect', Wilson et al., 1963). The presence of novel mates is related to arousal, willingness to mate, and increases in sperm allocation/frequency (Dewsbury, 1981). These effects have been observed, for example, in male rats (Bermant et al., 1968; Brown, 1974; Fiorino et al., 1997; Tlachi-López et al., 2012; Wood et al., 2004; Yamashita et al., 2011), beef bulls (Bailey et al., 2005a, 2005b), guppies (Jordan & Brooks, 2010), pond snails (Koene & Ter Maat, 2007), birch catkin bugs (Reinhold et al., 2015), cuttlefish (Schnell et al., 2015), and burying beetles (Steiger et al., 2008). Moreover, some studies have observed the Coolidge Effect in both sexes of rats (Ventura-Aquino & Fernández-Guasti, 2013), female Golden Hamsters (Lisk & Baron, 1982), and female (but not male) decorated crickets (Gershman & Sakaluk, 2009).

Other work suggests nuance in the Coolidge effect, where multiple encounters with novel females predict reduced courtship effort but increased sperm investment (Devigili et al., 2015). Limited research suggests that the Coolidge effect may be observable in humans. For example, penis circumference is larger in men when novel erotic stimuli are introduced to an experimental presentation (Koukounas & Over, 2000). Although some studies suggest that the Coolidge effect may only be observed in particular species that trade-off between the costs (e.g., energetic costs; see Pizzari et al., 2003) and

fitness benefits of multiple matings with a familiar mate (e.g., Jordan & Brooks, 2010; Thomas & Simmons, 2015). For example, male guppies reduce reproductive mating effort around familiar female mates; in the presence of novel mates, male guppies increased reproductive mating effort, reduced foraging effort, and reduced lifetime growth (Jordan & Brooks, 2010). This phenomenon may explain sexual behaviour and sexual motivations in both humans and animal species.

For clarity, the Coolidge effect will be one of the central theories underpinning the work in this thesis. The term 'Coolidge like effects' can either mean preference for novelty for both sexes or that men like novelty more than women. Even though some species do show females preferring novelty, they are less common (please see above, i.e., rats, Golden Hamsters, and decorated crickets), and human women have not been shown to prefer novelty in mates more than men (this research included). The benefits of the Coolidge effect are male dominated: increase in sperm allocation/frequency (Dewsbury, 1981) and increase in penis circumference (Koukounas & Over, 2000). Benefits that are not gendered: increase arousal and willingness to mate (Dewsbury, 1981) are meant to maximize fitness and genetic diversity of offspring ('The Coolidge Effect', Wilson et al., 1963). The key term is promoting genetic diversity. For example, the promotion of genetic diversity improves resistance to pathogens and increases a species ability to adapt to changing environments by creating multiple genetic defences to face a diverse range of exposures (Hawley et al., 2005; Jump et al., 2009; Trontti et al., 2006). The questions one would need to ask pertaining to humans is: does not knowing the parentage (i.e., paternity) of a child have greater benefits or consequences? And how do humans compare to their animal counterparts? A few differences between humans and the animals listed above is humans tend to have one child at a time versus a litter, human gestation takes longer, and the need of parental involvement is much higher for a human baby. Research on monogamy states that monogamy is formed in species either due to low options when population density is less numerous or/and a solo female needs assistance with child rearing (Kleiman, 1977). Monogamy is a preference for familiar partners. Monogamy also has social elements in humans and non-humans (Lukas & Clutton-Brock, 2013). For example, childcare is more socially expected of

human women than men (Craig & Mullan, 2011; García-Mainar, 2011; Sevilla et al., 2020) and female promiscuity has stronger social consequences than men (Crawford & Popp, 2003; Kreager & Staff, 2009; Sagebin Bordini & Sperb, 2013). Therefore, while there are social and biological reasons for both human men and women to be monogamous, mating motivations support the opposite (e.g., maximize one's biological output) and have more allowances for men. These reasons are why the Coolidge effect pertains more to men, even when women also show a preference for novelty.

Indeed, some have gone as far as to claim that "without the Coolidge effect there would be no internet porn" (Wilson, 2012). Wilson (2012) claimed the brain is "rewired" due to exposure (Meerkerk et al., 2006) and sexual functioning is in turn impacted, via research attributed to SIAMS in 2011 (NewsCore, 2015; also reviewed on www.yourbrainonporn.com; please note no academically reputable source could be found for SIAMS, 2011), requiring a "neurochemical rebirth" to counteract its effects. In light of this claim and subsequent criticism within the academic community (e.g., Fleming, 2013; Helfer-Parker, 2016), an empirical test of this claim is provided within this thesis. In sum, the design of many modern technological platforms may affect how we respond to these factors when selecting a romantic partner and aspects of intimacy more generally (see Section 1.4: Technology's impact on human sexuality). Therefore, because the autonomy to choose and exposure to novelty are important in human courtship and because modern dating sites and apps may influence how people consider these aspects when selecting a mate, the relationships between these factors warrants investigation.

1.6. Is the "modern world" conducive to seeking novelty?

Novelty in choice can increase interest and enjoyment (Iyengar & Lepper, 2000). However, having too many options can cause choice overload and lead to consumers feeling fatigued and unable to choose, which increases their frustration and decreases satisfaction (Iyengar & Lepper, 2000, Scheibehenne et al., 2010). This holds true for dating apps as well (D'Angelo & Toma, 2017, Finkel et al., 2012). However, one of the main reasons users use dating apps is, in fact, to increase the size of their dating pool (Finkel et al., 2012). Thus,

this raises the question: why are consumers seeking a large amount of novel mates?

Most users of dating apps are younger (Anderson et al., 2020), and younger populations seek to increase their social circles (see Wrzus et al., 2013 for a meta-analytic review). The motivations for using online dating also vary and include seeking intimate connections (i.e., partnership and sexual), wanting entertainment, being open to new experiences, and learning how to adapt to the current dating market (e.g., Timmermans & De Caluwé, 2017, LeFebvre, 2018, Ward, 2017). Furthermore, not everyone who uses online dating is looking to instantly choose a long-term mate (LeFebvre, 2018), and even those users who are looking for such a connection still believe that dating should be fun. This means that novelty's appeal of enjoyment may meet a user's desire for entertainment, regardless of their other motivations for using online dating. However, eventually choice fatigue and frustration may explain why more than a third of daters eventually quit online dating (LeFebvre, 2018). This leads to the next question about daters who quit using online dating and those who do not use this technology: does novelty's pull towards entertainment push away from commitment in general/off-line?

One way we can test these questions is to look at our social judgement of others. For example, attractiveness judgements of others are a good proxy for the extent to which we are willing to allocate social effort to other people in different contexts (see Langlois et al., 2000 and Rhodes, 2006 for reviews) and whether face perception plays an important role in social behaviours (Fiske & Neuberg, 1990). The final section will provide an overview of the causes and consequences of first impression judgements based on physical cues, which is one of the dimensions that is important in these judgements.

1.7. The consequences and dimensions of first impressions based on physical characteristics

Humans make quick judgments about each other (Hassin & Trope, 2000). For example, judgements on observed behaviour (e.g., face, body, speech, and tone of voice) can be made in under thirty seconds, and faster judgments do not differ from longer observations (four and five minutes) in accurately

predicting traits such as personality (see, e.g., Ambady & Rosenthal, 1992 for a meta-analytic review). These initial impressions form the perceiver's view of a target's attributes (perceived age, race, and sex), which can lead to stereotyping instead of viewing the person as an individual (Fiske & Neuberg, 1990). As previously stated, this happens with modern dating as well, where the abundance of options leads to a large number of initial meetings in a short period of time (Finkel et al., 2012). Quick and easily accessible qualities, such as age, height, and weight, take precedence over unobservable qualities, such as occupational status, educational attainment, religious affiliation, and smoking status (Lenton & Francescioni, 2010), which may lead to inaccurate judgements on personality (see, e.g., Ambady & Rosenthal, 1992 for a meta-analytic review; Fiske & Neuberg, 1990; Hassin & Trope, 2000). People rapidly judge faces on attractiveness (Willis & Todorov, 2006), even when this quality is irrelevant to the task at hand (Ritchie et al., 2017). This tendency may play a role in the quick visual judgments made while selecting mates on dating apps (David & Cambre, 2016) and selecting which pornography to view (e.g., Rupp & Wallen, 2007; Ogas & Gaddam, 2011).

A person's level of attractiveness can have other real-world implications in addition to online dating. Attractive children and adults are treated more favourably and have an advantage for dating, winning elections, succeeding in the job market, and cooperating with others (see Langlois et al., 2000 and Rhodes, 2006 for reviews). For example, attractiveness is linked to how much an employee is paid and how often they get hired. Attractive people generally earn more and get hired more often than average-looking people, who in turn earn and get hired more often than unattractive people (Frieze et al., 1991; Hamermesh & Biddle, 1994; Marlowe et al., 1996). Unattractive women are less likely to participate in the job market and are more likely to marry men who earn less money (Hamermesh & Biddle, 1994), which could be a factor for dating apps. Being attractive can also influence court decisions: unattractive people tend to receive harsher prison sentences (see Mazzella & Feingold, 1994 for a meta-analytic review; Zebrowitz & McDonald, 1991). Furthermore, this "attraction" level has ties to stereotypes and race, as defendants who appear to have less Caucasian facial features are prosecuted more harshly (Blair et al., 2004; Eberhardt et al., 2006). In contrast, defendants who are attractive,

female, of high socioeconomic status (Mazzella & Feingold, 1994), white (Blair et al., 2004), and youthful in appearance (Zebrowitz & McDonald, 1991) tend to get lighter sentences. However, if the jury perceives the defendant as exploiting their looks, they tend to sentence them more harshly (Mazzella & Feingold, 1994). Being attractive also influences voting, for instance, attractive people tend to win elections (e.g., Little et al., 2007; Marlowe et al., 1996). Attractiveness also affects parenting and childcare—attractive children are treated better than unattractive children, and this difference can significantly impact a child's upbringing and education (Kenealey et al., 1988).

Various factors contribute to a person's perceived attractiveness. One factor that is considered attractive is novelty in the case of the Coolidge effect, however there is also a strong claim that familiarity can be equally attractive in other contexts (e.g., Batres et al., 2017; Peskin & Newell, 2004; Rhodes et al., 2001; Sofer et al., 2015). Attraction to familiar and novel people will be the main dimension examined in this thesis. This dimension is a straightforward variable to manipulate experimentally, such as by looking at someone's typicality related to a population average and/or whether or not you have seen or not seen an individual before.

Familiarity is considered to be attractive (e.g., Batres et al., 2017; Peskin & Newell, 2004; Rhodes et al., 2001; Sofer et al., 2015) over novelty in some contexts, and is usually more attractive to women than men (i.e., a 'Coolidge-like' phenomenon; Little et al., 2014). In fact, familiarity with someone can enhance our social and/or romantic attraction to them (e.g., Moreland & Zajonc, 1982; Zajonc, 1968). Attraction to a given appearance (e.g., facial) can be enhanced if that person has 'typical' features close to a population average (e.g., Batres et al., 2017; Grammer & Thornhill, 1994; Lie et al., 2008; O'Toole et al., 1994; Rhodes et al., 2005; Sofer et al., 2015).

However, although familiarity is attractive, attraction to familiar individuals may be determined by certain factors. For example, during a second viewing of faces, on average, men have a stronger preference for novelty and their attractiveness ratings of female faces decreased from baseline; in contrast, women, on average, prefer familiar faces and their ratings of male faces increase from baseline (Little et al., 2014; see also Morton & Gorzalka, 2015; Tan et al., 2013). This has been interpreted as evidence for a 'Coolidge-

like' effect in humans (Little et al., 2014). The attractiveness of faces is also moderated by resemblance to a participant's current partner, and this effect is stronger in women than in men (Little et al., 2014). Collectively, examining responses to both familiar and novel choices enable examination of the extent to which short-term experimental manipulation of choice may moderate mate preferences. This examination can be applied to analyse how users select potential mates from dating apps or whether other online environments affect attractiveness perception following exposure to many hypothetical sexual partners (i.e., internet pornography).

In sum, social judgements can be made rapidly (i.e., attraction Willis & Todorov, 2006) and can have an impact on how people select a romantic partner (reviewed in Little et al., 2011; Rhodes, 2006). Dating apps rely on these quick judgments by creating a binary accept or reject (usually by swiping) on little information in the form of a handful of photos and an optional small textual biography about the potential mates (Finkle et al., 2012). Facial judgements can be key to how attractiveness is evaluated (Oosterhof & Todorov, 2008; Sutherland et al. 2013; Vernon et al., 2014) and similarity motivates users to connect on dating apps (Finkel et al., 2012). Familiarity is a factor of attractiveness and facial judgments (e.g., Batres et al., 2017; Peskin & Newell, 2004; Rhodes et al., 2001; Sofer et al., 2015), however, the Coolidge effect states that novelty in mate choice can have benefits to mating strategies and orient males towards novelty versus familiarity (Wilson et al., 1963). The Coolidge effect has been observed in humans (Koukounas & Over, 2003) and is mostly observed in males (Wilson et al., 1963). Finkel and colleagues (2012) contributed the Coolidge effect to dating apps in terms of an 'assessment mindset' that influences daters to prefer novelty in hopes of a next more optimal mate. Similar theories were presented in a 2012 popular TEDx talk, where the Coolidge effect is hypothesized to be present in human males who view pornography. The hypothesis states that the plethora of novel erotic stimuli leads men to prefer novel mates, which like the 'assessment mindset' in dating apps may interfere with their ability to commit to a single partner ('The great porn experiment', Wilson, 2012). Chapter 2 in this thesis will directly test Finkel and colleagues (2012) claims that an 'assessment mindset' leads daters to be influenced by the Coolidge effect. Chapters 3 will directly test Wilson's (2012)

claim that pornography leads men to be influenced by the Coolidge effect, the first experiment to our knowledge to do so. Testing these claims is important as social and intimate relationships have a bearing on well-being, physical and psychological health, adjustment, and happiness (e.g., Diener & Seligman, 2002; Fowler & Christakis, 2008; Haidt, 2006; Zhu et al., 2013; see also Cacioppo & Patrick, 2008; Holt-Lunstad et al., 2010), thus it is important to understand how technological innovations may impact our interactions with possible partners and our sociability more generally.

1.8. Overview of theory and experimental chapters

Chapters 2 and 3 represent the results of six experiments which examine whether the experience of two different online environments (dating apps and pornography) moderates attractiveness judgements of familiar versus novel faces. Specifically, these chapters will investigate whether an experimental choice context/assessment mindset alters a user's preference for familiar and novel faces and bodies, inferring that a preference for familiarity is an indication for commitment to an intimate partner and a preference for novelty as an indication for non-commitment. Chapter 2 will examine how different mate choice conditions influence the attractiveness ratings between novel and familiar faces in an online dating context. Chapter 3 will examine how exposure to images of pornography actress at various levels of sexual signalling influences the attractiveness ratings between novel and familiar faces and bodies. All the experiments with be adapted from Little and colleagues (2014) experimental model to explore if the Coolidge effect's preference for novelty holds true for online dating users and pornography consumers.

Chapter 2 will present the first two experiments from the Sculley, Ritchie, and Watkins (2021). Experiment 1 will follow Little and colleagues (2014) model with the participants being allocated to either a slideshow phase of either preferred-sex dating images (voluntarily sent by dating app users) or to the control condition of dessert images. This experiment evaluates if exposure to a fast-paced mate selection, like dating apps, may influence a user's attraction preference for novel or familiar mates. The pre-test post-test rating task

consists of both male and female standardized faces. The results of Experiment 1 indicate facial attractiveness differed reliably between pre- and post-slideshow. Experiment 2 will follow the same model; however, the slideshow phase has a low-choice and high-choice conditions to evaluate if the breadth of the mate selection has influence on user's attraction preference for novel or familiar mates. The sample was also changed to single participants only, as partnership status has an effect on how people rate facial attraction (e.g., Karremans et al., 2011; Little et al., 2014). The results of Experiment 2 indicate women, but not men, were less attracted to the familiar face set post-slideshow, and men were relatively more attracted to novel people than women were post-slideshow. Experiment 3 will again follow the same model as 1 and 2 but negates the slideshows for a one-minute pause to evaluate if the slideshows have influence on user's attraction preference for novel or familiar mates. The results of Experiment 3 indicate no sex differences in single people's preference for familiar versus novel faces in the absence of slideshow. The fourth experiment adds a match reciprocation element to the slideshows. Following a similar model as the second experiment, we added an acceptance and rejection condition to the slideshow condition and only used only the preferred sex dating images. Post-slideshow, participants were told to imagine which of the slideshow participants they were interested in and then told either those "potential mates" were or were not romantically interested in the participant. When participants were in the non-reciprocation condition, similar to Experiment 2, single women were less attracted to the same person after experimental manipulating the ability to choose. When participants were in the reciprocation condition novelty was preferred with men being relatively more attracted to novel people than women were post-slideshow. This package of experiments supports that intimate selection can be effected by different choice conditions. The next package of experiments will look at how adding different levels of sexual signalling may influence those intimate choices as well.

Chapter 3 will present the first experiment from Sculley and Watkins (2022). Similar to the previous experimental package, these experiments will follow Little and colleagues (2014) experimental model. However, in the pre-test post-test rating task, only female faces were shown, and the male faces were

replaced by female bodies. The participants were randomly allocated to one of three slideshow conditions, all of which contained the same pornographic actress at various levels of sexual signalling: clothed, naked, or visually penetrated. The sample in this experiment consisted of only heterosexual males. The results indicate that heterosexual men were less attracted to familiar bodes post-slideshow. Post-slideshow also revealed that heterosexual men were less salient with their attractiveness dimensions to novel women when sexual signalling was higher. To add more solid support to our findings based in mate selection, the next experimental sample consisted of homosexual males only. The second experiment followed the same experimental set up as the previous experiment, however, only two slide shows were used out of the three, the clothed and the naked; the visually penetrated condition was not included in this experiment. The sample, as previously stated, included homosexual males only. The results support that homosexual males were less attracted to familiar faces and bodies. Adding these results to the previous experiment where heterosexual males were less attracted to familiar bodies, supports that visual exposure to attractive women influences male preference. Homosexual males' preferences were also not influenced by the different slideshow conditions, like the heterosexual males, indicated that sexual preference played a role in how the males were rating the faces and bodies on attraction.

Collectively, these experiments in this thesis suggest the way potential mates are configured during the selection process does influence attractiveness ratings. People are more attracted to novel faces when romantic interest is reciprocated versus not reciprocated (i.e., when people have more choice; Chapter 2). Women, but not men, are less attracted to a familiar potential mates from baseline post experimental slideshow (Chapters 2). Regardless of male sexual orientation, mere exposure to pornographic actresses reduces attractiveness of familiar bodies post-slideshow (Chapters 3), and familiarity is relatively less salient on the attractiveness dimension compared to novelty for heterosexual men when sexual arousal is greater (Chapter 3). This body of work suggests the way the modern technology is designed has influence over a user's experience. Users should be cautious and aware of these influences

when deciding which technology they would like to engage with, and developers should consider how their website and app designs effect their consumers' decisions.

Chapter 4 will review the overall discussion of the work presented through Chapters 1 and 2.

Chapter 2.

Does the Experience of Using an Online Dating Site Reduce the Attractiveness of Familiar Preferred-Sex Faces?

This chapter is adapted from the following publication:

Sculley, J., Ritchie, K. L., & Watkins, C. D. (2021). Having options alters the attractiveness of familiar versus novel faces: Sex differences and similarities. *Computers in Human Behavior*, *124*, 106937.

Chapter 2. Does the Experience of Using an Online Dating Sites Reduce the Attractiveness of Familiar Preferred-Sex Faces?

Abstract

Although online dating allows users to access a wider pool of romantic partners, choice could induce an 'assessment mindset', orienting users towards 'optimal' or alternative partners and undermining their willingness to commit or remain committed to someone. Contextual changes in judgements of facial attractiveness can shed light on theorizing around the 'assessment mindset' that may be induced via online dating platforms. We directly test this proposal by activating a context where participants imagine choosing between items in picture slideshows (dates or equally attractive desserts), observing its effects on attraction to i) faces on second viewing and ii) novel versus familiar identities. Single women, relative to single men, were less attracted to the same face on second viewing (Experiment 2 and 4), with this sex difference only observed after imagining not 'matching' with any romantic dates in our slideshow (i.e., low choice, Experiment 4). These effects (Experiment 2) were not moderated by slideshow content (romantic dates or desserts) or choice set size (five versus fifteen items). No equivalent sex differences were observed in the absence of experimental choice slideshows (Experiment 3), and these effects (Experiment 2) were not moderated by slideshow content (romantic dates or desserts) or choice set size (five versus fifteen items). Following slideshows, novel faces were generally more attractive than familiar faces (Experiment 1), with this effect stronger in men than in women (Experiment 2) and stronger across both sexes after imagining 'matching' with desired romantic dates (i.e., *high choice*, Experiment 4). This latter effect provided us with the strongest evidence in support of Finkel and colleagues' original theorizing. Our initial set of experimental findings reveal a different pattern of results for men and women that. This may underpin different experiences for men and women when using online dating sites. Collectively our findings suggest that familiarity does not necessarily 'breed liking' when we have the autonomy to choose, revealing socio-cognitive mechanisms that could underpin online interactions,

such as when browsing profiles and deciding how to allocate effort to different users.

Introduction

2.1. Social judgements of faces and their consequences

Social judgements of others can have real-world consequences (reviewed in Todorov et al., 2015), including when we select a romantic partner (reviewed in Little et al., 2011; Rhodes, 2006). Valence (independent of stimuli such as faces - i.e., one of the three key emotional dimensions reflecting pleasantness/unpleasantness on the two ends of the spectrum.) and attractiveness are key dimensions on which we evaluate faces (Oosterhof & Todorov, 2008; Sutherland et al., 2013; Vernon et al., 2014), and attractive faces are motivating to engage with at the neural and behavioural level (reviewed in Hahn & Perrett, 2014). Moreover, attractiveness judgements of faces are made rapidly (Willis & Todorov, 2006), even when these judgements are irrelevant to the task at hand (Ritchie et al., 2017). Complementing classic studies in social psychology which proposed that 'familiarity breeds liking' (Zajonc, 1968; see Bornstein, 1989 and Montoya et al., 2017 for meta-analytic reviews), familiarity (e.g., Batres et al., 2017; Peskin & Newell, 2004; Rhodes et al., 2001; Sofer et al., 2015) and typicality/representativeness of a population average (e.g., Grammer & Thornhill, 1994; Langlois & Roggmann, 1990; Lie et al., 2008; Rhodes & Tremewan, 1996; Rhodes et al., 1999) underpins attractiveness judgements of faces, at least in part. The experiments in this thesis focusses on the dimension of familiarity versus novelty and its role in attractiveness judgements, first in the context of online dating.

2.2. Assessment mindsets induced via online dating platforms

While the above evidence points to the importance of familiarity in face and person perception, a large number of people (see, e.g., Wilson et al., 2012 for discussion) spend a reasonable proportion of their leisure time interacting with others in an online environment (see US Bureau of Labor Statistics, 2019 for recent data), which affords users access to a wide range of unfamiliar/novel social partners, and often involves the use of profile pictures where an individual displays their face and/or body. Profile browsing is a critical aspect of online dating. Dating profiles may be conceptualized as a 'sales pitch' where people make their initial choices learning about and evaluating a large number of

potential partners quickly, and contacting them in a low-cost manner in the absence of a social context, which may shape approach-avoidance behaviour differently, compared to our behaviour when indicating initial romantic interest in-person (see Finkel et al., 2012 for discussion). Finkel and his colleagues (2012) theorized that as searchable or visible traits are more salient online than attributes normally gleaned via experience during in-person courtship (e.g., humour or conversation quality), online dating may foster a relatively superficial 'assessment mindset' where we critically evaluate potential dates in comparison to (many) available alternatives, which may, in turn, orient dating app users towards an 'optimal' partner beyond their first 'mutual match' (see, e.g., Miller & Todd, 1998 for related discussion).

2.3. Assessment mindsets and the role of choice in dating

An assessment mindset may motivate behaviour at various stages of the online dating process, including when we browse through profiles, choose whether to respond to a high level of interest/contact from multiple users, when 'screening' partners during an early date, and deciding whether to signal 'commitment' to a current romantic prospect (a second date or beyond), explore alternate prospects (i.e., to remain 'active' within the platform), or disengage from online dating entirely (see Chapter 1 for further discussion). For example, although feelings of choice and autonomy are important for health and well-being (e.g., Deci & Ryan, 2012), large choice sets promote frugal choice strategies when dating, based on superficial (Lenton & Francescioni, 2010) and/or minimal cues (see Finkel et al., 2012 for discussion), and reduce the likelihood of female speed-daters saying yes to a date (Fisman et al., 2006). These findings complement work on choice set size and general consumer decision making, where a larger choice set size decreases our motivation to buy (Iyengar & Lepper, 2000) and lowers our satisfaction with our eventual decision ('The Choice Overload Hypothesis', e.g., D'Angelo & Toma, 2017; see Scheibehenne et al., 2010 for variance in the effect across studies). This effect has also been observed in face-to-face 'speed dating', where people meet many potential partners across a series of short interactions. Greater choice (more opposite-sex partners to choose from) and greater variance in speed dater traits (e.g., age, height, occupation, and education levels of potential partners) were related

to fewer romantic proposals made across speed dating events (Lenton & Francesconi, 2011). As directly observable characteristics are particularly salient in an online environment, access to many potential partners on an online dating platform may foster an assessment mindset which undermines our willingness to commit or remain committed to a romantic partner at different stages of the dating process.

2.4. The current experiments: Online dating platforms and contextual changes in attractiveness judgements

Experimental activation of an 'assessment mindset' and its corresponding effects on attractiveness judgements of familiar and novel faces enables us to test Finkel and colleagues' (2012) proposal directly, as attractiveness is an important dimension of face perception, and our motivation to engage with faces (Hahn & Perrett, 2014). Thus, contextual changes in our attraction to a given individual (e.g., in light of exposure to others) enables us to examine whether 'familiarity breeds liking' (Zajonc, 1968; see Bornstein, 1989 and Montoya et al., 2017 for meta-analytic reviews) in an online environment. This can shed light on the perceptual mechanisms (attractiveness judgements) involved at different stages of the dating process, such as when we evaluate multiple profiles quickly, and the attractiveness of others may be strengthened or attenuated in light of the presentation of many novel alternate partners. In biology, the presence of novel mates orients (predominantly) males of several species towards alternate mates (e.g., Devigili et al., 2015; Jordan & Brooks, 2010; Koene & Ter Maat, 2007; see also Pizzari et al., 2003), and may facilitate sexual arousal in men (Koukounas & Over, 2000; 'The Coolidge Effect', Dewsbury, 1981; Wilson et al., 1963). This theoretical perspective has been applied to examine preferences for familiar versus novel faces. Little and colleagues (2014) demonstrated a 'Coolidge-like' effect in humans, where familiar versus novel faces were more attractive to women than men, on average (Little et al., 2014). When using an online dating app, as the same profile can be encountered multiple times (e.g., when deciding whether to 'commit' or remain committed to that option in light of alternatives), familiarity is an important dimension of research on dating and choice. The current set of experiments adapts Little et al.'s (2014) paradigm, examining the attractiveness

of both familiar faces and novel face identities. Specifically, we examine whether the ability to choose between items, activated by pictorial slideshows with an accompanying context, directly reduces attractiveness ratings of i) familiar faces (i.e., from one's original attraction, *sensu* Little et al., 2014) and ii) familiar faces *relative to* unfamiliar/novel faces.

Our first experiment examined two pre-registered hypotheses (https://osf.io/xs74r/). As online dating sites may foster an assessment mindset which undermines our willingness to commit to a partner because choice is greater (Finkel et al., 2012), we examine whether activating the context of using an online dating site (i.e., thinking about accepting or rejecting people presented in pictorial slideshows) reduces the attractiveness of familiar preferred-sex faces compared to our control condition (Hypothesis #1). This design enables us to directly test Finkel and colleagues' (2012) proposal that choice undermines commitment, if imagining having options has a direct (negative) effect on our attraction to familiar faces, which would be particularly relevant to the stage at which someone searches for and dates potential partners via this platform (i.e., before committing to an 'optimal' choice). We also examine whether this predicted effect is weaker or absent in females compared to males, given the general focus on male sociosexual orientation and reproductive fitness in studies of the 'Coolidge effect' (e.g., Little et al., 2014; Jordan & Brooks, 2010, Hypothesis #2).

Experiment 1

Methods

2.1.1. Participants

Our first online experiment (188 heterosexual individuals, 93 of whom were male, M_{age} = 24.69 years, *SD* = 8.52 years) was run via Qualtrics, with procedures for recruitment, informed consent and testing approved by our local Ethics Committee (please see Appendix C) and hypotheses, methods, and exclusion/inclusion criteria pre-registered initially via the Open Science Framework (https://osf.io/xs74r/). A convenience sample was recruited on and

off Abertay University campus by the first author via word of mouth, flyers, social media, and our research participation scheme, with participants either granted course credit or entered into a draw for a £15 Amazon voucher. We registered an initial data collection-stopping rule of 54 heterosexual individuals per experimental factor (i.e., 216 participants), based on 90% power to detect a moderate effect (i.e., $r > .30$) when comparing two independent groups (Lakens & Evers, 2014). However, in this initial experiment, applying exclusion criteria on outliers, including response times exceeding 15 minutes ($N = 10$), meant that cells met 80% power to detect a moderate effect ($N \geq 41$ per cell) except for males allocated to the control condition ($N = 39$).

2.1.2. Face Stimuli (familiar/test faces and novel/distractor faces)

Face stimuli and accompanying attractiveness ratings were taken from a publicly available image set (Face Research Lab London Set; DeBruine & Jones, 2017 https://doi.org/10.6084/m9.figshare.5047666.v3) and consisted of full colour images (1350x1350 pixels) of Caucasian individuals taken under standardized conditions with direct gaze, neutral expression, identical t-shirt, and no adornments. In order to select a subset of images for use in our experiments, we analysed DeBruine and Jones' (2017) attractiveness ratings data from nine-hundred fifty heterosexual females' (M_{age} = 22.40 years, SD = 4.57 years) and five-hundred fifteen heterosexual males' (M_{age} = 23.92 years, SD = 4.66 years) judgments of preferred-sex faces, who rated attractiveness on a 1 (much less attractive than average) to 7 (much more attractive than average) Likert scale. Based on their data, we selected a subset of faces from around the mid-point in attractiveness. Following a procedure adapted from Little et al. (2014), participants in our first experiment rated a set of 10 test faces (5 male, 5 female) on two occasions (i.e., 'familiar faces'), and also rated an additional 10 distractor faces (5 male, 5 female) on the second occasion (i.e., 'novel faces'). The male test set (M_{age} = 23.20 years, SD = 3.63 years; $M_{attractiveness}$ = 3.41, SD = 0.43), male distractor set (M_{age} = 25.00 years, SD = 4.36 years; $M_{attractiveness}$ = 3.48, SD = 0.36), female test set (M_{age} = 24.20 years, SD = 3.70 years; $M_{attractiveness}$ = 3.43, SD = 0.22), and female distractor set (M_{age} = 26.00 years, SD = 4.30 years; $M_{attractiveness}$ = 3.49, SD = 0.20) were matched in attractiveness as rated by this large independent sample (DeBruine and

Jones, 2017) of heterosexual Caucasian judges aged between 18 and 35 (all $t < .48$, all $p > .64$). Participants rated both same-sex and opposite-sex faces to examine the boundaries of our predicted effects of choice on face preferences (i.e., whether effects were specific to romantic attraction or applicable to social attraction more generally). Such designs are common in research examining whether social attributions of faces are context-specific (see, e.g., Little et al., 2011 for a review).

Even though the face stimuli are all Caucasian, all ethnicities were free to take part in the experimental slideshows. This may represent a limitation when rating Caucasian faces, however as participants responded to the same person on second viewing, and attractiveness differences between two Caucasian image sets were controlled for, 'other-race biases' are not likely to represent a major issue for this research.

2.1.3. Experimental slideshow images: Pilot-test ratings of images of potential dating partners and desserts

To collate dating images, we recruited volunteers to donate an image of themselves which they would use on their online dating profile, which could be (if they wished) a full-body photograph, provided nobody else was in the picture. The donors of these unstandardized 'ambient' photographs were different identities to the standardized face stimuli used before and after our picture slideshows. Note that while 'ambient' photographs were used to give an authentic context to our experimental design (browsing through profile pictures) and converge with models explaining the dimensions underpinning social inferences of faces from standardized photographs (Sutherland et al., 2013; Vernon et al., 2014), we measured responses to standardized face photographs presented before and after these slideshows in order to examine changes in attractiveness judgements of the same identity in the absence of potential artefacts which could reduce the internal validity of our findings (e.g., differences in eye gaze, head tilt, expression, makeup).

To pilot test our choice set slideshow images, we recruited independent samples of thirty-one heterosexual males (M_{age} = 32.87 years, SD = 7.29 years) and sixty-four heterosexual females (M_{age} = 35.67 years, SD = 9.91 years) to rate hypothetical dating images of thirty-two females (M_{age} = 25.75 years, SD =

3.8 years) and forty-one males (M_{age} = 27.12 years, *SD* = 4.7 years) respectively. Raters were recruited via Prolific academic and reimbursed the equivalent of £5 per hour.

A further independent sample (31 females, 33 males; M_{age} = 33.58 years, *SD* = 11.24 years) was recruited via Prolific academic to rate sixty images of various desserts extracted from Pixabay.com, presented on SurveyMonkey. Deserts were selected and pilot tested as control stimuli in order to present equally attractive exemplars from the same category which people could think about selecting (or not) while viewing a pictorial slideshow (i.e., variation in images within a given category that also activates an assessment mindset). In all pilot tests of slideshow images (dating images and desserts), images were presented on SurveyMonkey in the centre of the screen in a randomized order (500 x 600 pixels, with a resolution of 72 pixels per inch). On each trial, using the scale from the International Affective Picture System (Lang et al., 1997), participants were asked how each image made them feel on a 1 to 9 scale on the valence, arousal and dominance dimensions: “happy” (=1) versus “unhappy” (=9), “excited” (=1) versus “calm” (=9), and “controlled” (=1) versus “in-control” (=9). Ratings of valence, arousal, and dominance were collected in an attempt to control for differences in emotional responses between the two slideshows in the dating experiments. Participants were also asked how attractive each person/dessert was on a 1 (not attractive) to 7 (very attractive) scale. We used this data to create a slideshow of 15 male dating images (M_{age} = 26.73 years, *SD* = 3.37 years), 15 female dating images (M_{age} = 26.33 years, *SD* = 4.01 years), and 15 desserts (control stimuli). Critically, each of the three sets were matched in attractiveness (all absolute $t < 0.69$, all $p > .49$, see Table 2.1 for descriptive statistics). Thus, any differences observed between slideshow conditions can be attributed to the content of the slideshows rather than their attractiveness (i.e., social versus non-social stimuli that are equally attractive).

Table 2.1. Pilot ratings of slideshow stimuli (SD in parentheses).

	Attractiveness	Valence	Arousal	Dominance
Male Dating Images	3.79 (.50)	4.15 (.39)	4.82 (.37)	5.21 (.20)
Female Dating Images	3.88 (.54)	4.56 (.25)	4.97 (.38)	5.07 (.21)
Desserts Control Images	3.75 (.52)	4.87 (.34)	5.12 (.31)	5.44 (.23)

2.1.4. Experimental procedure

The experiment consisted of three phases: a pre-slideshow attractiveness-rating task, a pictorial slideshow used to activate a choice context, and a post-slideshow attractiveness-rating task. In the pre-slideshow attractiveness rating task, participants were asked to rate the attractiveness of five female faces and five male faces presented sequentially in the centre of the screen in a randomized order, using the scale 'much less attractive' than average (=1), 'less attractive' than average (=2), 'slightly less attractive' than average (=3), 'of average attractiveness' (=4), 'slightly more attractive' than average (=5), 'more attractive' than average (=6), 'much more attractive' than average (=7). In the slideshow phase of our experiment, participants were randomly allocated either to our experimental condition (browse through a slideshow of online dating profiles) or our control condition (browse through a slideshow of desserts). Each slideshow consisted of fifteen images from our pilot study presented sequentially in the centre of the screen in a randomized order for four seconds each. For the dating slideshows, participants were allocated to view preferred-sex faces only (i.e., the sex they were attracted to), based on their self-reported sexual orientation. Before the slideshow, participants were informed that they were about to view a slideshow of online dating profiles/slideshow of desserts. We asked them to imagine that they are browsing through this website/these desserts, thinking about whether they would accept or reject each individual as a dating partner/choose each option to take home with them. They were asked to think for a few moments about this scenario and then imagine themselves in this scenario as they work their way through the images of potential

dates/desserts. Immediately following this, in the post-slideshow attractiveness rating task, participants were then shown the 10 familiar/test faces, as seen in the pre-slideshow phase of the experiment, and, to avoid guessing the nature of the study, 10 novel/distractor faces (*sensu* Little et al., 2014). All faces in the attractiveness-rating task were taken from the same image set (see Face Stimuli section) and were presented and rated in an identical manner to the pre-slideshow phase of the experiment.

2.1.5. Data processing and analytical strategy

Following Little et al. (2014), we calculated each participant's change in preference for familiar faces (i.e., from baseline), by averaging their attractiveness ratings of test faces. Averages were calculated separately for ratings of the five male faces and the five female faces and were also calculated separately for the pre-slideshow phase of the experiment and the post-slideshow phase of the experiment (i.e., four separate average values). To test our pre-registered hypotheses, each participant's change in preference was then calculated by subtracting their pre-slideshow score from their post-slideshow score. High scores (i.e., greater than zero) indicate a stronger preference for familiarity in faces. Conversely, low scores (i.e., below zero) indicate a stronger preference for novelty in faces.

In this experiment, we ran three models. A mixed design ANOVA on the dependent variable *change in preference for familiar/test faces*, with the within subjects factor *sex of face* (male faces, female faces), and the between subjects factors *experimental slideshow condition* (view images of potential dates, view images of potential desserts) and *participant sex* (male, female). Then, further analyses were run on the dependent variable *attractiveness of familiar/test faces* with the same model, but treating *experimental phase* (pre-slideshow, post-slideshow) as a within subjects factor. A third model re-ran this ANOVA with the within subjects factor *face set* (familiar/test face set, novel/distractor face set) in place of the factor *experimental phase*.

Results

2.1.6. Change in preference for familiar/test faces (i.e., from baseline)

The first model revealed no significant effects or higher-order interactions (all $F < 2.46$ all $p > .11$, all $n_p^2 < .014$).

2.1.7. Examining preferences familiar/test faces before and after slideshows

The second model revealed a main effect of *sex of face* ($F(1,184) = 12.53$; $p = .001$, $n_p^2 = .06$) which was qualified by an interaction with *participant sex* ($F(1,184) = 4.60$; $p = .033$, $n_p^2 = .024$). This interaction reflected that while men rated opposite-sex faces ($M = 3.87$, $SEM = .09$) as more attractive than same-sex faces ($M = 3.54$, $SEM = .10$, $t(92) = 3.64$; $p < .001$), women did not rate same-sex faces ($M = 3.62$, $SEM = .08$) differently to opposite-sex faces ($M = 3.51$, $SEM = .08$, $t(94) = 1.67$; $p = .10$). A main effect of *experimental phase* was also observed ($F(1,184) = 14.57$; $p < .001$, $n_p^2 = .07$). No other effects or interactions were significant (all $F < 2.46$ all $p > .11$).

Paired t-tests to interpret the main effect of *experimental phase* revealed that familiar faces were less attractive after our slideshow ($M = 3.63$, $SEM = .06$, BCa 95%CI[3.53,3.75]) than before our slideshow ($M = 3.72$, $SEM = .06$ BCa 95%CI[3.61,3.83], absolute $t(187) = 3.75$; $p < .001$, $r = .14$).

2.1.8. Attractiveness of familiar versus novel identities following the choice slideshow

Rerunning the ANOVA with the within subjects factor *face set* in place of the factor *experimental phase* revealed the same pattern of results as above, with the exception that a main effect of the former factor (face set) was observed in place of the latter (experimental phase) which was no longer part of the model. Paired t-tests to interpret the main effect of *face set* revealed that, after our choice slideshows, participants were more attracted to the novel face set ($M = 3.73$, $SEM = .05$, BCa 95%CI[3.63,3.84]) than they were to the familiar face set ($M = 3.63$, $SEM = .06$ BCa 95%CI[3.53,3.75]; absolute $t(187) = 3.31$; $p < .01$, $r = .12$).

Experiment 2

Our first experiment did not support our pre-registered hypotheses; although familiar faces, in general, appeared to be less attractive after our choice set slideshows than they were before our choice set slideshows (in the absence of any change from a participant's baseline attraction). Familiar faces were also less attractive relative to our novel face image set following the slideshows, even though these two image sets were balanced in attractiveness. The purpose of our second experiment was twofold. First, to examine whether our pattern of results replicated in a larger independent sample of single individuals only, or if this strategy generated results consistent with our original predictions, given that a subtle manipulation related to a dating context would be more salient to single people, and as differences in partnership status may add noise to our model, as it moderates responses to familiarity and/or attractiveness in faces (e.g., Karremans et al., 2011; Little et al., 2014). Furthermore, as previously discussed, because choice set size may be important in motivating frugal search strategies (reviewed in Finkel et al., 2012), in addition to activating an assessment mindset in the same way as our first experiment, we also manipulated choice set size more directly by presenting participants with either the same or fewer items (romantic dates or desserts) within slideshows of the same time span.

Methods

2.2.1. Participants

Four hundred thirty-nine heterosexual individuals (231 of whom were male, M_{age} = 26.38 years, *SD* = 4.84 years) were recruited via Prolific Academic (see, e.g., Peer et al., 2017), and reimbursed the equivalent of £5 per hour, with duplicate responses from the same IP address not analysed. An outlier labelling rule was used to exclude participants with long response times (Hoaglin et al., 1986; *N* = 4). Two participants informed us of reporting the wrong sexual orientation and were thus excluded given that the experiment allocated them to a choice context slideshow of their preferred-sex. All cell sizes exceeded 80% power to detect a moderate effect ($N_{Smallest\ cell}$ = 47) and 90% power when

testing pre-registered hypotheses (i.e., that did not take our two new choice set size conditions into account).

2.2.2. Procedure

The second experiment was identical to the first experiment except that, during the slideshow phase of the experiment, participants were randomly allocated to one of four slideshow conditions (*N* = 104 dating images-high choice; *N* = 112 dating images-low choice, *N* = 123 dessert images-high choice; *N* = 99 dessert images-low choice). The high choice slideshows were identical to the initial experiment (15 images). In the low choice slideshows, participants viewed a fixed subset of 5 images from the high choice slideshows in a randomized order during the same 1-minute timespan. The low choice slideshows were matched in mean rated attractiveness to the high choice slideshows (Female $\text{slideshow}_{\text{High}}$ = 3.88, *SD* = .54; Female $\text{slideshow}_{\text{Low}}$ = 3.91, *SD* = .10; Male $\text{slideshow}_{\text{High}}$ = 3.79, *SD* = .50; Male $\text{slideshow}_{\text{Low}}$ = 3.84, *SD* = .19; Dessert $\text{Slideshow}_{\text{High}}$ = 3.75, *SD* = .52; Dessert $\text{slideshow}_{\text{Low}}$ = 3.79, *SD* = .15).

2.2.3. Data processing and analytical strategy

The second experiment followed an identical analytical strategy to the first experiment, except that *choice condition* (more choice, less choice) was included in our models as an additional between subjects factor. Analyses with the within subjects factor *experimental phase* (pre-slideshow, post-slideshow) were not run here, as this prior analysis was run to establish whether attractiveness ratings differed between the two experimental phases. This motivated the current experiment, where we examine pre-registered predictions in terms of within-subjects changes in attractiveness ratings, on a larger sample of single individuals.

Results

2.2.4. Change in preference for familiar/test faces (i.e., from baseline)

A main effect of *sex of face* ($F(1,424) = 4.43$; $p = .036$, $n_p^2 = .010$) and a main effect of *participant sex* ($F(1,424) = 5.52$; $p = .019$, $n_p^2 = .013$) was observed, with no other significant effects or higher order interactions (all $F < 2.18$, all $p >$

.14). The main effect of *participant sex* reflected that women's attractiveness ratings of familiar faces decreased from baseline relative to men's attractiveness ratings of familiar faces (absolute $t(430) = 2.35$; $p = .019$, see Figure 2.1a).

2.2.5. Attractiveness of familiar versus novel identities following the choice slideshow

We observed a main effect of *sex of face* ($F(1,424) = 8.79$; $p = .003$, $n_p^2 = .02$) and a main effect of *face set* ($F(1,424) = 54.82$; $p < .001$, $n_p^2 = .11$) that was qualified by an interaction with *participant sex* ($F(1,424) = 6.15$; $p = .014$, $n_p^2 = .014$). An interaction between *experimental slideshow condition* and *participant sex* was also observed ($F(1,424) = 8.33$; $p = .004$, $n_p^2 = .019$). No other effects or interactions were significant (all $F < 3.61$ all $p > .058$). The interaction between *face set* and *participant sex* reflected stronger attraction to novel versus familiar faces among male participants ($M_{Novel} = 4.02$, BCa 95%CI[3.88,4.14], $M_{Familiar} = 3.82$, BCa 95%CI[3.71,3.92]; absolute $t(227) = 7.64$; $p < .001$, $r = .25$) than among female participants ($M_{Novel} = 3.97$, BCa 95%CI[3.86,4.07], $M_{Familiar} = 3.87$, BCa 95%CI[3.77,3.97]; absolute $t(203) = 3.41$; $p = .001$, $r = .12$, see Figure 2.1b).

To interpret our higher order interaction between *experimental slideshow condition* and *participant sex*, a final ANOVA was run on the dependent variable *attractiveness of faces after slideshow* (collapsed across face set), separately for male and female participants, with the between subjects factor *experimental slideshow condition*. This analysis revealed that, for men, attractiveness ratings of faces were greater after browsing through dating images ($M = 4.04$, BCa 95%CI[3.89,4.18]) than after browsing through dessert images ($M = 3.78$, BCa 95%CI[3.63,3.94], $F(1,226) = 3.76$; $p = .012$, $n_p^2 = .027$). However, for women, attractiveness ratings of faces tended to be greater after browsing through dessert images ($M = 4.00$, BCa 95%CI[3.86,4.14]) than after browsing through dating images ($M = 3.83$, BCa 95%CI[3.67,3.99], $F(1,202) = 2.78$; $p = .097$, $n_p^2 = .014$), although this difference was not significant.

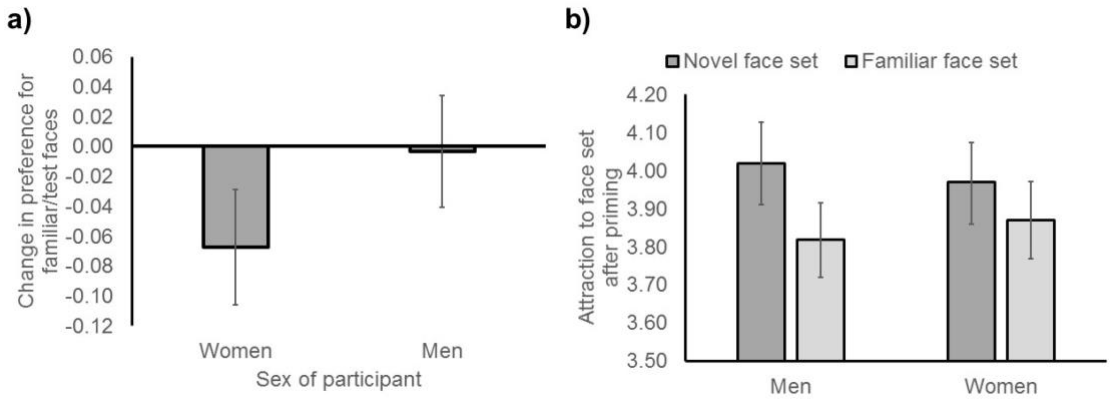

Figure 2.1. Panel a. Women's but not men's preference for familiar faces decreases from baseline. Panel b. A stronger effect of activating a choice context on single men's attraction to novel versus familiar faces (r = .25) than single women's attraction to novel versus familiar faces (r = .12). Error bars show 95%CI.

Experiment 3

Experiment 2, on single individuals only, revealed a sex difference in preferences for familiar faces following activation of an assessment mindset. Attractiveness ratings of faces on second viewing influenced women's behaviour differently to men's following picture slideshows designed to encourage participants to think about evaluating different items. After activating an experimental choice context, women tend to be less attracted to the same person while men do not show a change in preference. Although this effect was observed across both slideshow conditions (romantic dates and desserts), decision-making can be influenced in much lower stakes choice tasks than selecting a romantic partner (see Scheibehenne et al., 2010), so a null effect of experimental slideshow condition might be deemed consistent with the generality of this effect on the behaviour under study (i.e., profile browsing, having different options, and its hypothesised effects on attractiveness judgements of faces). However, as familiarity generally enhances attractiveness (e.g., Batres et al., 2017; Peskin & Newell, 2004; Rhodes et al., 2001; Sofer et al., 2015), a third experiment was run where we examined familiarity/novelty preferences in the absence of picture slideshows with a choice context, in order that we could make stronger inferences about the effects observed in our first and second experiments in the presence of a general choice context (i.e., effects that were not qualified by the type of slideshow viewed).

Methods

2.3.1. Participants

One hundred thirty heterosexual individuals (64 of whom were male, M_{age} = 23.78 years, *SD* = 3.68 years) took part in our third online experiment run via the same recruitment platform as the first two experiments. No outlier labelling rule was used here, as potential outliers (*N* = 5) could be an artefact of the time spent during the one-minute break phase of this experiment. Sample size was determined in a manner consistent with our previous experiments, but the

overall sample size was smaller as there were fewer between subjects' factors (with the exception of participant sex).

2.3.2. Procedure, data processing and analytical strategy

The third experiment was identical to our previous experiments, except that, in place of the slideshow phase of the experiment, participants were simply asked to take a one-minute break ($M_{Duration}$ = 24 seconds) before an automatic timer directed them to the second attractiveness rating task. The variable duration of the delay across participants is not a cause for concern as familiarity effects are observed at longer and shorter delays (reviewed in Montoya et al., 2017) and in self-paced tasks involving responses to faces (e.g., Little et al., 2014). We follow the same analytical strategy as in our initial experiment, except that, in its absence, there were no between subjects factors related to slideshows included in our models.

Results

2.3.3. Change in preference for familiar/test faces (i.e., from baseline)

We observed a main effect of *sex of face* ($F(1,128) = 9.78$; $p = .002$, $n_p^2 = .071$), where familiarity was more attractive when judging women's faces ($M = .08$, BCa 95%CI[.02,.14]) than when judging men's faces ($M = -.05$, BCa 95%CI[-.12,.003], absolute $t(129) = 3.12$; $p = .002$). No other effects or interactions were observed (both $F < .54$, both $p > .46$).

2.3.4. Attractiveness of familiar versus novel identities

We observed a main effect of *face set* ($F(1,128) = 13.06$; $p < .001$, $n_p^2 = .09$) which was qualified by an interaction with *participant sex* ($F(1,128) = 7.06$; $p = .009$, $n_p^2 = .05$). No other effects or interactions were observed (all $F < 2.92$, all $p > .09$). The interaction between *face set* and *participant sex* reflected that men were more attracted to novel versus familiar identities (M_{Novel} = 3.98, BCa 95%CI[3.82.4.14], $M_{Familiar}$ = 3.75, BCa 95%CI[3.57,3.90]; absolute $t(63) = 4.15$; $p < .001$, $r = .25$), but women did not differ in their preference for novel versus familiar identities (M_{Novel} = 3.77, BCa 95%CI[3.59,3.92], $M_{Familiar}$ = 3.73, BCa 95%CI[3.57,3.88]; absolute $t(65) = .73$; $p = .47$).

2.3.5. Rerunning analyses on single individuals

Analysing data only from individuals not in a romantic relationship (48.5% of sample) generated the same pattern of results, except that, in contrast to our second experiment, no interaction between *face set* and *participant sex* was observed ($F(1,61) = 1.42$; $p = .24$). An interaction between *face set* and *sex of face* was observed ($F(1,61) = 4.50$; $p = .038$), where the sample were more attracted to novel male faces than familiar male faces ($M_{Novel} = 4.08$, BCa 95%CI[3.84,4.30], $M_{Familiar} = 3.78$, BCa 95%CI[3.53,3.99]; absolute $t(62) = 3.58$; $p = .001$, $r = .22$), but did not differ in their preference for novel versus familiar female faces ($M_{Novel} = 4.00$, BCa 95%CI[3.82,4.19], $M_{Familiar} = 3.92$, BCa 95%CI[3.72,4.11]; absolute $t(62) = 1.23$; $p = .22$).

Experiment 4

A more direct manipulation of choice induced via 'matching success' in a dating context

The results of our third experiment suggest that, in the absence of activating a general choice context (accepting or rejecting romantic dates or desserts), no sex differences in single men versus single women's preference for familiar versus novel faces are observed. The purpose of the final experiment of this chapter was as follows: First, we examined whether the sex difference observed in Experiment 2 (Women's but not men's preference for familiar faces decreases from baseline. A stronger effect of activating a choice context on single men's attraction to novel versus familiar faces (r = .25) than single women's attraction to novel versus familiar faces (r = .12)) was replicated when our two face image sets were counterbalanced across participants either to be used as familiar/test faces or novel/distractor faces. Replicating the effect in this instance would enable us to make a stronger inference that our findings generalize across different faces, even though the two image sets were balanced in rated attractiveness in Experiments 1-3. Second, as our findings reported thus far are observed across both dating and dessert slideshows, we manipulate choice more directly in this instance by focussing on dating slideshows only, but providing an additional context where participants imagine that those whom they are romantically interested in have either reciprocated or not reciprocated their romantic interest (i.e., 'matched'). The researchers hypothesize that being rejected will lead to negative feelings that will decrease app engagement and being accepted will lead to positive feelings that will increase app engagement. Thus, although the effects of 'Choice overload' may be observed regardless of what category of item the person is choosing from (see Scheibehenne et al., 2010 for discussion), this adaptation to our experimental design enables us to directly examine whether a greater or lesser proportion of romantic options moderate attractiveness judgements of familiar versus novel faces, such that greater romantic options orient the user towards novelty versus familiarity.

Methods

2.4.1. Participants

An independent sample of three-hundred fifty-two single heterosexual individuals (181 males, 171 females. M_{age} = 22.05 years, *SD* = 3.43 years) took part in the experiment, with recruitment of participants aged 18-30 inclusive conducted via Prolific Academic. Participants were reimbursed the equivalent of £5 per hour, with duplicate responses from the same device not permitted. The same strategy was used to determine sample size as the previous experiments, based on 90% power to detect a moderate effect (Lakens & Evers, 2014). For transparency, as the same outlier labelling rule used in Experiment 2 excluded a large proportion of the sample (*N* = 76), results are reported here before and after outlier exclusion.

2.4.2. Procedure

The final experiment of this chapter consisted of an identical pre-slideshow attractiveness rating phase and identical post-slideshow attractiveness rating phase as used in Experiment 2, with the exception that the presentation of face sets was counterbalanced across participants such that half judged one of our two face image sets as the familiar/test image set, with the other face image set acting as the novel/distractor set, and vice versa for the other half of participants. In the slideshow phase of the final experiment of this chapter, participants viewed the same 15 individuals of their preferred-sex in a randomized order, as used in Experiment 1 and the high choice condition within Experiment 2 (i.e., we did not manipulate choice set size in light of the prior null effect). Participants proceeded through the slideshow with the same dating instructions as used previously, however they were provided with an additional context immediately after viewing the slideshow. Here, participants were randomly allocated to one of two slideshows where their romantic interest was either reciprocated (*N* = 174) or not reciprocated (*N* = 178). Specifically, we informed them:

> "You have just spent time thinking about these people as potential dating partners on an online dating website, and whether or not you would accept

or reject them. Of those individuals whom you would be romantically interested in, imagine that **ALL/NONE** of them have reciprocated their interest in you (i.e., you have **matched/not 'matched'** with any of them). Please spend a few moments thinking about how you would feel in this scenario, and proceed to complete the questionnaire on the next page to describe how you would feel in this scenario."

Participants were then directed to complete the 20-item Positive and Negative Affect Schedule (Watson et al., 1988), by way of a manipulation/engagement check. They were told that the scale consists of a number of words that describe different feelings and emotions, and that they should read each item and mark the appropriate answer (1 = 'very slightly or not at all' to 5 = 'extremely' scale) according to how they would feel in the online dating scenario described on the previous page. We subtracted the average response to the negatively worded items from the average response to the positively worded items, and confirm that the experimental manipulation directly reduced positive affect in the direction intended (Interest reciprocated M = .69, SEM = .06, Interest not reciprocated M = -.27, SEM = .08, $t(306.69) = 9.55$; $p < .001$, r = .48). Participants then rated familiar/test and novel/distractor faces in the same manner as before (i.e., post-slideshow attractiveness rating phase), and were debriefed and could exit the experiment.

2.4.3. Data processing and analytical strategy

Data were coded and analysed in an identical manner to Experiments 1 and 2, except that in this instance the between subjects factor *experimental slideshow condition* consisted of the two levels: interest reciprocated from potential dates, interest not reciprocated from potential dates.

Results

2.4.4. Change in preference for familiar/test faces (i.e., from baseline)

No significant effects or interactions were observed (all $F < 2.72$, all $p > .10$). Applying the same outlier labelling rule as used previously for long response times (76 cases excluded) revealed an interaction between *participant sex* and

experimental slideshow condition ($F(1,272) = 3.90$; $p = .049$, $n_p^2 = .014$). Of note, in light of the significant effect of *participant sex* observed in Experiment 2, the equivalent main effect of participant sex observed here would be significant in a one tailed test ($F(1,272) = 3.01$; $p = .084$, $n_p^2 = .01$). No other effects or interactions were significant in the model (all $F < 1.74$, all $p > .18$).

Interpreting the significant two-way interaction revealed that while the one-tailed effect of participant sex was in the same direction to that of Experiment 2 (i.e., men were more attracted to familiar faces on second viewing ($M = .06$, BCa 95%CI[.01,.10]) than were women ($M = -.01$, BCa 95%CI[-.07,.04]), this was qualified by *experimental slideshow condition* such that there was no difference in responses between male ($M = .03$, BCa 95%CI[-.03,.10]) and female participants ($M = .04$, BCa 95%CI[-.05,.13]) when dating interest was reciprocated (absolute $t(134) = .17$; $p = .87$), however men were more attracted to familiar faces on second viewing ($M = .09$, BCa 95%CI[.02,.16]) than women were ($M = -.05$, BCa 95%CI[-.12,.01]), when dating interest was not reciprocated (absolute $t(138) = 2.60$; $p = .01$, $r = .22$, Figure 3.1a).

2.4.5. Attractiveness of familiar versus novel identities following the choice slideshow

Analyses revealed an interaction between *sex of face* and *participant sex* ($F(1,348) = 4.13$; $p = .043$, $n_p^2 = .012$), which was qualified by a higher-order three way interaction with *face set* ($F(1,348) = 4.13$; $p = .043$, $n_p^2 = .012$). A two-way interaction between *face set* and *experimental slideshow condition* was also observed ($F(1,348) = 4.32$; $p = .039$, $n_p^2 = .012$), with no other significant effects or interactions in the model (all $F < 1.77$, all $p > .18$).

The only finding within the model that was robust to outlier exclusion was the two-way interaction between *face set* and *experimental slideshow condition* ($F(1,272) = 6.66$; $p = .010$, $n_p^2 = .024$) with all other effects and interactions in the model not significant (all $F < 2.93$, all $p > .08$). This two-way interaction revealed that participants were more attracted to novel ($M = 3.80$, BCa 95%CI[3.66,3.94]) versus familiar faces ($M = 3.70$, BCa 95%CI[3.57,3.82]) after their dating interest had been reciprocated (i.e., relatively greater choice, absolute $t(135) = 2.38$; $p = .019$, $r = .10$), but there was no difference in their preference for novel ($M = 3.80$, BCa 95%CI[3.67,3.91]) versus familiar faces (M

= 3.84, BCa 95%CI[3.73,3.95]) after their dating interest was not reciprocated (i.e., less choice, absolute $t(139) = 1.31$; $p = .19$, Figure 3.1b).

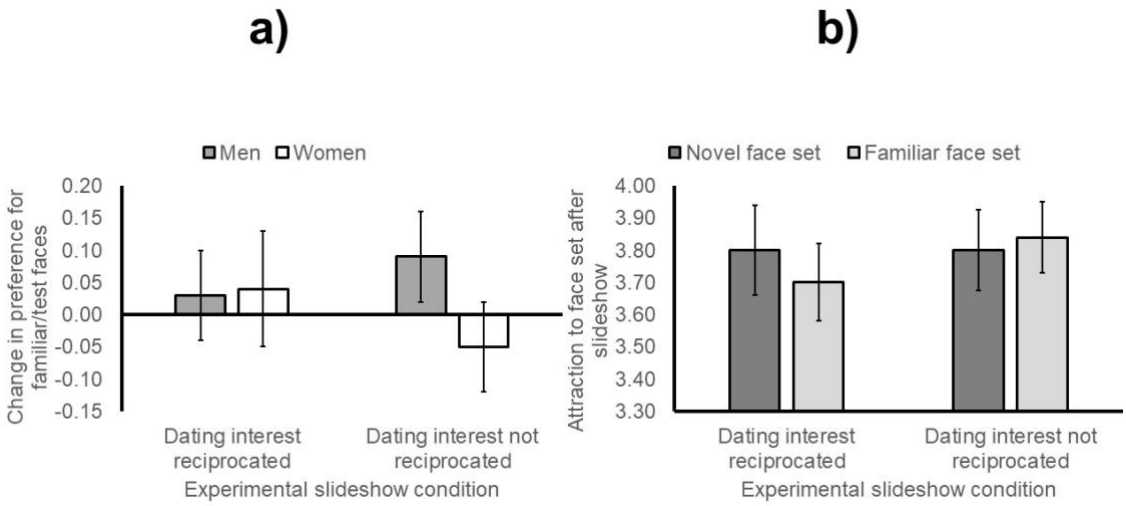

Figure 2.2. Less choice (dating interest not reciprocated) moderates the sex difference reported in Experiment 2, where men are more attracted to familiarity than are women (attractiveness ratings of faces on second viewing, panel a). Greater choice (dating interest reciprocated) orients dating app users towards novelty versus familiarity (preference for novel versus familiar face image set following slideshow, panel b).

Discussion

2.5.1. Summary of findings (Dating experiments and preferences for familiarity versus novelty)

Contrary to our pre-registered predictions, our first experiment did not reveal a decrease from baseline in attractiveness ratings of opposite-sex faces on second viewing, after activating a choice context via pictorial slideshows. Further exploratory analyses suggested that familiar faces were less attractive after our slideshows than they were before our slideshows, demonstrating an effect of when the faces were rated versus a predicted baseline change in individual preferences for faces. Meaning the slideshow had more of an effect than just a decrease in seeing a familiar face a second time. Moreover, participants were more oriented towards novel versus familiar faces after our slideshows, even though these two image sets were matched in attractiveness. Our second experiment, on a larger sample of single individuals revealed that

unpartnered women, relative to unpartnered men, were less attracted to familiar faces following our slideshow manipulation, with no effect of choice set size (fifteen versus five items to accept or reject) or the content of the slideshow they had just viewed (potential dates versus potential desserts) on face preferences. Moreover, when comparing responses to the two equally attractive face image sets, both men and women were more attracted to the novel versus familiar face image set, with this effect twice as strong in men (r = .25) than in women (r = .12). Men, in contrast to women, also rated the same post-slideshow face images as more attractive after browsing through dating versus dessert slideshows, suggesting that a dating context motivates men's attraction to faces more generally.

In the absence of a pictorial slideshow designed to activate an assessment mindset (Experiment 3), no sex differences in unpartnered participants' face preferences were observed, which suggests that the experimental context activated generated sex differences in attractiveness perception among unpartnered people, even if it was observed regardless of the type of image they viewed (romantic dates or desserts), or the sex of face they rated before and after our slideshows. Finally, an additional manipulation where participants imagined 'matching' with all (greater choice) or none (less choice) of their desired romantic dates revealed a sex difference in responses to faces following outlier exclusion (Experiment 4). In a one-tailed test, men were more attracted to familiar faces on second viewing than were women, which was a pattern of results consistent with Experiment 2. However, this sex difference was qualified by the experimental slideshow condition they were allocated to, such that it was present and in the same direction when dating interest had not been reciprocated (less choice, or no romantic 'matches'), but no sex difference in responses to faces were observed when dating interest had been reciprocated (more choice or success in 'matching'). Indeed, in this latter scenario, both men and women were more attracted to our novel versus familiar face image set, suggesting that 'success' on an online dating site both induces positive affect, as indexed via our manipulation check, but orients dating app users towards novel versus familiar people, consistent with early theorizing (Finkel et al., 2012).

2.5.2. Theoretical implications

Our findings provide a direct experimental test of some of Finkel and colleagues' early theorizing on the costs and benefits of online dating sites (Finkel et al., 2012). Namely, how a larger pool of potential dates on an online site can induce an assessment mindset and undermine commitment at different stages of the dating process, such as when browsing profiles or when deciding to 'commit' to a second date, as users are oriented towards an 'optimal' romantic partner in light of many available alternatives. This can be evidenced by contextual changes in our attraction to the same faces on a second occasion (see Little et al., 2014), and our attraction to familiar faces *relative to* novel faces after experimentally activating a choice context, as facial attractiveness is a critical dimension of face perception and social interaction (reviewed in Little et al., 2011; Sutherland et al., 2013), attractiveness judgements are made in a mandatory fashion (Ritchie et al., 2017), and are important in shaping our motivation to approach or avoid specific people (reviewed in Hahn & Perrett, 2014). Specifically, our research reveals sex differences in attractiveness judgements that are not moderated by choice set size *per se* when inducing an assessment mindset while browsing through profile pictures (Experiment 2) but are explained by choice set size following *responses* from dating app users, where low choice (i.e., zero 'matches') orients men versus women towards familiarity when rating the attractiveness of faces on second viewing (Experiment 4). Stronger preferences among single women than single men for novelty versus familiarity across these two experiments complements speed dating research on choice sets and women's willingness to say yes to a romantic date (Fisman et al., 2006), where women were less likely to accept a romantic date if they had more romantic options. Researchers could extend our experimental paradigm to examine the extent to which other individual or contextual factors moderate the effects observed here, such as self-rated attractiveness, target attractiveness (e.g., attractive versus average faces), and how social norms may shape dating decisions, such as potential pressures to make dating decisions that vary at different stages of the lifespan.

In general, our findings develop prior work on choice and dating behaviour, which did not control for a participant's baseline attraction when examining similar topics (D'Angelo & Toma, 2017), which was an important

control in the current set of experiments, in order to establish whether attractiveness perceptions change in light of contextual information (the online dating environment and the ability to accept or reject people in brief slideshows), independent of the general desirability/attractiveness of the standardized face image. We also develop this literature by distinguishing between the potential effects of an online environment on changes in our attraction to familiar people, and how we evaluate familiar partners relative to novel social partners. Our results showed that novel faces are more attractive than familiar faces when controlling for attractiveness differences between two image sets (Experiment 1), with this effect stronger in men than women (Experiment 2), and stronger across both sexes following 'success' when matching with others (Experiment 4). Experiment 3 (Chapter 2) further inferred that our experimental manipulation was influencing attractiveness ratings of faces, by exchanged the pictorial slideshows for a one-minute wait period. The results indicated that there were no sex differences in single people's preferences for the familiar versus the novel face sets in the absences of slideshows. Findings from this set of analyses advance the literature on the positive relationship between familiarity and attractiveness (e.g., Batres et al., 2017; Peskin & Newell, 2004; Rhodes et al., 2001; Sofer et al., 2015), by suggesting that user experiences with technology could moderate person perception in light of the presence of alternate social partners within online social networks. Indeed, that greater choice via romantic matching was related to weaker preferences for familiar faces (Experiment 4) directly suggests that online experiences of positive valence may have potentially negative effects on how we commit or remain attracted to familiar people. While some of our findings from these analyses suggest sex-specific and cross-sex effects that may be 'Coolidge-like' in their nature (Little et al., 2014), further work would be required to examine effects of technology on relationship functioning beyond online settings given that, for example, we found no evidence that these contexts moderated men's attractiveness ratings of the same person on second viewing, in the direction predicted. Our design has advantages in establishing the precise nature of 'Coolidge-like' effects in humans moving forward, as it distinguishes between the attractiveness of the same person over time versus the attractiveness of that person relative to others within the population.

2.5.3. Limitations and practical applications

There are limitations to our research. First, contrary to our pre-registered hypotheses, we did not observe a change in attractiveness judgements that was specific to familiar opposite-sex faces, and the effects observed generalized across both pictures slideshows where participants could choose between items/people. Although we did not predict this, our findings support Finkel and colleagues' (2012) theorizing, but suggest a general mechanism involved in person perception where the autonomy to choose between items, in and of itself, moderates face/person perception. It is worth noting, however, that Experiment 4 partly addressed this issue by subtly moderating information provided solely within a dating context (matching or not matching with desired romantic partners), which altered both affect and face perception in ways that were consistent with Finkel and colleagues' theorizing (2012), albeit across both sexes of face evaluated. Thus, further work on assessment mindsets, preferences, and the allocation of online effort to social partners more generally will likely prove fruitful.

Further research could examine relationships between initial social judgements and actual (online or face-to-face) dating behaviours, to elucidate the stage in the user experience to which our research is most directly relevant. As we activated a context relevant to the user experience of online dating for only a brief period, however, and noticed an effect on face preferences, it may well be that effects of real-world interaction and prolonged profile browsing on attractiveness judgements are more substantial, and have a greater effect on subsequent decisions, if such impressions are formed in an involuntary manner (Ritchie et al., 2017) and physical attractiveness motivates further contact in an online dating setting (Finkel et al., 2012). Indeed, our observation of sex differences in attractiveness judgements after activating a choice context raises further questions on how men and women may diverge in their user experience when using online dating apps, if real-world data on the number of contacts initiated versus responses received suggests that women are relatively selective while men 'cast their net out wide', all else equal (see Finkel et al., 2012 for discussion).

Although the purpose of our research was to examine the socio-cognitive processes involved in online dating interactions, longitudinal research on this

topic could build upon our work by examining objective indicators of commitment or effort within a dating context, such as the number of dates or length of courtship, when a relationship moves from online to offline and/or when individuals make decisions pertinent to different stages of a relationship (e.g., the escalation of intimacy, commitment, and marriage). Further research in this area also has general practical application if it provides an evidence base for programmers to add empirically supported algorithms or filters to limit the 'mating pool' to active and single participants, or those genuinely engaged in finding a romantic partner for a given type of romantic relationship, for example.

In Experiment 4, it could be argued that matching at levels other than 0% or 100% success would have greater external validity. Nonetheless, our design objectively manipulated choice, as participants either imagined having romantic options or no romantic options. Indeed, this design was the optimal way to run an experiment comparable to our previous experiments, while controlling for differences between participants in the number of pictured individuals in the slideshows whom they were attracted to. Setting one's popularity or 'matching success' to a given level (e.g., 50%) may have induced noise when participants responded to our task. It is also worth noting that for a given period of time spent online, specific individuals may be very unlikely to receive replies let alone mutual romantic interest (see Bruch & Newman, 2018), so our design has some relevance to real-world behaviour on online dating platforms. Indeed, lack of matching success is one of the primary motives for deleting a dating app (LeFebvre, 2018).

Future work could test our findings via an approach that emphasises external versus internal validity, such as via simulated dating platforms or 'high stakes' where there is the option to date a mutual match. It is worth noting however that high external validity can also induce noise or confounds that make interpretation of effects difficult. For example, participants may integrate appearance cues with other profile details, attend to distractors within the simulation or have certain preconceptions of specific dating sites. Our experimental design had high internal validity with the controls we employed, and was ecologically valid insofar as participants had to make relatively quick attractiveness judgements of faces in an online setting, which had an effect on emotion according to the manipulation check within Experiment 4.

Finally, while some popular dating platforms have a 'swipe mechanism' akin to accepting or rejecting individuals in a one-shot manner (e.g., Tinder, Bumble, Hinge), other platforms do not have this mechanism and instead have a manual browsing feature where users are not directly prompted to make a choice. As our participants were given instructions to imagine accepting or rejecting different individuals/items during slideshows, our findings are potentially applicable across different platforms. Our findings perhaps best speak to the process of inducing an assessment mindset and its effects on attractiveness evaluations during profile browsing when users are considering their options, albeit the decision to commit or remain committed to someone is ultimately resolved when said user no longer has a need to use the dating service. Indeed, being in an exclusive relationship or lack of success in matching are the two primary reasons for deleting a dating app (LeFebvre, 2018). As mentioned previously, our findings suggest a general effect of choice and inducing an assessment mindset on attractiveness judgements of faces when thinking about accepting or rejecting people/items based on physical/surface characteristics alone. This points to the utility of our paradigm for further research into the internet and social perception more generally, and choice and speed dating (e.g., Lenton & Francescioni, 2011), albeit we found no evidence in our data that choice set size per se influenced attractiveness judgements of faces. We exercise some caution in claiming that our findings will directly generalize to speed dating research, given that dynamic cues presented within these interactions may strengthen or attenuate the effects observed here (e.g., expansive body posture; see Vacharkulksemsuk et al., 2016).

Our pre-registered hypotheses were specific to attractiveness judgements of preferred-sex faces, and were motivated by theory proposing that a wider pool of possible dating partners induces an assessment mindset that orients users towards novel versus familiar partners at various stages of the online dating process (Finkel et al., 2012). However, our research observed a general effect of inducing an assessment mindset (preferred-sex romantic partners and equally attractive dessert items) on social perceptions of both preferred- and non-preferred sex faces. This was observed among individuals not currently in a romantic relationship, where dating motives would be

stronger, and even when we provided an additional authentic dating context in our Experiment 4, by asking participants to think about 'matching' with all versus none of the individuals they previously viewed and were attracted to. Thus, our findings have implications for online dating interactions, and may be particularly relevant to the stage of browsing profile pictures, while the findings of the final experiment of this chapter corroborated earlier theory (Finkel et al., 2012). However, the nature of our effects suggest that an assessment mindset has implications for online social interaction more generally which should be explored in other contexts too (e.g., allocating effort to familiar versus novel friends).

Of note, observing these effects from brief presentations of picture slideshows, with an accompanying context to imagine, suggests that our effects may well be more substantial in the real world. For example, if individuals use the dating platform for longer intervals and/or if profile images are accompanied by other cues that evince rewarding online interactions (e.g., emoticons, speedier replies or offers of social contact from novel social partners). Meaning, the user might spend their energy interacting with the app than choosing a mate. Our experiments were suited to examine attractiveness preferences of romantic partners in online environments, given earlier theorizing on the extent to which these environments place a relative emphasis on assessment based on easy-to-verify physical characteristics compared to face-to-face interaction (e.g., in static profile pictures), even though social perceptions of faces would play an important role in both contexts (see, e.g., Hahn & Perrett, 2014; Little et al., 2011; Rhodes, 2006; Todorov et al., 2015 for reviews). The effects we observed in Experiments 1-4 may well be stronger on platforms that emphasise physical judgements or platforms that may be more popular for short- versus longer-term relationships (e.g., Tinder versus Match, see, e.g., Silva et al., 2018 for discussion). These effects may also be accentuated prior to an individual making use of a matching algorithms. For example, daters are exposed to a wider range of profile pictures before completing questionnaires to filter users based on similarity, it is possible that engaging with algorithms fosters self-determination in and of itself (see Tong et al., 2016 for discussion). Meaning different amounts of user and algorithm control affect dater decisions differently; people like to have some level of control (swiping), but also like having some

level convivence (algorithm) as well (see Tong et al., 2016 for discussion). This may parallel the current manipulation, where individuals think about accepting versus rejecting people/items, and where choice set size did not alter social judgements in Experiment 2. Finally, while our paradigm examines attractiveness perceptions of familiar faces after our manipulation (i.e., previously encountered versus new faces), it would of course be fruitful to also manipulate the extent to which additional traits in a profile picture or text-based biography are common versus rare compared to the average within a choice set, given the different information presented across different platforms, and current knowledge on desirable traits in dating profiles (e.g., related to a healthy lifestyle, engagement with outdoors, and creativity; Lee et al., 2019). Ultimately, these and related questions could be addressed if dating companies subject their algorithms, and data on user behaviours, to empirical scrutiny (see Finkel et al., 2012 for discussion).

Conclusions

In sum, our experiments suggest that choice alters social and romantic attraction to others, which may be relevant in the design of, and experience with, online dating sites. People are more attracted to novel faces than they are attracted to familiar faces when romantic interest is reciprocated. We found no evidence that men are less attracted to the same person after activating an experimental choice context, while women tend to be less attracted to the same person after activating an experimental choice context. Differences in attractiveness judgements moderated by technology may nudge people towards or away from certain decisions or underpin romantic outcomes when using online platforms to find a romantic partner.

The important take away here is that the current choice mechanics of dating apps do not assist the user in making optimal mate choices according to the research presented in this thesis. While technology adds a lure of convenience to its consumers, that convenience could be cutting out necessary mechanisms. The results of this research indicate that success on dating apps influences daters to be more selective, meaning they might say no and swipe more. While being selective can be a good thing, holding out for a better mate

in terms of the ‘assessment mindset’ means the effort from users is going more into swiping and less into selecting. Technology is a staple in today’s society, and it is my hope that technology will adapt to users’ needs in a psychologically beneficial way.

Chapter 3.

Could Internet Pornography Generate 'Coolidge-Like' Effects in Heterosexual and Homosexual Men?

This chapter is adapted from the following publication:

Sculley, J. & Watkins, C. D. (in press). The Great Porn Experiment V2.0: Sexual arousal reduces the salience of familiar women when heterosexual men judge their attractiveness. *Archives of Sexual Behavior*.

Chapter 3. Could Internet Pornography Generate 'Coolidge-Like' Effects in Heterosexual and Homosexual Men?

Abstract

Pornography has become widely accessible in recent years due to its integration with the internet, generating social scientific and moralistic debate on potential 'media effects', given correlations between consumption and various sexual traits and behaviours. One popular public debate (*'The great porn experiment'*, Wilson, 2012) claimed that exposure to internet pornography has addictive qualities that could impact men's sexual relationships, underpinned by the 'Coolidge effect', where males are sexually motivated by the presence of novel mates. As claims about internet and sexual addictions are scientifically controversial, we provide a direct experimental test of his proposal. Adapting a paradigm used to examine 'Coolidge-like' effects in men, we examined the extent to which exposure to images of pornographic actresses altered men's attractiveness ratings of i) familiar faces/bodies on second viewing and ii) familiar versus novel women's faces/bodies. Independent of slideshow content (pornographic versus clothed versions of same actress), heterosexual men were less attracted to familiar bodies, suggesting that mere visual exposure to attractive women moderated these men's preferences. However, consistent with one of our pre-registered predictions, heterosexual men's preferences for familiar versus novel women were moderated by slideshow content such that familiar women were less salient on the attractiveness dimension compared to novel women when sexual arousal was greater (pornographic versus clothed slideshows). In sum, our findings demonstrate that visual exposure/sexual arousal moderates attractiveness perceptions, albeit that much greater nuance is required considering earlier claims.

Introduction

Although the overall pattern of results in Experiments 1 through 4 (Chapter 2) suggest nuance/caution in the conclusions we make in light of earlier theorizing, our incremental approach to these experiments suggests generally good corroboration for Finkel and colleagues (2012) theorizing where choice on an online dating platform may have ironic effects on our willingness to commit to a current prospect in light of alternate prospects. This is indexed predominantly via the difference in attractiveness judgements reported in Figure 2.2b, with attractiveness a proxy for our willingness to indicate social effort to a given person (see Section 1.7 and the Introduction Section of Chapter 2 for discussion). As a (separate) relatively recent technological innovation, pornography may alter attractiveness perceptions in a similar manner in ways that have effects on our commitment to, or behaviour towards others in sexual and intimate relationships.

In a 2012 TEDx talk, Gary Wilson claimed that access to a plethora of novel sexual partners online may undermine men's commitment and functioning within long-term romantic relationships, drawing on the Coolidge effect in part during his talk. Adapting the same experimental paradigm used in the previous chapter, we provided the first direct empirical test to our knowledge of some of his claims. The next chapter (Chapter 3) examines whether novel pornographic stimuli have a direct effect on heterosexual and homosexual men's attractiveness ratings of familiar versus novel women's faces and bodies.

While there are equivocal findings to date on the impact of pornography on sexual behaviour and intimacy (reviewed in Chapter 1, Section 1.4), one biological phenomenon provides an avenue to examine its potential effects via an experimental design. In 2012, a popular TEDx talk, from a self-proclaimed former science teacher Gary Wilson ('The great porn experiment', Wilson, 2012), argued that pornography consumption could have potentially addictive effects for male viewers. Wilson (2012) claimed that fast exposure to many different sexually active and receptive females activates reward related areas of the brain and potentially impacts their wider relationships with an individual female partner (e.g., in a more committed context). At the time of writing, his

talk had gained over 14 million views on YouTube. Part of his talk rested on the premise that the Coolidge effect (Wilson, 1963) is a biological reality that underpins the enjoyment of pornography by men. The Coolidge effect describes a positive effect of novel female mates on male sexual motivation (e.g., Jordan & Brooks, 2010), which would be adaptive if the potential reproductive rate is higher in males than females across many species (see Chapter 1, Section 1.5 for further discussion). Wilson claimed in his talk that the 'unending novelty' associated with pornography consumption may interfere with everyday pleasures experienced during real relationships, as the dopaminergic effects of pornography may be addictive for the male viewer and desensitise them to regular sexual activity. There is evidence that even male primates are motivated to view female genitalia (Deaner et al., 2005), that novel erotic stimuli induce "Coolidge like" effects in men measured via erection (Koukounas & Over, 2000), and learning has an effect on arousal and the sexual response more generally (see, e.g., Pfaus et al., 2001 for review). However, research on internet addictions (e.g., Przybylski et al., 2017) and sexual addiction are controversial in terms of their scientific validity (Ley, 2014). Thus, experimental tests of various claims made by Wilson are warranted. Especially, because Gary Wilson's (2012) claims are based on his opinions and not scientific evidence, including his claims about sex addiction.

Experiment 5

Laboratory experiment on heterosexual men's preferences for familiar versus novel bodies and faces, following exposure to pornographic content

In this Chapter, we attempt to provide the first direct test of Wilson's proposal to our knowledge. Namely, that exposure to pornography can generate 'Coolidge-like' effects in heterosexual men. Attractiveness and/or valence based on physical appearance are important in social outcomes (Maestripieri et al., 2017; Todorov et al., 2015), social perception (Oosterhof & Todorov, 2008; Sutherland et al., 2013), social memory (Maner & Ackerman, 2015), and the motivation to engage with an individual (Hahn & Perrett, 2014). Much work

has also examined how these attractiveness judgements differ according to context (see e.g., Little, Jones, & DeBruine, 2011 for a review). While familiarity is generally attractive (e.g., Lie, Rhodes, & Simmons, 2008; Peskin & Newell, 2004), Little, DeBruine, and Jones (2014) demonstrated 'Coolidge-like' effects in face perception, such that men were more attracted to novelty than women, as indexed by changes in the attractiveness ratings of faces on second viewing. We adapted this paradigm, following the experiments reported in Chapter 2, to test whether exposure to pornographic images influences the attractiveness of novel versus familiar bodies and faces. Again, we examined whether our predictions were supported when measuring changes in preferences for the same bodies/faces from baseline (*sensu* Little et al., 2014), and when comparing the perceived attractiveness of our familiar/test image set to a novel/distractor set of bodies/faces (i.e., familiar versus novel identities).

We pre-registered the following hypotheses (Introduction and method section at: https://osf.io/3yr7k/). Based on research on the Coolidge effect in males (e.g., Jordan & Brooks, 2010), 'Coolidge-like effects' in men (Little et al., 2014), and the purported effects of internet pornography on men's attraction to novel females (Wilson, 2012), we predicted that slideshows with images of pornographic content would directly reduce men's preferences for familiar bodies on second viewing (i.e., a stronger preference for novelty), compared to our control condition where men view the same actress clothed (*Hypothesis #1a*). Similarly, when coding data to measure attraction to our novel versus familiar image sets post slideshow, we predicted the same effect (i.e., stronger preference for novel versus familiar women after exposure to pornography, *Hypothesis #1b*). Given that the desire to view attractive, nude bodies is a strong motive for viewing pornography, we examined whether the predicted effects were stronger for subsequent attractiveness judgements of bodies versus faces (*Hypothesis #2a*). Finally, as the hallmark of hardcore heterosexual internet pornography, compared to sex depicted within film more generally, is arguably the ability to view visible penile vaginal intercourse, we examined whether our predictions were moderated by pornographic content, such that a stronger cue to sexual availability (observing penile vaginal intercourse during partnered sex versus solo female nudity) has a stronger effect on men's preferences for novelty in female bodies (*Hypothesis #2b*).

Methods

3.1.1. Participants

One hundred twenty-nine heterosexual men took part in our laboratory experiment and were recruited from both on and off-campus. While we did not exclude participants according to their age or sexuality (i.e., at the recruitment phase), we targeted a sample of heterosexual males aged 18-35 approximately. The study was advertised as examining responses to internet images (Modern technology and social responses to internet images) and participants were eligible to enter a prize draw for one of two £15 Amazon vouchers. At the consent phase of the experiment, participants were informed that the study may or may not involve looking at sexually explicit images. At the debrief phase of the experiment, participants had the opportunity to withdraw their data given that the project could be argued to entail deception (which was justified to ensure that our manipulation was reliable). No participants withdrew from the research at this point, although data from six participants could not be used due to technical error (two participants) or the participant not following instructions (four participants), resulting in a final sample size for analysis of one hundred twenty-three heterosexual men (M_{age} = 24.36 years, *SD* = 6.18 years). Sample size was calculated based on 80-90% power to detect a moderate effect in an experiment with three between subjects' conditions (i.e., 41-54 participants per cell; Lakens & Evhers, 2014). All procedures for recruitment and testing were granted ethical approval (Approval code: EMS994, please see Appendix D).

3.1.2. Face and body stimuli

To select stimuli, we used a procedure adapted from Little et al. (2014), male participants rated a set of 10 test photographs (5 female faces, 5 female bodies) on two occasions, rating an additional 10 distractor photographs (5 female faces, 5 female bodies) on the second occasion, with each body image belonging to the same woman as each face image (i.e., 10 Caucasian women used in total). All body images were a subset of images from a publicly available image set (3d.sk) as used in Morrison et al. (2017, https://osf.io/8vzwd/), with accompanying face images used in our prior research (e.g., Watkins et al.,

2017). All face and body images were taken under standardized conditions. Face images (600x800 pixels) consisted of women posing with a neutral expression, no adornments, and hair tied back from forehead. Body images (600x800 pixels) consisted of women posing in a standardized star shape front-on to camera with breasts visible but genitals and face obscured. The female test set (M_{age} = 24.4 years, *SD* = 4.34 years; $M_{Attractiveness}$ = 4.36, *SD* = 0.47, M_{BMI} = 19.86 kg/m^2, *SD* = 1.50) and female distractor set (M_{age} = 24.8 years, *SD* = 2.39 years; $M_{Attractiveness}$ = 4.39, *SD* = 0.31, M_{BMI} = 18.65 kg/m^2, *SD* = 1.43) were matched on facial attractiveness as rated in Talamas and colleagues (2016). We matched the two image sets on facial attractiveness rather than body attractiveness given the greater importance of the former over the latter in attractiveness judgements (e.g., Currie & Little, 2009; Furnham et al., 2001). Of note, attractiveness judgements of faces and bodies can be underpinned by similar traits (e.g., adiposity, see, e.g., de Jager et al., 2018 for a review) and this design was optimal to test Hypothesis 2a (differences in responses to the same woman in light of modality), while controlling for attractiveness differences between familiar and novel image sets.

3.1.3. Pornographic images

We pilot tested a set of fifty-seven images belonging to nineteen Caucasian female pornographic actors downloaded from a free adult website (hqbabes.com). According to statistics provided by youporn.com, these female actors ($M_{Current\ age}$ = 26.14 years, *SD* = 3.21 years; M_{BMI} = 18.58 kg/m^2, *SD* = 1.41), at the time of 30th January 2019, had a total of 1,701 videos viewed collectively over 41 million times ($M_{Actor\ Views}$ = 2.2 million *SD* = 2.1 million; $M_{Actor\ Views\ per\ video}$ = 22,970, *SD* = 23,799; Median Actor Rank = 134, *SD* = 738). For each actor we selected an image of the woman: i) clothed without breasts or genitals visible, ii) nude with genitals visible and no other clothing or adornments, and iii) nude, engaging in visible penile vaginal intercourse (PVI) with a male actor, with 15 of these images picturing sex in a ventro-ventral position. These images were then pilot tested on a sample of ninety-one heterosexual males, with each male rating one of three image sets, with trials presented in a random order (650x1000 pixels or 1000x650 pixels for PVI images) on surveymonkey.com. Participants in the control condition were

reimbursed the equivalent of £5 per hour via prolific.ac (*PVI*: 29 males, M_{age} = 31.24 years, *SD* = 5.06 years. *Nude*: 30 males, M_{age} = 32.37 years, *SD* = 9.22 years. *Clothed/Control*: 32 males, M_{age} = 24.59 years, *SD* = 6.06 years).

In these pilot studies, men rated each randomized image on the three dimensions of affect used in the International Affective Picture System (i.e., Valence, Arousal, Dominance, Lang et al., 1997) using a 1-9 scale where *low* scores indicate high valence, high arousal, and low dominance (feeling controlled) respectively. Ratings of valence, arousal, and dominance were collected in an attempt to control for differences in emotional responses between the slideshows in the experiments. Based on this pilot data we selected a subset of 15 images per condition with the same 15 female actors used across all three experimental conditions. Here, the two pornographic slideshows differed from the control slideshow on the three dimensions of affect (all $p < .045$, except dominance for Nude v Clothed/Control, where $p = .07$) but did not differ *from each other* (all $p > .19$) on the three dimensions of affect (*PVI slideshow*: $M_{Valence}$ = 3.83, *SD* = 0.31; $M_{Arousal}$ = 4.28, *SD* = 0.26; $M_{Dominance}$ = 5.79, *SD* = 0.29. *Nude slideshow*: $M_{Valence}$ = 3.74, *SD* = 0.29; $M_{Arousal}$ = 4.15, *SD* = 0.26; $M_{Dominance}$ = 5.73, *SD* = 0.34. *Clothed/control slideshow*: $M_{Valence}$ = 4.34, *SD* = 0.33; $M_{Arousal}$ = 4.63, *SD* = 0.58; $M_{Dominance}$ = 5.51, *SD* = 0.29).

3.1.4. Procedure

The experiment was run via Superlab version 4.5 (Cedrus Corporation, San Pedro, California), with a fixation cross presented in the centre of the screen for 200 milliseconds in between all image trials. First, all participants viewed a one-minute slideshow to stabilize baseline levels of arousal across the sample. In this slideshow, we used 12 low-arousal, high-valence nature images presented in a randomized order for 5000 milliseconds each. After reading instructions, participants then proceeded to the first phase of the experiment (pre-slideshow attractiveness rating task). Participants were presented with 10 randomized trials consisting of five faces and five bodies, with five female models used in total. On each trial, participants were asked to indicate their preference for the face/body on a 1 to 7 scale (much less/more attractive than average). Immediately after this, participants completed the pictorial slideshow phase of the experiment, with participants blind to the condition they were allocated to.

Participants were randomly allocated to one of three conditions (PVI slideshow, Nude slideshow, Clothed/Control slideshow) using the random number generator on Excel. Participants were simply asked to look closely at the images presented within a one-minute slideshow, with trial order randomized and each trial presented for 4000 milliseconds in the centre of the screen (520x800 pixels or 800x520 pixels in the PVI slideshow condition). Immediately after the pictorial slideshow, participants were asked to rate the same test set of faces and bodies and an additional distractor set of 5 female faces and 5 female bodies, with attractiveness rated in the same way as the pre-slideshow phase of the experiment and all trials randomized. After this phase, participants were debriefed.

3.1.5. Initial processing of data and analysis plan

Following Little et al. (2014), we calculated each participant's change in preference for familiar faces/bodies (i.e., from baseline), by averaging their attractiveness ratings of test faces/test bodies. Averages were calculated separately for ratings of the five female faces and the five female bodies and were also calculated separately for the pre-slideshow phase of the experiment and the post-slideshow phase of the experiment (i.e., four separate average values). To test our pre-registered hypotheses, each participant's change in preference was calculated by subtracting the participant's pre-slideshow score from their post-slideshow score. High scores (i.e., greater than zero) indicate a stronger preference for familiarity in faces/bodies. Conversely, low scores (i.e., below zero) indicate a stronger preference for novelty in faces/bodies. Average ratings of distractor faces/bodies in the post-slideshow phase of the experiment were also compared, to examine relative preferences for novel versus familiar women (faces and bodies separately) during the post-slideshow phase of the experiment.

Mixed design ANOVAs were run on our two dependent variables, with follow up *t*-tests with bias correct and accelerated bootstrapped confidence intervals (1000 samples). Two-tailed *p* values were reported for all analyses, with significance set at the level $p < .05$. Data were analysed from heterosexual males who completed all trials in both phases of our experiment (pre- and post-slideshow attractiveness ratings of faces and bodies).

Results

3.1.6. Change in preference for familiar/test images (i.e., bodies and faces, from baseline, Hypotheses # 1a, 2a, 2b)

A within subjects ANOVA was run on the dependent variable *change in preference for test image set*, with the within subjects factor *modality* (female bodies, female faces) and the between subjects factor *experimental slideshow condition* (Penile-vaginal intercourse slideshow, nude slideshow, clothed/control slideshow). This analysis revealed an effect of *modality* that went in the predicted direction ($F_{1,120}$ = 3.48; p = .064, n_p^2 = .03). No effect of *experimental slideshow condition* was observed ($F_{2,120}$ = 1.08; p = .34, n_p^2 = .02) or interaction between *experimental slideshow condition* and *modality* ($F_{2,120}$ = .90; p = .41, n_p^2 = .02).

As our pre-registered hypothesis (#2a) was directional, we confirmed whether the trend effect of *modality* went in the same direction as predicted. We ran a one sample t-tests against chance (i.e., zero) to examine whether preferences changed in general/at all from baseline (i.e., slideshows of pornographic actresses), led to a decrease in preference for bodies but not faces, revealed that experimental manipulation reduced the attractiveness of familiar bodies (M = -0.13, BCa 95%CI[-.22, -.03], absolute t_{122} = 2.64; p = .009, r = .41) but not familiar faces (M = -0.02, BCa 95%CI[-.13, .07], absolute t_{122} = -0.50; p = .62, Figure 4.1a).

3.1.7. Exploratory analyses: Change in preference for familiar/test images (i.e., bodies and faces, from baseline)

We ran further exploratory analyses (one sample t-tests) split by slideshow condition to rule out potential alternate explanations for our findings, as both of our pornographic slideshows elicited similar levels of arousal during pilot tests, but men may have responded differently to the same woman when she was alone versus partnered (i.e., effects moderated by image content versus sexual arousal, consistent with Hypothesis #2b). This analysis revealed no changes in attractiveness judgements from baseline in any of our slideshows, when men judged faces (all absolute t < .51, all p > .61). The penile-vaginal intercourse slideshow did not alter body preferences from baseline (t_{40} = -.06, p = .95). The

clothed female slideshow did not alter body preferences from baseline (t_{40} = -1.81, p = .08, r = .28). The nude female slideshow altered body preferences from baseline (t_{40} = -2.55, p = .015, r = .40).

As the Penile-Vaginal Intercourse slideshow did not elicit any change in preference from baseline, and pilot testing revealed that both pornographic slideshows were equally arousing (but more arousing than our control condition), we repeated our ANOVA on participants who took part in two of our slideshows only (nude, clothed/control). Rerunning the ANOVA on this data revealed the predicted effect of *modality* ($F_{1,80}$ = 4.64; p = .034, n_p^2 = .06) and no other significant effects or interactions (both F < .37 both p > .57). This analysis revealed, consistent with the initial pre-registered analysis, that body preferences (t_{81} = -3.12, p = .002, r = .35) but not face preferences (t_{81} = -.59, p = .56) decreased from baseline *across* both slideshows. The additional analyses in Experiment 5 were unplanned but run for principled reasons as the pre-registration of these experiments allows for transparency.

3.1.8. Changes in response times to familiar/test images (i.e., bodies and faces, from baseline)

Analyses of response time data both for the original pre-registered model ($M_{\text{Change in RT}}$ = -1.87 seconds, SD = 2.22 seconds) and for this exploratory model ($M_{\textit{Change in RT}}$ = -1.87 seconds, SD = 2.57 seconds) revealed no significant effects or interactions (all F < 2.50, all p > .11).

3.1.9. Attractiveness of familiar versus novel women following exposure to pornographic actors (Hypotheses # 1b, 2a, 2b)

Next, we ran a separate mixed design ANOVA on the dependent variable *attractiveness of familiar versus novel women following exposure to pornographic actors*, with the within subjects factor *modality* (female bodies, female faces) and *image set* (familiar/test set, novel/distractor set) and the between subjects factor *experimental slideshow condition* (PVI slideshow, nude slideshow, clothed/control slideshow). This analysis revealed a main effect of *modality* ($F_{1,120}$ = 10.19; p = .002, n_p^2 = .08), which reflected a stronger attraction to faces (M = 4.09, BCa 95%CI[3.96,4.20]) than bodies (M = 3.89, BCa 95%CI[3.78,4.00], t_{122} = 3.22; p = .002, r = .14). An interaction between *modality*

and *image set* was also observed ($F_{1,120}$ = 77.09; p < .001, n_p^2 = .39), which reflected greater attraction to the novel (M = 4.18, BCa 95%CI[4.03,4.32]) versus familiar face image set (M = 4.00, BCa 95%CI[3.87,4.14], absolute t_{122} = 3.00; p = .003, r = .13) but greater attraction to the familiar (M = 4.14, BCa 95%CI[4.01,4.27]) versus novel body image set (M = 3.64, BCa 95%CI[3.51,3.77], absolute t_{122} = 11.13; p < .001, r = .45). Consistent with our predictions (*Hypothesis #1b*), a main effect of *image set* ($F_{1,120}$ = 22.33; p < .001, n_p^2 = .16) interacted with *experimental slideshow condition* ($F_{2,120}$ = 4.01; p < .021, n_p^2 = .06). No other effects or interactions were significant (all F < 0.84 all p > .43).

Paired *t*-tests split by experimental slideshow condition were run to examine the significant interaction between *experimental slideshow condition* and *image set*. This analysis revealed that familiar faces and bodies (M = 4.17, BCa 95%CI[3.93,4.42]) were more attractive than novel faces and bodies (M = 3.88, BCa 95%CI[3.61,4.17]) following our control slideshow (i.e., a low arousal condition: absolute t_{40} = 5.41; p < .001, r = .39). In the opposite direction to that predicted, familiar faces and bodies (M = 4.04, BCa 95%CI[3.84,4.25]) were also more attractive than novel faces and bodies (M = 3.91, BCa 95%CI[3.72,4.11]) following our penile-vaginal intercourse slideshow (absolute t_{40} = 2.56; p < .014, r = .20). There was no difference in preference for familiar faces and bodies (M = 4.00, BCa 95%CI[3.79,4.22]) versus novel faces and bodies (M = 3.94, BCa 95%CI[3.72,4.18]) following our nude slideshow (absolute t_{40} = .84; p = .41, Figure 4.1b).

3.1.10. Response time to familiar versus novel women following exposure to pornographic actors

Response time data on the same ANOVA model revealed a main effect of *modality* ($F_{1,120}$ = 12.77; p = .001, n_p^2 = .10) and a main effect of *image set* ($F_{1,120}$ = 9.91; p = .002, n_p^2 = .08), with no other significant effects or interactions (all F < 1.86, all p > .16). Here, men were faster to respond to the familiar image set (M_{RT} = 3.86 seconds, SD = 1.76 seconds) than the novel image set (M_{RT} = 4.19 seconds, SD = 2.08 seconds, t_{122} = 3.13; p = .002, r = .14) and were slower to respond to body images post-slideshow (M_{RT} = 4.19 seconds, SD = 1.96 seconds) than they were to face images post-slideshow (M_{RT} = 3.86 seconds,

SD = 1.86 seconds, t_{122} = 3.60; p < .001, r = .16). Excluding participants with response times three standard deviations above the mean (N = 13 participants) did not alter the pattern of results reported here for response times, although the main effect of *image set* now only approached significance ($F_{1,107}$ = 3.33; p = .071, n_p^2 = .03).

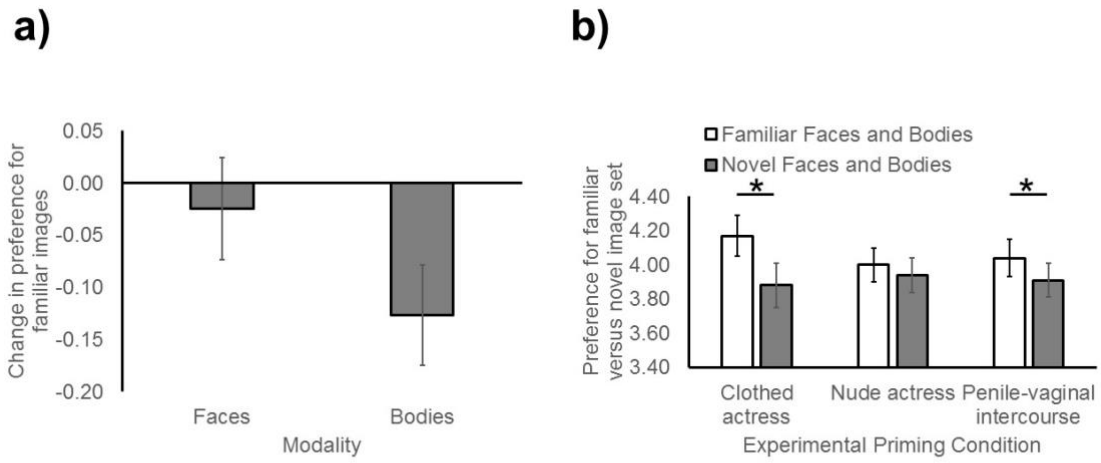

Figure 3.1. Slideshows with images of pornographic actresses decreases men's preference for familiar bodies but not familiar faces (Panel a, r = .41). Low arousal is related to a stronger preference for familiar women (i.e., faces and bodies, r = .39) while greater arousal reduces the distinction between familiar and novel women on the attractiveness dimension (Panel b). Error bars show +/- 1SEM.

The results of Experiment 5 demonstrated that heterosexual men were less attracted to familiar bodies following exposure to slideshows of pornographic actresses (i.e., clothed, nude, and PVI); however, the effect was independent of sexual arousal (i.e., manipulated via slideshow content) and the attractiveness of familiar faces did not decrease from baseline. In separate analyses on responses to familiar versus novel image sets, heterosexual men's preferences were moderated by slideshow content, however, suggesting that greater sexual arousal reduces the salience of familiar women relative to novel women on the attractiveness dimension. To make stronger inferences about

the extent to which our prior effects could be attributed to sexual arousal among heterosexual men, the final experiment reported here (Experiment 6) built upon this work accordingly.

Experiment 6

Effects of pornography exposure on homosexual men's attractiveness judgements of familiar versus novel women

To make stronger inferences about the extent to which the effects observed in Experiment 5 could be attributed to sexual arousal among heterosexual men, we recruited an independent sample of homosexual men to take part in our experiment, given that, in contrast to women, male sexual arousal is sex specific and independent of sexual orientation (Chivers et al., 2004). A comparable set of findings between a heterosexual and homosexual sample of men, in the absence of any effect of experimental slideshow condition in analyses (i.e., sexual arousal) would support a mere visual exposure account (e.g., Stephen & Perera, 2014; Sturman et al., 2017) as an explanation for men's attractiveness judgements of familiar versus women following exposure to pornographic actresses. By contrast any effects of experimental slideshow condition observed in Chapter 4 but not Chapter 5 would lend support to the role of sexual arousal in men's attractiveness judgements of familiar versus novel women. Comparisons between samples will then be made in order to interpret our original pre-registered hypotheses.

Methods

3.2.1. Participants

Eighty-five homosexual men took part in our experiment. Due to the difficulty in recruiting a large sample of homosexual men on an efficient timescale on campus (for research on a sensitive topic), men were recruited predominantly from LGBQT+ locations in the United States and Scotland known to the researcher, with the permission of the owners of the locations. The experiment was advertised and participants were reimbursed in the same way as Experiment 5. Three participants withdrew from the research after granting consent, resulting in a final sample size for analysis of eighty-two homosexual men (M_{age} = 36.06 years, *SD* = 10.21 years). Sample size was calculated in the same way as in Experiment 5, with all updates to recruitment and testing granted ethical approval (Approval code: EMS2438, please see Appendix E).

3.2.2. Stimuli and slideshow images

Stimuli were identical to Experiment 5, except that only two slideshow conditions were used (nude versus clothed versions of the same actress), to avoid confounds where homosexual men could be attracted to the male depicted in the partnered (PVI) pornographic slideshow condition.

3.2.3. Procedure, data processing, and analytical strategy

The experimental procedure, and procedure for processing and analysing data were identical to Experiment 5, except that our participants completed the task in a private back booth seating area, in an ambient environment.

Results

3.2.4. Change in preference for familiar/test images (i.e., bodies and faces, from baseline)

A within subjects ANOVA on the dependent variable *change in preference for test image set*, with the within subjects factor *modality* (female bodies, female faces) and the between subjects factor *experimental slideshow condition* (Nude slideshow, clothed/control slideshow) revealed no significant effects or interactions (all $F < 2.59$, all $p > .11$). A follow up one-sample *t*-test to examine whether there was a general change in preferences for familiar faces and bodies from baseline (i.e., against zero, collapsed across modality) revealed that men's preference for familiarity decreased from baseline at levels greater than chance ($M = -.17$, BCa 95%CI[-.32,-.04], absolute $t_{81} = 2.66$; $p = .009$, $r = .14$).

3.2.5. Changes in response times to familiar/test images

Running an identical model on changes in response times for this experiment revealed a main effect of *modality* ($F_{1,80} = 128.27$; $p < .001$, $n_p^2 = .62$) and no other significant effects or interactions (both $F < 1.03$, both $p > .31$). This effect of modality reflected an increase in response time when judging the attractiveness of faces on second viewing ($M = 3.53$ seconds, $SD = 2.09$ seconds, $SEM = .23$ seconds) and a decrease in response time when judging

the attractiveness of bodies on second viewing (*M* = -2.07 seconds, *SD* = 3.55 seconds, *SEM* = .39 seconds, absolute t_{81} = 11.32; $p < .001$, r = .53, Figure 5.1a). Excluding participants (*N* = 14) above or below three standard deviations from the mean on this measure did not alter this pattern of results (effect size *r* increased to 0.72).

3.2.6. Attractiveness of familiar versus novel women following exposure to pornographic actors

A mixed design ANOVA was run on the dependent variable *attractiveness of familiar versus novel women following exposure to pornographic actors*, with the within subjects factor *modality* (female bodies, female faces) and *image set* (familiar/test set, novel/distractor set) and the between subjects factor *experimental slideshow condition* (Nude slideshow, clothed/control slideshow). This analysis revealed a main effect of *modality* ($F_{1,80}$ = 7.15; p = .009, n_p^2 = .08), which interacted with *image set* ($F_{1,80}$ = 18.96; $p < .001$, n_p^2 = .19), reflecting greater attraction to the novel face image set (*M* = 3.72, BCa 95%CI[3.36,4.08]) than the familiar face image set (*M* = 3.53, BCa 95%CI[3.19,3.87], absolute t_{81} = 2.74; p = .007, r = .15), but greater attraction to the familiar body image set (*M* = 3.45, BCa 95%CI[3.11,3.83]) than the novel body image set (*M* = 3.21, BCa 95%CI[2.87,3.62], absolute t_{81} = 4.17; $p < .001$, r = .22, Figure 5.1b). No other effects or interactions were significant (all $F < 2.68$, all $p > .10$).

3.2.7. Response time to familiar versus novel women following exposure to pornographic actors

An identical model on response time data revealed no significant effects or interactions (all $F < 1.42$, all $p > .23$). Excluding participants (*N* = 14), who gave responses more than three standard deviations from the mean response time across trials (7.37 seconds) did not alter this pattern of results.

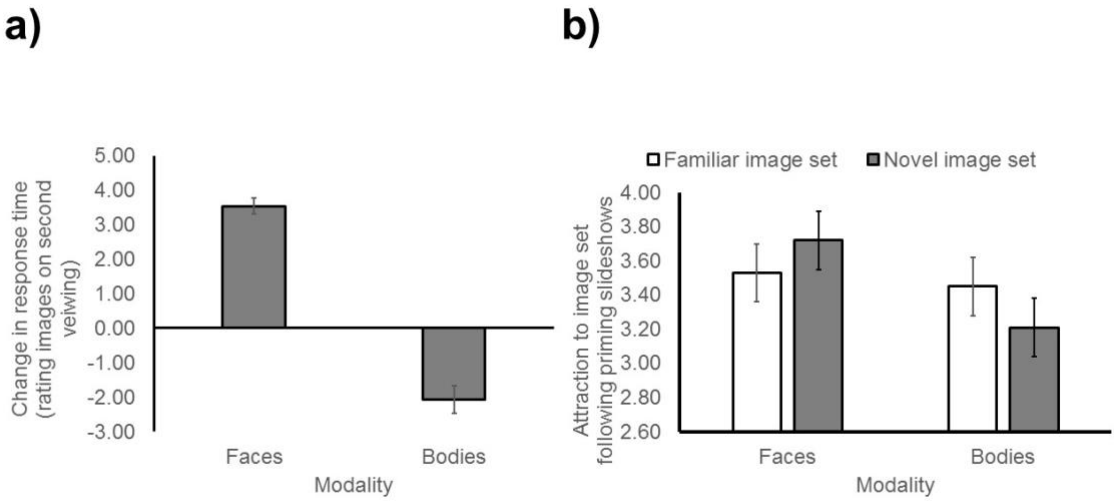

Figure 3.2. Homosexual men take more time to rate the attractiveness of familiar faces on second viewing and less time to rate the attractiveness of familiar bodies on second viewing (Panel a, *r* = .53). Identical to our first experiment (n_p^2 = .39), homosexual men generally preferred novel faces and familiar bodies (Panel b, n_p^2 = .19). Error bars show +/- 1SEM.

Discussion

3.3.1. Summary of experimental findings (Effects of exposure to pornography on men's preferences for familiar versus novel women)

In our first experiment on heterosexual men (Experiment 5), contrary to our pre-registered predictions, we did not observe an effect of viewing pornography on men's preferences for novelty in bodies (i.e., a reduced preference for familiar bodies on second viewing, Hypothesis #1a). Although heterosexual men were less attracted to familiar bodies, but not familiar faces, on second viewing (i.e., in the predicted direction of Hypothesis #2a, see Figure 4.1a), this change in preference was independent of the content of our slideshows. Indeed, although exploratory *t*-tests indicated that our sexually arousing slideshow (nude actress) altered body preferences in the predicted direction, while clothed versions of the same actress (low arousal) did not, rerunning our model to compare these two conditions revealed the same general effect on heterosexual men's preferences. Thus, looking at attractive pornographic

actresses who are of high 'market demand' (see 'Pornographic images' Section 4.1.3.), reduced men's preference for familiar bodies, independent of sexual arousal as confirmed via pilot tests of our slideshows.

When comparing the effects of exposure to pornography on heterosexual men's preferences for novel versus familiar women (i.e., different image sets), we found partial support for Hypothesis #1b. Although we did not observe any evidence that novel women were perceived as more attractive than familiar women following exposure to pornography, we did find evidence that greater sexual arousal reduced the salience of familiar women relative to novel women on the attractiveness dimension. In other words, familiar women were perceived as relatively less attractive than novel women following exposure to nude or sexually active actresses, compared to when those same actresses were clothed, as evidenced by our significant interaction between image set and experimental slideshow condition (Figure 4.1b).

As male sexual arousal is sex-specific regardless of men's sexual orientation (Chivers et al., 2004), our final experiment on homosexual men enabled us to make stronger inferences on whether any effects observed among heterosexual men could be attributed to sexual arousal. Similar to heterosexual men, merely looking at pornographic actresses (independent of image content) reduced their preferences for familiar women, albeit this effect generalized across familiar faces and bodies. When comparing responses to different image sets, we observed an identical interaction to the first experiment, where homosexual men were more attracted to novel versus familiar women's faces and familiar versus novel women's bodies (Figure 5.1b). However, in contrast to the Experiment 5, we observed no interaction between image set (familiar versus novel) and experimental slideshow condition, suggesting that the effects observed in our first experiment could be attributed to sexual arousal (Hypothesis 1b, Figure 4.1b). Of note, general time spent looking at women differed according to sexual orientation, following mere exposure to pornographic actresses. Heterosexual men spent longer (330 milliseconds) evaluating women's bodies versus faces post-slideshow, while homosexual men spent less time viewing/evaluating familiar bodies, and more time viewing/evaluating familiar faces on second viewing (Figure 5.1a, large effect size). This suggests that a different pattern of results emerge for effects of our

manipulation on looking/evaluation time versus the attractiveness judgements themselves. Collectively, our data suggest that mere visual exposure to attractive women moderates attractiveness judgements of women regardless of men's sexual orientation, while sexual arousal via exposure to pornographic content moderates' men's perceptions of familiar versus novel women on the attractiveness dimension.

3.3.2. Theoretical implications

There are several implications of our findings. First, although our findings provide some support that exposure to pornography generates 'Coolidge-like' effects in heterosexual men (Kokounas & Over, 2000; Little et al., 2014), our data suggest that these effects are much more nuanced than claimed by Wilson in his highly viewed TEDx talk. For example, when examining changes in the perceived attractiveness of the same woman (face or body), our findings could be better accounted for by theories of mere visual exposure on subsequent body perception (e.g., Stephen & Perera, 2014; Sturman et al., 2017) rather than sexual arousal per se, as they were observed in men of both sexual orientations. Indeed, earlier claims are hard to reconcile with our data, as heterosexual men's preferences for familiar women's faces did not change following exposure to pornography. This suggests that pornography exposure is unlikely to alter men's attractiveness judgements of the same woman and is noteworthy considering the importance of face versus body in social perception (Currie & Little, 2009; Furnham et al., 2001). Also, face and body attractiveness are underpinned by similar traits (see de Jager et al., 2018 for a review), as people can place different emphasis on the face versus body when forming attractiveness judgements even if similar traits/dimensions can underpin this judgement.

Our second set of analyses, across heterosexual and homosexual men, lends support to the Coolidge effect as a framework for understanding male responses to novel versus familiar women in terms of sexual arousal. Although heterosexual men did not perceive novel women (faces and bodies) as more attractive than familiar women, sexual arousal reduced the perceived distinctiveness of familiar versus novel women on the attractiveness dimension (Figure 4.1b). Thus, greater sexual arousal induced by internet pornography

reduces the perceived distinction between familiar versus novel women on the attractiveness dimension. Critically, although mere exposure to pornographic actresses moderated both heterosexual and homosexual men's preferences for familiar versus novel women in the same manner, preferences for familiar versus novel women were moderated by the content of our slideshows (more- versus less-arousing) among heterosexual men only. Collectively, our research demonstrates that mere visual exposure to attractive women moderates attractiveness perceptions of bodies more generally, while sexual arousal moderates heterosexual men's preferences for familiar versus novel women. While the former result suggests that media stimuli in general influences attractiveness perceptions of bodies, pornographic content has specific effects on heterosexual men's comparative judgements of women, at least in the short-term.

3.3.3. Limitations and future directions

There are limitations to our research. First, our main experiment was limited to adult males in their mid-20s, albeit our randomized slideshow design rules out differential responses to our slideshows that are mere artefacts of demographic characteristics. Randomly allocating people to experimental conditions should generally even out the demographic makeup of people in each cell/condition rather than skewed to a demographic (therefore we have potentially reduced their influence on results in the design). Nonetheless, it would be useful to examine whether our effects are stronger or weaker according to age (older-age and/or adolescent samples). Considering factors such as level of pornography consumption, sexual disgust, age at first exposure to pornography, and socioeconomic status, would also be useful in future. Of note, familiarity effects can be observed after relatively short exposure durations (Montoya et al., 2017), and our data suggest that participants could differentiate two image sets based on familiarity following a brief (one-minute) experimental slideshow manipulation, as their attractiveness judgements of them differed even though the two image sets were equivalent in facial attractiveness. Nonetheless, it would be useful to extend our line of research to examine the extent to which our manipulation influences perceptions of personally familiar individuals. Given that men's face ratings of the same woman did not change

on second viewing, for example, it might be unlikely that the same manipulation would alter perceptions of faces for whom the participant is romantically attached (versus attracted) to. Indeed, 'Coolidge-like' effects in men's judgements of faces appear to be stronger when men are given contexts to evaluate faces related to short-term sexual attraction versus long-term commitment, and men also perceive faces that resemble their romantic partners as more attractive than faces that share less resemblance (Little et al., 2014). Thus, our findings may speak more directly to contexts prior to commitment and the potential (subtle) interplay between men's sexual experiences online and offline. As affective experiences with faces can be generalized to novel faces that share resemblance to learned faces (Verosky & Todorov, 2010), it is possible that simulated sexual experiences online may influence men's partner search for specific traits, such as learned traits of positive valence when using online dating sites. Manipulating the exposure duration to faces/bodies and actresses would also be useful, to understand the temporal dimensions of our effects, which may be more substantial in the real world as our experimental manipulation was brief. Manipulating the relative familiarity versus novelty of faces would also be an important means with which to develop this line of research, in contrast to the one- versus two-time exposure used here. This could be manipulated, for example, with an "*x* versus 3*x* exposure", or by manipulating the extent of the morph between a new and old face (Verosky & Todorov, 2010).

Second, our experiments exposed men to images of pornographic actresses. This was done to improve internal validity, where men are exposed to the same actress who is either clothed, fully naked with genitals visible, or naked and engaged in visible penile-vaginal intercourse (i.e., removing confounds related to actress identity, body size, and shape). Exposure to the latter is arguably the hallmark of hardcore heterosexual internet pornography in contrast to how sex scenes are typically depicted on non-paywalled programs on television. Although future work could examine whether our effects generalize to watching videos and/or more interactive forms of pornography (e.g., via webcam or VR; see Elsey et al., 2019), such a design can induce noise, as dynamic images bring other factors/confounds into play, such as an individual male's preference for a given theme/style of pornography, the

expressiveness or enjoyment (or lack thereof) of different actors, sexual positions used, and so forth. As our tightly controlled experiment exposed men to a relatively reduced range of sexual arousal via picture slideshows, further research such as this would allow us to examine whether our effects are attenuated or accentuated at much lower- and higher-levels of arousal, even though relatively small changes to slideshow content (one-minute slideshows of the same women clothed versus nude) were sufficient to alter heterosexual but not homosexual men's preference for familiar versus novel women. Manipulating the attractiveness of the actresses within the stimulus set, and measuring the participant's own attractiveness, would also be important, to examine whether our effects generalize across a wider range of sexual attractiveness, which may partly be reflected in different styles of pornography (e.g., "amateur" or "girl next door" content; Hald & Štulhofer, 2016).

Finally, the findings from the experiments presented here cannot be generalized to how women interact with pornography. We focussed on males in light of prior theory, and due to the practical (and potential ethical) difficulties of running an identically designed experiment on women, as prior work on the sex-specificity of sexual arousal (Chivers et al., 2004) means that it would be difficult to conclude from images of dyadic sex whether women's subsequent preferences are influenced by the actor or actress. Lack of consent from an academic testing platform prohibited us from running an equivalent experiment on women with no experimenter interaction (i.e., maximum privacy). Fewer women than men watch pornography (Albright, 2008; Ogas & Gaddam, 2011), with qualitative research suggesting that women are less motivated to view male genitalia than men are to view female genitalia (Eck, 2003). Indeed, attractive women are in receipt of more prosocial biases towards them than are attractive men (see Maestripieri et al., 2017 for discussion), which may be an important driver in the greater market demand of female versus male pornographic actors. Nonetheless, further research on women's judgements would be necessary, particularly as reported pornography use is quite high for both men and women in some samples (e.g., 91.5% of men and 60.2% of women report consumption in the past month; Solano et al., 2020). This could be done, for example, by adapting our paradigm to look at women's responses to literary pornography (see Döring, 2009 for review), or by considering motives

to view pornography that are shared by men and women, such as sexual curiosity and self-exploration (Bothe et al., 2021). Pending further independent replication, our findings have practical implications. By integrating these findings with research on training programmes related to sex education, researchers and practitioners may make more careful or nuanced conclusions on the effects of this media on behaviour, when considering the literature as a whole.

Conclusions

In sum, our findings suggest that mere exposure to pornographic actresses directly reduces the attractiveness of familiar bodies on second viewing, independent of men's sexual orientation. Although none of our male samples perceived novel women as more attractive than familiar women following exposure to pornographic images, heterosexual men perceived familiar versus novel women as less distinct on the attractiveness dimension when sexual arousal was relatively high.

Chapter 4.

General Discussion: Overview, future directions, and conclusions

Chapter 4. General Discussion: Overview, future directions, and conclusions

Overview of empirical chapters

Facial judgments, especially attractiveness judgments, can be made quickly (e.g., Hassin & Trope, 2000; Lenton & Francescioni, 2010; Willis & Todorov, 2006) and have long-term consequences and benefits on how humans maintain their sociability (e.g., Diener & Seligman, 2002; Fowler & Christakis, 2008; Haidt, 2006; Zhu et al., 2013; see also Cacioppo & Patrick, 2008; Holt-Lunstad et al., 2010). These initial judgements progress relationships into longer commitments and those relationships are vital to a person's overall wellbeing (e.g., Diener & Seligman, 2002; Fowler & Christakis, 2008; Haidt, 2006; Zhu et al., 2013; see also Cacioppo & Patrick, 2008; Holt-Lunstad et al., 2010) and can even influence their overall success (e.g., Baldwin et al., 1997; Ladd et al., 1996; Ryan, 2001); making the selection process an extremely important factor to human life. As technological advances have become increasingly popular for selecting and maintaining intimate connections (e.g., Statista Research Department, 2021; please refer to Chapter 1 Sections 1.1 & 1.5), knowing how these social technologies assist or hinder the selection process is extremely important for consumers and developers. The main goal of this thesis was to examine if the design of dating apps and pornography sites (i.e., rapid presentation of romantic/sexual partners) generates an 'assessment mindset' (Finkel et al., 2012) in consumers, accompanied by 'Coolidge like' effects where users prefer novel versus familiar partners, undermining their commitment to current partners in light of having greater choice. Thus, this thesis reported the results of six experiments on how the selection process of dating app and pornography consumers may be influenced by Coolidge like effects.

The research presented on dating apps and social perceptions of faces (Chapter 2) were based on two pre-registered hypotheses:

H1 The context of using an online dating site (thinking about accepting or rejecting people in picture slideshows) may foster an 'assessment mindset' that will reduce the attractiveness of

familiar preferred-sex faces compared to our control condition due to a greater level of choice (Finkel et al., 2012).

H2 This effect will be weaker or absent in females compared to males (i.e., 'Coolidge Effect', e.g., Little et al., 2014; Jordan & Brooks, 2010).

Using a pre-test post-test design adapted from Little and colleagues (2014), we were able to measure Coolidge like effects (preference for novel versus familiar mates) by measuring the change between the pre- and post-slideshow attractiveness ratings of the familiar face/body set and the differences in attractiveness ratings between the familiar and novel faces/bodies sets post-slideshow. For example, in Chapter 2 after the experimental slideshows, novel faces were more attractive than familiar faces regardless of slideshow content and even though we controlled for attractiveness differences between two image sets. Similarly in Chapter 3, heterosexual men were less attracted to familiar bodies post-slideshow and homosexual men were less attracted to familiar faces and bodies post-slideshow. These changes in attractiveness ratings are linked to the 'assessment mindset', where commitment might be undermined in hopes that a more optimal novel option will appear (Finkel et al., 2012), and to the Coolidge effect, where novel mates are preferred over familiar mates (Wilson et al., 1963). The main findings of this body of work will be discussed next.

Experiment 1 (Chapter 2) has two pictorial slideshow conditions (i.e., preferred sex dating images and the control image set of desserts). The results found there was no support for our pre-registered hypotheses; however, facial attractiveness differed reliably between the pre- and post-slideshow rating phases showing a preference for novelty and indicating that choosing between items in general might have a general effect on attractiveness ratings. Further results demonstrated that there was no change in attractiveness ratings of the familiar set post-slideshow from the pre-slideshow baseline ratings. However, Men rated the opposite sex faces (female face set) more attractive than same sex faces (male face set), but women did not rate the opposite (male face set) and same sex faces (female face set) differently.

Experiment 2 (Chapter 2) was adapted to improve clarity on how the dating app selection process may influence dater decisions, by only testing individuals who reported being single (not in a romantic relationship). Research also indicates that single people respond differently to new mate options compared to partnered people (e.g., Karremans et al., 2011; Little et al., 2014). The pictorial slideshow conditions were also adapted to create a choice option comparable to Iyengar and Lepper's (2000, e.g., jam jars) high-choice verse low-choice experiments. The slideshow phases were doubled to include a five-option (low-choice) and a fifteen-option (high-choice, used in the Experiment 1) of each pictorial slideshow conditions (i.e., the experimental male and female preferred sex dating slideshows and the control desserts slideshow). The results indicated that single women, but not men, were less attracted to the familiar photo set post-slideshow regardless of the slideshow content they had been presented with to think about selecting (potential dates versus potential desserts; Figure 2.1a). Women also preferred the novel face set over the familiar face set; however, this effect was stronger for the men (please refer to Figure 2.1b). Men's were also more attracted to novel and familiar faces after viewing the preferred-sex dating slideshow compared to the control condition (Dessert images), indicating that dating motivations increase men's attractiveness ratings in a general sense. Further experiments explored these effects in Chapter 2.

To make further inferences that our experimental manipulation was influencing attractiveness ratings of faces, Experiment 3 (Chapter 2) exchanged the pictorial slideshows for a one-minute wait period. The results indicated that there were no sex differences in single people's preferences for the familiar versus the novel face sets in the absences of slideshows. This suggested that the observed attractiveness ratings in the previous experiments (Experiments 1 & 2 in Chapter 2) were in response to our experimental manipulations, even though there appears to be no clear effect of slideshow content on the responses observed in our dating app experiments.

In Experiment 4 (Chapter 2), only the fifteen preferred-sex dating image sets were used (slideshow content and choice set size were not manipulated), however, there we included a new condition and a manipulation check: an Acceptance and Rejection Condition and a twenty-item Positive and Negative

Affect Schedule (Watson et al., 1988). The familiar and novel photo sets were also swapped for half the participants, following feedback from reviewers to minimize potential artefacts where results may be driven by the stimulus set and not generalizable to the wider population of faces, even though attractiveness differences between image sets were controlled for in the study design. This added context of imagining 'matching' or 'not matching' with romantic dates whom we are attracted to was designed to make the experiment more authentic to the process of selecting partners on a dating site. The Acceptance Condition stated to the participants that all their desired romantic dates were interested in them, meaning that the participant had a greater pool of dates to choose from; the Rejection Condition stated the opposite saying none were interested, meaning the participant had a lesser pool of dates to choose from. The twenty-item Positive and Negative Affect Schedule (Watson et al., 1988) confirmed that the experimental manipulation directly reduced positive affect in the intended direction, negative for not reciprocated and positive for reciprocated. When dating interest was not reciprocated, men were more attracted to the familiar face set post-slideshow than were women (please refer to Figure 3.1a). When dating interest was reciprocated, there was no difference in men and women's responses; both sexes were more attracted to the novel face set (please refer to Figure 3.1b). These results support that success on a dating app can lead to an 'assessment mindset' (Finkel et al., 2012) and Coolidge effect (Wilson et al., 1963), where novelty is preferred when large mate pools are available in hopes of a more optimal mate will appear. Although this effect may be limited to certain stages of the dating interaction such as when browsing profiles, this assessment mindset may interfere with one's ability to commit as it pulls daters towards novelty, and away from familiar mates/commitment, in hopes the next mates will be more optimal. Another modern technology has been predicted to also interfere with one's ability to commit to a partner due to a preference of novel stimuli, pornography.

In a 2012 TEDx talk, Gary Wilson claimed that the plethora of novel pornographic images is causing men to be unable to commit to a familiar in-person partner due to the Coolidge effect. Using the same experimental model as in in the previous chapter, we directly tested Gary Wilson's claims in the following chapter (3), which to our knowledge we are the first to do so. Chapter

3 examined whether novel pornographic stimuli effect a heterosexual man's attractiveness ratings of familiar and novel female faces and bodies pre and post an experimental slideshow (Experiment 5).

The second package of experiments (Chapter 3) set out to test the claim that novel pornographic stimuli create a preference for novelty in a selection context (Wilson, 2012).

Two experiments (Experiments 5 & 6) test the following pre-registered hypotheses:

H1a The pornographic (nude and visual penetration) versus clothed slideshow photos of the same female actress will reduce the attractiveness of familiar bodies on a second viewing, indicating a preference for novelty.

H1b Novel women will be perceived as more attractive than familiar women post-slideshow.

H2a These predictions will be stronger for body photo set versus faces.

H2b These predictions will be stronger depending on the image content, with higher sexual signalling having a stronger pull towards novelty (PVI verses nude verses clothed).

Using the same pre-test post-test design adapted from Little and colleagues (2014) used in the previous experimental package (Chapter 2), we were able to measure similar Coolidge like effects. The main findings of this second body of work will be discussed next.

In experiment 5 (Chapter 3) the sample comprised of heterosexual men who viewed either one of three picture slideshows all depicting the same actress set in either: clothed, nude, or visibly penetrated conditions. The pre- and post-slideshow stimuli sets depicted both female faces and bodies for the familiar and novel sets. Heterosexual men reduced their attractiveness ratings for familiar bodies but not faces post-slideshow regardless of slideshow content (please review Figure 4.1a). However, an exploratory analysis showed that the sexually arousing nude slideshow condition reduced preference for familiar bodies versus the low arousing clothed condition did not. However, rerunning

the analysis to compare the nude and clothed conditions showed the same general effect on heterosexual men's preferences; meaning, looking at attractive pornographic actresses in general reduces men's preferences for familiar bodies, i.e., independent of sexual arousal. In sum, the results do not suggest that novel women are perceived as more attractive than familiar women post-exposure to pornography, however, greater sexual arousal led heterosexual men to perceive familiar women as relatively less attractive than novel women (please review Figure 4.1b). To confirm or rule out the role of sexual arousal in moderating attractiveness ratings in this experiment, a final experiment was conducted on a sample of homosexual men.

Experiment 6 (Chapter 3) included only the clothed and nude slideshow conditions, to rule out confounds in presenting nude men and nude women to homosexual men in the PVI condition. Results showed that like the heterosexual sample, mere exposure to pornographic actresses reduced preferences for familiar women; however, heterosexual men reduced preference for familiar bodies only while homosexual men reduced preference for familiar bodies and faces. In tandem with the heterosexual sample, homosexual men were also more attracted to novel face and familiar body sets (please review Figure 5.1b). In contrast to the heterosexual sample, there were no distinctions between the novel and familiar image sets as a result of our experimental manipulation, indicating that the results in Experiment 5 may be attributed to sexual arousal among heterosexual men driving their preferences (please refer to Figure 4.1b). Comparing the two samples also showed a sexual orientation difference for time spent viewing each image before rating the pre- and post-slideshow image sets. Heterosexual men took longer to rate women's bodies compared to faces post-slideshow, homosexual took longer to rate familiar faces compared to bodies post-slideshow (please refer to Figure 5.1b). Collectively, the data points to exposure to attractive women influences attractiveness judgements of bodies, but not faces for heterosexual men, generally regardless of sexual orientation; and that sexual arousal moderates heterosexual men's perceptions of the attractiveness of familiar women relative to the attractiveness of novel women.

In sum, our experiments suggest that choice of many potential dating and/or sexual partners in online environments can influence attractiveness

judgments based on physical characteristics. People were more attracted to novel versus familiar faces when they imagined having *more choice* by virtue of thinking about matching with all prospective partners online. In this context (dating apps), gender may be a factor in different judgements and behaviours while engaging with online dating sites; women were less attracted to familiar faces after inducing an assessment mindset which was not observed in the male sample in a dating app context. Sexual orientation may also be a factor for assessing attractiveness in an online choice context. In an online pornographic context, mere exposure to attractive female pornographic actresses reduces the attractiveness of familiar female bodies from baseline. When sexual arousal is relatively high, heterosexual men perceive familiar versus novel women differently on the attractiveness dimension. Technology moderates how consumers make intimate choices regarding their dating partners and evaluations of others following exposure to pornographic material. How these choices are presented and manipulated by technology can have an impact on user experience which previous research suggests may be tied to their overall wellbeing. The next section will discuss theoretical implications.

Theoretical implications

The first package of experiments (Chapter 2) set out to answer two hypotheses: one of which is do dating websites/apps foster an 'assessment mindset'. The 'assessment mindset' is when daters pull towards novel mates instead of committing to a familiar mate in hopes the next mate will be more optimal (Finkel et al, 2012). The results from Experiments one through four support that dating websites/apps do foster an 'assessment mindset', specifically when a user is successfully gaining matches (Experiment 4). This indicates that success on a dating app could mean gaining more matches than gaining the correct match/matches. According to the research presented here, dating app consumers are responding more to the collection of matches than the actual matches themselves. Since we used the twenty-item Positive and Negative Affect Schedule, we can back up out claims of the 'assessment mindset' because our participants felt positive (rather than negative) when they had matches and preferred novelty.

However, I also hypothesize that having a high selection of matches could revert users back to the choice fatigue and overload (Scheibehenne et al., 2010) they experience during the swiping process. Research supports that exposure to a choice set where the quality and volume of options cannot be evaluated can lead to choice fatigue and overload regardless of what the item the choice set is (i.e., dating options or desserts; please see Scheibehenne et al., 2010 for a meta review). Meaning experimentally manipulating choice in a general sense can lead to altered decision outcomes. The effect is further supported in similar dating research where reciprocation was not necessary to lead to users being noncommittal. This was accounted for in another similar experiment on choice in a dating app context done by D'Angelo & Toma in 2017. D'Angelo & Toma (2017) followed the same model as Iyengar and Lepper's (2000) jam jar experiment and found support for the choice overload hypothesis and Finkel and colleagues' (2012) 'assessment mindset'. When online daters had the choice between twenty-four (High) or six (Low) potential dates, daters from the high choice set were less satisfied with their final choice and more likely to exchange their choice for another dating option one week later (D'Angelo & Toma, 2017). The work in this thesis follows suit in supporting these claims, however, our work in this thesis furthers the evidence by controlling for the person's baseline attractiveness via our pre-test post-test experiment model (Little et al., 2014). This baseline was important in establishing the change in attractiveness after interacting with a hypothetical online environment via our experimental slideshows. Looking at how an online setting changes people's attraction to familiar people from baseline and compared to novel people, we were able to develop this literature further.

The experiments in this thesis and similar research (D'Angelo & Toma, 2017) support that current choice mechanics of dating apps do not assist the user in making optimal mate choices. While technology adds a lure of convenience to its consumers, that convenience could be cutting out necessary mechanisms. For example, while users can make dating selections from a seemingly endless pool online from anywhere, they are also susceptible to choice fatigue, choice overload, and the 'assessment mindset'.

The first package of experiments (Chapter 2) also set out to answer a second hypotheses: males will be more inclined to choose novelty than women

based on the Coolidge Effect. The Coolidge Effect is when novel mates are preferred over familiar mates usually to maximize sexual and genetic fitness, this effect is also usually male dominated (e.g., Jordan & Brooke, 2010; Koukounas & Over; Little et al., 2014; Wilson et al., 1963). Some of the results of this thesis are consistent with the Coolidge effect. For example, Experiment 1 resulted in facial attractiveness differing reliably showing a preference for novelty. However, Experiment 1 did not support a sex difference, which is usually the case with the Coolidge effect. Further exploration with a single sample, Experiment 2 showed support for the sex difference in the Coolidge effect as men preferred the novel face set more than women. However, in Experiment 2 and 4, women were less attracted to familiar faces post-slideshow as they decreased their ratings from baseline; further analyses in Experiment 4 showed the sex difference was contextual to the condition where dating interest was not reciprocated. Experiment 4 did not show a sex difference for preference for the familiar face set when dating interest was reciprocated; however, in support of the Coolidge effect participants were more attracted to the novel face set when there was reciprocation. Reciprocation indicated a potentially greater selection of mates which induced a preference for novel options which by definition is consistent with the Coolidge effect. In sum, the Coolidge effect and the gender difference is contextual for dating websites/apps according to the research presented here.

Pervious research also shows similar support to our findings on unexpected gender difference regarding the Coolidge effect. Women are less likely to commit to a dating partner during a speed dating event (Fishman et al., 2006). Speed dating events present the daters on average with ten to twenty dates (e.g., Copper, 2022; McDonald, 2014; Parfitt, 2014) which is in the range of our slideshow image sets that contained fifteen images (Experiment 1, 2 high-choice, and 4). The research also points to women (Fishman et al., 2006) being more noncommittal (higher preference for novelty) than men when presented with dating options which is in line with our sex difference in Experiment 2 and 4, where women, but not men reduced preference for familiar faces from baseline. This is also in line with the results of Experiment 4, women usually see a higher success rate during speed dating events than men (Fishman et al., 2006) which like the results in Experiment 4, shows

reciprocation and success in a dating context can lead to an ‘assessment mindset’ for a preference for novelty (Finkel et al., 2012).

The results of Chapter 2 indicate that success on dating apps influences daters to be more selective, meaning they might say no and swipe more. People are more attracted to novel faces than they are attracted to familiar faces when romantic interest is reciprocated. Differences in attractiveness judgements moderated by technology may nudge people towards or away from certain decisions or underpin romantic outcomes when using online platforms to find a romantic partner. While being selective can be a good thing, holding out for a better mate in terms of the ‘assessment mindset’ means the effort from users is going more into swiping and less into selecting. We found no evidence that men are less attracted to the same person after activating an experimental choice context, while women tend to be less attracted to the same person after activating an experimental choice context. Context was the main moderator of the Coolidge effect in this and in previous studies, showing a more nuanced effect with technology and gender disparities or lack thereof. In sum, our findings in Chapter 2 suggest that choice alters social and romantic attraction to others, which may be relevant in the design of and experience with online dating sites.

Further theories presented in a 2012 popular TEDx talk have hypothesised that the Coolidge effect is present in human males who view pornography, where the plethora of novel erotic stimuli leads men to prefer novel mates, which like the ‘assessment mindset’ in dating apps may interfere with their ability to commit to a single partner (‘The great porn experiment’, Wilson, 2012). We were able to directly test Wilson’s (2012) claims in Chapter 3.

The results of Chapter 3 are consistent with the Coolidge effect in some respects. For example, greater sexual arousal reduced the difference between familiar and novel women on the attractiveness dimension. However, the results do not demonstrate that novel women are perceived as more attractive than familiar women post-exposure to pornography and heterosexual men did not reduce their attractiveness ratings for familiar faces post-slideshow regardless of slideshow content. Previous research in social perception suggests that faces have a greater influence in attractiveness judgements than

bodies do (e.g., Currie & Little, 2009; Furnham et al., 2001); meaning that while Chapter 3 supports that heterosexual men reduced their attractiveness ratings for familiar bodies, they did not reduced their attractiveness ratings for familiar faces post-slideshow regardless of slideshow content. This suggests that pornography exposure is unlikely to alter men's attractiveness judgements of the same woman.

Chapter 3's results further explored the Coolidge effects in men as a possible response to online pornography by examining the attractiveness ratings among a sample of homosexual men to confirm or rule out the role of sexual arousal in attractiveness judgements of familiar versus novel women following exposure to pornographic content. Like the heterosexual sample, mere exposure to pornographic actresses reduced preferences for familiar women and homosexual men were also more attracted to novel face and familiar body sets. These similar results across sexual orientation lend support to theories of mere visual exposure on subsequent body perception (e.g., Stephen & Perera, 2014; Sturman et al., 2017), rather than sexual arousal. However, although mere exposure to pornographic actresses moderated both heterosexual and homosexual men's preferences for familiar versus novel women in the same manner, preferences for familiar versus novel women were moderated by the content of our slideshows (more- versus less-arousing) among heterosexual men only. The results also support that greater sexual arousal induced by internet pornography reduces the perceived distinction between familiar versus novel women on the attractiveness dimension as slideshow content moderated heterosexual men's, but not homosexual men's, attractiveness ratings.

In sum, although these findings provide some support that exposure to pornography generates 'Coolidge-like' effects in heterosexual men (Kokounas & Over, 2000; Little et al., 2014), our data suggest that these effects are much more nuanced than claimed by Wilson in his highly viewed TEDx talk. For example, our research demonstrates that mere visual exposure to attractive women moderates attractiveness perceptions of bodies more generally. However, pornographic content moderates sexual arousal in heterosexual men's attractiveness judgments for familiar versus novel women, at least in the short-term.

Our research supports the Coolidge effect with certain nuances in various contexts. Chapter 2 support that choosing between options in general and being successful on dating apps (more choice via people reciprocating your interest in them) influences men and women to prefer novel people which is consistent with the Coolidge effect (Wilson et al., 1963) and Finkel and colleagues (2012) 'assessment mindset'. Chapter 3, show some support for the Coolidge effect in heterosexual male pornography viewing, however, sexual arousal and orientation only accounted for some effects of novelty preferences; mere exposure to pornographic actresses also accounted for some influence on novel and familiar preference regardless of sexual orientation. The next section will discuss directions for future research.

Directions for future research

Dating apps and older age groups. This body of research could be developed by looking at other demographic characteristics. The experiments in the dating chapter (2) included ages where dating app use is particularly common (18–29-year-olds: 48%, 30-49: 38%, 50-64: 19%, and 65+: 13%; Anderson et al., 2020). However, older daters are one of the populations that could receive the greatest benefit from dating apps, as in-person access is more limited offline compared to younger daters due to limited options to find single people in their current social networks (e.g., Lever et al., 2008; Rosenfeld & Thomas, 2012). Exploring how different age groups form relationships through modern technology could give users and developers insight that could help bridge social capital. Especially, since loneliness in older populations has been an important topic in recent years (e.g., CDC, 2021; Lee & Ishii-Kuntz, 1987; NHS, 2018). I hypothesize that older age groups will lean more towards familiarity than younger age groups at first, but as they adapt to technology they will be in line with the younger age groups' preference for novelty.

Social apps and younger age groups. A social media experiment was setup on adolescents that was pilot tested, but due to the school partner not being available, we were unable to pursue this project further following setup. Expanding the social app selection research to younger individuals would also

be ideal, as technology users are as young as pre-school age (Genc, 2014). Social selections and habits online are being established during childhood and adolescence (Wilmer et al., 2017), insight into how these habits are formed could help users of all ages adapt to socializing better in an online environment. Also, younger groups' internet usage and social habits are some of the biggest concerns for parents (e.g., Guan & Subrahmanyam, 2009; Liau, et al., 2008; Twenge et al., 2018), future research in this area could help them understand how to guide their children appropriately online. I hypothesize that younger age groups will lean more towards novelty than older age groups as they are more in tuned with technology and its influence than older age groups.

Dating apps and non-binary. The experiments presented in this thesis were binary with gender and sexuality. While heterosexual and homosexual participants and male and female participants were included in this package of experiments, other genders and sexuality were not represented. It should be noted that sexuality and gender were given to the researchers by the participants' preferences; however, only preferences that were binary were used. Non-heterosexual users are more likely to use dating apps (non-heterosexual 55%, heterosexual: 28%; Anderson et al., 2020; Sumter & Vandenbosch, 2019) and could benefit from research that is specific to their gender and sexual preferences. Diversity in research also helps to create a more through and in-depth picture of the breath of the field of research. I hypothesize that all sexualities and genders will have similar responses to novelty as this research. However, non-binary sexuality and genders do have smaller dating pools and different dating standards than the mainstream binary. Meaning, I would not be surprised if there were variations in novelty and familiarity preferences in non-binary groups.

Pornography mediums, and gender. Different genders have been shown to respond differently to different pornography mediums, with men preferring visual pornography and women preferring written erotica (Ogas & Gaddam, 2011). Research has also supported that visual mediums of pornography may have different arousal rates, such as VR being more arousing than 2D scenes for men, but not women, another gender difference (Elsey et al., 2019). Using

different pornography mediums and gender samples with Little and colleagues (2014) experimental design would give a broader insight to how pornography influences the attractiveness of novel and familiar preferences of faces and bodies. I hypothesize that textual pornography users would lean more towards familiarity as textual pornography usually builds characters and relationships to a higher degree than visual pornography. Since women prefer written erotica more than men, I would expect the usual gender difference in the Coolidge effect would also hold up. In terms of VR, I would expect the opposite to written erotica users (preference for novelty), as it is more visual and more male dominated.

Pornography stimuli: various attractiveness levels. Research has suggested that manipulating the attractiveness of the experimental slideshow pornography actors/actresses and measuring the participant's own attractiveness could examine if the results from this thesis generalize over a broad range of attractiveness (Hald & Štulhofer, 2016). This information could help characterize different pornography preferences and content such as "amateur" or "girl next door" which are meant to represent more normal people versus professional pornography actors (Hald & Štulhofer, 2016). The results could represent how different attraction levels may alter one's preferences for novelty and familiarity as well as attraction ratings in general. I hypothesize that higher status individuals (e.g. more mainstream attractive or famous pornographic actresses) will influence participants to prefer novelty. Based on Experiment 4, having success with a higher status individuals could make participants feel they are succeeding more in the dating market which we supported makes individuals prefer novelty.

Pornography stimuli: immersion/dynamism condition. Adding immersion/dynamism to the pornography research could match the styles of interactive pornography, such as OnlyFans which is a popular pornography platform for consumers who pay for pornography (e.g., Boseley, 2020; Frishberg, 2021; Statista Research Department, 2022b; Statista Research Department, 2022c). OnlyFans is interactive as users pay to communicate with the actresses through text, voice, or by requesting the actress create bespoke

acts and pornography for the users. Users may also interact with these actresses regularly to the point of familiarly where the actress will know their name and preferences. Finding out more of how users select and interact with less mainstream or paid pornography means would be useful for understanding consumers and aid developers and actors. The interaction may also increase familiarity and possibility attraction, which would be important addition to how sexual stimuli influences novelty and familiarity preferences. I hypothesize that interactive users will lean more towards familiarity, because like textual erotica users, interactive pornography builds more character and relationship than mainstream visual pornography.

Other selection criteria. As our reciprocal condition had an influence on the attractiveness ratings in the post-slideshow condition, other factors might also have an influence as well. According to Finkel and colleagues (2012) computer mediated conversation is beneficial up to a certain point. Researching how different communication prompts and initiations lead to an in-person meeting could give valuable insight into how consumers are appearing and what is more effective. Adding an in-person component to the dating app selection could also be beneficial, as the main obstacle from transitioning from computer-based communication and in-person meeting is over expectations. Exploring how the selection process holds up with the furthering of the relationship would be useful for consumers and developers. I hypothesize that adding other aspects to the dating process will create more novel experiences with mates the users are becoming more familiar with. It will also add to the information a user has to process in their selection process for each mate. New information about daters should be exciting enough for the users to lean into the familiar mates. However, based on Experiment 4, I hypothesize that the commitment a dater will have towards their matches will depend on how successful they are in a dating context. The more successful a dater is the more novelty they prefer.

Personally familiar stimuli. Assessing different levels of familiarity on familiarity and novelty preference would also be a valuable direction for this research. Stimuli could be taken from famous familiar people of various attractiveness, or there is also the possibility to show photos at different exposure rates, such as

three times instead of two for the familiar face set, or by manipulating the extent of similarity of facial features between the novel and familiar face sets. I hypothesize that increasing familiarity without novel options will pull users towards liking familiarity, even if it is just mere exposure effect. However, the more novelty is showcased, by increasing familiarity and then introducing novelty or creating more novel facial features, the participants will pull towards novelty. As this would be a textbook experiment of the Coolidge effect.

Conclusion

This thesis suggests that that the choice facilitated via online environments may alter both social and romantic attraction to others, which may be relevant in the design of, and experience with, online dating sites and internet pornography. The work presented here suggests differences in attractiveness judgements moderated by technology may nudge people towards or away from certain decisions or underpin romantic outcomes when using online platforms to find a romantic partner. Moreover, some of the central findings of this thesis are consistent with 'Coolidge-like' effects in humans (Little et al., 2014) and Finkel and colleagues 'assessment mindset' induced via online dating platforms. This thesis also suggests that mere exposure to pornographic actresses directly reduces the attractiveness of familiar bodies on second viewing, independent of men's sexual orientation. These findings provide some support that exposure to pornography generates 'Coolidge-like' effects in heterosexual men (Kokounas & Over, 2000; Little et al., 2014), however, much more nuanced than claimed by Wilson (2012) in his highly viewed TEDx talk.

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Appendices

Appendix A.1: Open Science Framework (OSF) project link for Experiments 1, 2, 3, & 4 (Chapter 2): https://osf.io/xs74r/

Appendix A.2: Open Science Framework (OSF) direct link to data for Experiments 1, 2, 3, & 4 (Chapter 2): https://osf.io/xs74r/files/osfstorage

Appendix B: Open Science Framework (OSF) project link for Experiments 5 & 6 (Chapters 3): https://osf.io/3yr7k/

Appendix C: Ethical Approval for Experiments 1 – 4 (Chapter 2)

Research Ethics application 'Modern technology, choice and romantic attraction'
Abertay Ethics System <abertayethics@sutherland.pw>
Mon 10/30/2017 4:55 PM
To:

- JORDAN SCULLEY [redacted]

This application has been granted full approval. The standard research conditions apply.
--

Appendix D: Ethical Approval for Experiment 5 (Chapter 3)

Name: Jordan Rae Sculley

Project Title: Modern technology and social responses to novelty in bodies

Reference: EMS994

Status: Full Approval

Approval Date: 07.01.19

The Standard Conditions below apply to all approved student Research Ethics applications:

i. If any substantive changes to the proposed project are made, a new ethical approval application must be submitted to the Committee.
ii. The Proposer must remain in regular contact with the project supervisor.
iii. The Supervisor must see a copy of all materials and procedures prior to commencing data collection.
iv. Any changes to the agreed procedures must be negotiated with the project supervisor.

Appendix E: Ethical Approval for Experiment 6 (Chapter 3)

Name: Jordan Rae Sculley

Project Title: Modern technology and social responses to novelty in bodies

Reference: EMS2438

Status: Full Approval

Approval Date: 11.12.19

The Standard Conditions below apply to all approved student Research Ethics applications:

i. If any substantive changes to the proposed project are made, a new ethical approval application must be submitted to the Committee.
ii. The Proposer must remain in regular contact with the project supervisor.
iii. The Supervisor must see a copy of all materials and procedures prior to commencing data collection.
iv. Any changes to the agreed procedures must be negotiated with the project supervisor.

Abertay University

GDPR Data Management

Data Sign Off Form

For undergraduate or postgraduate student projects supervised by an Abertay staff member.

This form MUST be included in the student's thesis/dissertation. Note that failure to do this will mean that the student's project cannot be assessed/examined.

Part 1: Supervisors to Complete

By signing this form, you are confirming that you have checked and verified your student's data according to the criteria stated below (e.g., raw data, completed questionnaires, superlab/Eprime output, transcriptions etc.)

Student Name:	Jordan Sculley		
Student Number:	[redacted]		
Lead Supervisor Name:	Dr Christopher Watkins		
Lead Supervisor Signature	[redacted]		
Project title:	Modern technological environments and individual differences in attractiveness perceptions from physical characteristics.		
Study route:	PhD ☑	MbR ☐	MPhil ☐
	Undergraduate ☐	Postgraduate taught ☐	PhD by Publication ☐

Part 2: Student to Complete

	Initial here to confirm 'Yes'
I confirm that I have handed over all manual records from my research project (e.g., consent forms, transcripts) to my supervisor for archiving/storage	Yes
I confirm that I have handed over all digital records from my research project (e.g., recordings, data files) to my supervisor for archiving/storage	Yes
I confirm that I no longer hold any digital records from my research project on any device other than the university network and the only data that I may retain is a copy of an anonymised data file(s) from my research	Yes
I understand that, for undergraduate projects, my supervisor may delete manual/digital records of data if there is no foreseeable use for that data (with the exception of consent forms, which should be retained for 10 years)	Yes

Student signature: [redacted]

Date: 28/03/2023