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Investigating the Use of Simulation as a Sex Education Intervention: The Influence of Perceived Attractiveness on Condom Use Intentions

by

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ABSTRACT

DEPARTMENT OF ELECTRONICS AND COMPUTER SCIENCE

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Sexually transmitted infections (STIs) are ongoing concerns. The best method for preventing the transmission of these infections is the correct and consistent use of condoms. The main aim of this thesis was to investigate the use of serious games and computer simulations for sexual health issues and, in particular, to explore the use of simulations to access and influence attitudes to sexual behaviour and risk. Judgements of attractiveness have previously been shown to influence the character of social interactions. This thesis sought to better understand the relationship between perceived attractiveness, perceived sexual health status and condom use intentions in both heterosexual male and heterosexual female populations. Both samples' perceptions of attractiveness influenced their condom use intentions. In particular, the more attractive a partner was judged to be on average, the more likely participants would be willing to have sex with them and the less likely they were to intend to use a condom during sex. Therefore, this work suggests that such risk biases should be incorporated into sexual health education programmes and condom use interventions. Few studies have explored the use of computer games in interventions for increasing condom use by challenging the false sense of security associated with judging the presence of an STI based on attractiveness. The studies reported in this thesis extend the literature by investigating the potential of computer simulations in serious games for sex education. Engaging in the simulations and games developed for this research had an impact on participants' confidence in evaluating sexual risks. The interventions' efficacy was associated with individual propensity for sexual sensation seeking and sexual excitation seeking. Moreover, the findings of this research work indicate that computer simulations could be an effective sex education intervention, in reducing the barriers to condom use.

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Nomenclature

$3D$ Three Dimensional
ABM Agent Based Model
BMJ British Medical Journal
CBS Condoms Barrier Scale
df degrees of freedom
$fMRI$ functional Magnetic Resonance Imaging
$FTFI$ Face to Face Interviews
$GLMM$ Generalised Linear Mixed Model
HBM Health Belief Model
HIV Human Immunodeficiency Virus
$JMIR$ Journal of Medical Internet Research
MSM Men who have Sex with Men
MSW Men who have Sex with Women
NHS National Health Services
ns not significant
RMP Research Mobility Programme
SAQ Self-completion anonymous questionnaires
SES Sexual Excitation Scale
SF Short Form
SI Sexual Inhibition
SIS Sexual Inhibition Scale
SS Sensation Seeking
SSS Sexual Sensation Seeking
SD Standard Deviation
STD Sexually Transmitted Disease
STI Sexually Transmitted Infection
UWA University of Western Australia
VR Virtual Reality
WSM Women who have Sex with Men

Chapter 1

Introduction

The main aim of the interdisciplinary research described in this thesis was to investigate the use of serious games and computer simulations for public health issues and, in particular, to explore the use of simulations to access and influence attitudes to sexual behaviour and risk. Subsidiary questions through which I explored this were whether the perceived attractiveness of an individual is regarded as being a reliable signal of their sexual health status and, more specifically, whether people use this signal when they have to make a decision about whether they will use a condom when engaging in sexual intercourse.

The reason I chose to develop simulations and serious games as part of this PhD is because they offer enormous potential for young people's sex education, a generation very familiar with computer and video game playing. Simulation models could give young people the potential to engage with a simulated world of people and their sexual interactions within which they can come to better understand the ramifications of their risk-taking sexual behaviour. The implications of risky sexual behaviour are hard for people to understand because this behaviour takes place in a complicated network of interacting people. By using a simulation of this setting, we aimed to enable users and practitioners to gain insights into the implications of risky sexual behaviour. As this network of interactions is an example of a complex system, it is hard for people to intuitively understand and therefore, simulations can help them in achieving a better understanding of the implications of risky sexual behaviour.

Further discussion on serious games is included in Chapter 2, that also discusses attractiveness, sexual health issues and sex research methodologies. Chapter 3 discusses the first steps towards building a simulation of STI spread in a sexual population. The main aim of the study described in Chapter 3 was to get familiar with the new concepts and methodologies (Health Psychology and Gaming), as at the time they were completely new areas for me.

Chapters 4 and 5 present work carried out on attractiveness and condom use decisions. This work received big media and academic impact. Researchers have contacted me with comments and questions and a few have already tried to replicate it. Thousands of people posted and contacted us with interesting and important information regarding their own sexual behaviours and strategies, which was a result of their self-reflections from our published material.

Chapter 6 explains the work carried out on the design and implementation of the simulation which was used for the serious game in our second simulation experiment and chapter 7 presents a comparison study between an improved simulation intervention and three other conditions. Chapter 8 provides a summary and a discussion of these studies, acknowledges limitations and makes suggestions for further development in this field.

The interdisciplinary research work carried out for the current thesis has effectively linked Computer Science and Healthcare. Chapter 4 was published in BMJ Open, which is a medical journal, chapter 5 was also submited in BMJ Open (received minor corrections, has been reviewed and resubmitted in January 2018), chapter 6 was published in JMIR Serious Games, which is a journal on gaming and chapter 7 was submitted in Computers in Human Behavior, which is a journal dedicated to examining the use of computers from a psychological perspective. Additionally, the work was presented in various national and international conferences, in particular:

- The Society for the Scientific Study of Sexuality Annual Meeting, Atlanta, United States, November 2017. (Chapter 7)
- Canadian Sex Research Forum Annual Meeting, Quebec City, Canada, September 2016 (Chapter 6)
- The Society for the Scientific Study of Sexuality Annual Meeting, New Mexico, United States, November 2015 (Chapter 4)
- Student Conference on Complexity Science, Granada, Spain September 2015 (Chapter 4)
- Student Conference on Complexity Sciences, Brighton, United Kingdom, August 2014 (Chapter 3)

Finally, I received the Research Mobility Program (RMP) award for a research visit in the University of Western Australia, where I spent a month (October 2014) working with Professor Leigh Simmons (Director/ARC Professorial Fellow in the Centre for Evolutionary Biology) and I presented my research work (Chapter 3) in the Computer Science, Psychology and Biology departments of UWA.

The key contributions of this thesis are:

- Better understanding of the relationship between perceived attractiveness, perceived sexual health status and condom use intentions in a heterosexual male population. Male perceptions of attractiveness influence their condom use intentions; such risk biases could profitably be discussed during sex education sessions and in condom use promotion interventions. (Chapter 4)

- Exploration of the relationships between perceived attractiveness, perceived sexual health status, condom use intentions and condom use resistance in women. Women's perceptions of men's attractiveness influence their condom use intentions; such risk biases should be incorporated into sexual health education programmes and condom use interventions. (Chapter 5)

- Investigation of the potential use of serious games for sex education. Engaging in the Term on the Tides game had an impact on participants' confidence in evaluating sexual risks. (Chapter 6)

- Better understanding of the potential of computer simulations for sex education. Computer simulations could be an effective sex education intervention that reduces the barriers to condom use. The interventions' efficiency was associated with individual propensity for sexual sensation seeking and sexual excitation seeking. (Chapter 7)

Chapter 2

Review of the Relevant Literature

This thesis intended to use computer science in order to address a sexual health issue. Therefore, the tasks were designed and implemented in such a way that the issue was identified, well understood and defined, the proposed solutions were thoroughly investigated and new ideas and suggestions were illustrated.

Discussions with senior researchers in the area of sexual health and the review of the previous literature presented in this section, pointed in the same direction; one of the major problems that young people still face is contracting STIs, mainly because they fail to judge the risks that they take during sexual encounters. Hence, the challenge was to find the best way to apply what is currently known in computer science to tackle this problem and to ascertain what tools we could further develop to assist towards this direction.

This investigation started by isolating one factor that causes inaccurate judgements of sexual health risk; perceived attractiveness. Therefore, this literature review is presented in four sections; the first discusses the association between perceived attractiveness and perceived health status, the methodological issues in this area of research and comments on the effectiveness of some current sex education interventions. The second presents serious games and simulation. In the third section, the opportunities for serious game simulations to contribute to sex education are explored and finally, the research questions of the thesis are introduced.

2.1 Attractiveness and Sexual Health

2.1.1 The Concept of Attractiveness

Physical attractiveness has been the subject of extensive research in the human behavioural sciences as it dramatically influences the social experience [Scott et al. (2013)],

especially mate choice [Valentine et al. (2014)]. The impressions that a person's appearance makes can strongly influence their interaction with the social environment. For example, studies have shown that accurate judgments of unfaithfulness (sexual trustworthiness, cheating) can be made on the basis of perceived attractiveness alone, without considering any behavioural cues [Buckingham et al. (2006); Rhodes et al. (2013)].

Several studies have examined the correlation between facial *symmetry* and attractiveness [Perrett et al. (1999); Scheib et al. (1999)]. Symmetry is believed to reflect health [Peters et al. (2007)]. Although symmetry appears to positively affect facial attractiveness [Scheib et al. (1999)], the magnitude of this effect is not generally agreed [Thornhill and Gangestad (1999); Lewis (2017)], as some studies found that asymmetry sometimes is preferred when the face exhibits a healthy status and has signals of *immunocompetence* (i.e., having a strong immune response).

Also, according to Little et al. [Little et al. (2014)], men tend to prefer novel faces, whereas women prefer familiar ones. These researchers examined sex differences in preferences for familiarity by exposing 83 women and 63 men to the same faces twice. They found that faces were judged as more attractive on the second rating by women and less attractive by men. In another study by the same group [DeBruine et al. (2008)], women's attraction to faces was positively related to self-rated similarity to their current partner's face, while the effect was significantly weaker for men. The authors' explanation of this phenomenon is that men tend to pursue more partners than women, as this dramatically increases their reproductive success, whilst women do not have the need to do so as they can be inseminated by only one man at a time.

Another theory suggests that faces are perceived as attractive when their configuration approximates the mathematical average facial configuration of the population [Trujillo et al. (2014)]. Hence, faces that deviate from this average configuration are perceived as relatively unattractive. It is claimed that this preference for mathematical *averageness* is common across cultures [Apicella et al. (2007)]. Studies suggest that the averageness of a face is both a necessary and sufficient condition to determine facial attractiveness [Langlois et al. (1994)].

As mentioned above, a number of traits have been proposed as being important in human mate choice and have been extensively independently analysed in order to explain why they have survived evolution. Currie and Little [Currie and Little (2009)] presented a study on the combination of these traits and their relative contribution to physical attractiveness. In one study they experimentally observed how the integration of traits such as symmetry, waist-to-hip ratio, body fat, etc., produced real mate choice behaviour. The study involved 127 men and 133 women, who were shown pictures of ten people of the opposite sex and rated them for their attractiveness for both a potential short-term relationship and a long-term relationship. Participants had to rate pictures of the face and the body independently. Finally, they were asked to rate the combined

pictures. For both genders and relationship types, face ratings were found to be the best predictor of the ratings of combined images. Men tended to rely more on female body ratings for short term relationships than long-term relationships but women showed no significant difference between ratings in the short and long-term conditions [Currie and Little (2009)].

Peters et al. [Peters et al. (2007)] addressed an important issue in their studies. They identified the fact that, if there is an interaction between facial and bodily attractiveness, faces and bodies cannot meaningfully be studied separately. Therefore, to ensure that previous results of mate choice studies based on only either face or body attractiveness were valid, they conducted the following experiment. Male and female participants were asked to rate opposite-sex, full-body photographs for overall attractiveness and were also asked to provide separate face and body ratings [Rhodes et al. (2005)]. The interaction between face and body attractiveness did not predict overall attractiveness and both made independent contributions to overall attractiveness [Peters et al. (2007)].

As this literature review focuses on the association between perceived attractiveness and sexual health it is worth discussing first how general health status is related to attractiveness. The following subsection explores relevant work in this area.

2.1.2 The Association between Perceived Attractiveness and Perceived General Health

Attractiveness can provide important information about characteristics that men and women value in a potential mating partner, such as their health and reproductive value [Maestripieri et al. (2014)]. Attractiveness itself is a component of reproductive value if it is heritable, as there is selection for raising attractive offspring who will find it easier to secure a mate.

According to Miller [Miller and Todd (1998)], sexual cues are signals of health and phenotypic quality that play an important role during mating. For example, a lower waist-to-hip ratio in women seems to be attractive to men. The suggested reason for this is that it indicates good hormonal levels and health. Women who are sexually immature, obese, post-menopausal, pregnant etc., have higher waist-to-hip ratio and are least preferred by men. Additionally, male sex hormones produce wider jaws, cheekbones and noses [Grammer and Thornhill (1994)]. Hence, these characteristics and many more used in Miller's study (such as height and facial averageness) are considered attractive, as they constitute hormonal balance and health indicators.

Leivers et al. [Leivers et al. (2014)] examined whether men's own phenotypic traits and female attractiveness together influence semen quality. Eighty-one heterosexual male participants collected semen samples while viewing images of highly attractive women and women with low attractiveness ratings. Both the male and female phenotypes

(attractiveness) interacted to influence semen quality in men. Highly attractive males produced better quality semen than less attractive men when responding to pictures of highly attractive women. This supports previous evidence that shows higher male investment in ejaculate quality when they mate with attractive women [Delbarco-Trillo (2011); Kelly and Jennions (2011)].

Rupp et al. [Rupp et al. (2009a)] used fMRI to measure the brain activity of twelve single heterosexual women, between 23-28 years old who were not using any hormonal contraception, while they viewed photos of men's faces. Stimuli were shown together with information regarding the potential risk of each man as a sexual partner in the form of the number of sexual partners and the frequency of condom use. Participants indicated their sexual preference towards low risk men compared with high risk men. In a similar study [Rupp et al. (2009b)] from the same research group, the twelve aforementioned female participants perceived masculinised faces to be both riskier and more attractive than feminised faces.

Evidence indicates that people not only believe they are able to recognise risky situations and avoid STIs [Bandura (1990); Poppen and Reisen (1997)] but also that they hold stereotypical beliefs about who is most likely to be infected with STIs. In particular, if the image of a sexual partner is not consistent with the image of someone who is infected with an STI, the possibility that the partner could be infected may be underestimated [Van der Pligt (1996)]. Implicit personality theories suggest that a set of assumptions or beliefs held by an individual about the characteristics of a person indicate whether the person is infected with an STI [Clark et al. (1996); Gold and Skinner (1996)] and often people tend to rely on these to evaluate risk. For example, a person met in a club may be judged to be more likely to be infected with an STI than someone met at a family dinner, or a person appearing to be fit and healthy might be assumed to not be infected with an STI. Additionally, people tend to believe that it is possible to evaluate a partner's level of STI risk based on their visible or inferred personal characteristics, such as appearance, education, and occupation, or the type of relationship that they have with that partner (such as short/long term, hooking-up, exclusive, open) [Pulerwitz et al. (2002)]. Perceived attractiveness has also been shown to induce good mood [Kenrick et al. (1993)] which encourages reliance on the use of stereotypes when forming impressions and condom use strategies [Park and Banaji (2000)].

2.1.3 Methodological Issues in Sexuality Research

Other than the rare laboratory studies in which sexual behaviour is directly observed by the researcher, sexuality research relies heavily on self-reported sexual behaviour [Catania et al. (1990a); Brener et al. (2003)]. This section focuses on some of the methodological challenges associated with self-report data.

First, as sex is a highly private activity, participants in studies have to overcome their fear of embarrassment in order to reveal to a stranger their sex-related thoughts, feelings, ideas, experiences and issues [Herold and Way (1988); Brener et al. (2003)]. Therefore, concerns are raised regarding the validity of such self-reported data. Evidence of people's negative attitudes towards revealing details about their sexual lives has been presented in the past [Catania et al. (1990b); Brener et al. (2003)]. However, Wiederman [Wiederman (1999)], in his study of volunteer bias in sexuality research, reported only discomfort in a minority of the participants, even though the content of the study was unknown to them before the session. Discomfort was unrelated to gender.

Another issue concerns over- or under-reporting of sexual activity by participants. This can happen for various reasons. For example, individuals in a relationship report different frequencies of sexual activity with their partner depending on their levels of sexual satisfaction [Catania et al. (1990a)]. Sexually satisfied partners report higher levels of activity than their less satisfied partner [Clark and Wallin (1964)]. Moreover, young men often have a tendency to over-report their sexual experiences as this can be an indication of their sexual power and/or value [Marsiglio (1988); Catania et al. (1990a); Papadopoulos (2010)]. Similarly, young women may under-report [Schroder et al. (2003)], as people are often more accepting of certain sexual behaviour (e.g. casual sex) for men than for women (sexual double standard) [Sprecher et al. (2013)]. In other words, reporting bias in sex research may occur due to social desirability [Catania et al. (1990a); Tourangeau and Yan (2007)] as participants tend to give responses that are socially acceptable within their peer and social groups.

In order for participants to feel more comfortable reporting their sexual experiences, methods such as self-completion anonymous questionnaires (SAQ), telephone interviews or computer assisted interviews may be better than face to face interviews (FTFI) [Fenton et al. (2001); Jiang et al. (2006); Nguyen et al. (2012)]. On the other hand, FTFIs minimise non-responding and enable explanation of unfamiliar terms and clarification of questions [Weinhardt et al. (1998)]. Although telephone interviews can provide more privacy than FTFIs, some high risk people are homeless or transient and they cannot be reached by phone [Weinhardt et al. (1998)]. Durant [Durant et al. (2002)] investigated the difference between "anonymous" and "confidential" data collection. Participants in the anonymous condition did not provide any personal information, whilst participants in the confidential condition were asked to provide their name and date of birth, although they were assured of confidentiality. The results suggested the benefits of anonymity; all dropouts and the majority of nonresponses occurred in the confidential condition [Schroder et al. (2003)].

However, even when participants in studies are willing to be honest and accurate, they may fail to do so due to the difficulty of recalling details about their sexual activity [Catania et al. (1990a); Fenton et al. (2001)]. Memory accuracy can be influenced

by the "complexity" of the individual's sexual life. In other words, people in long-term monogamous relationships can potentially find it easier to recall certain sexual details than people who engage in sexual activities with multiple partners [Catania et al. (1990a); Fenton et al. (2001)]. Moreover, memory errors are affected by the length of the reference interval and also by the frequency of the sexual behaviour in question e.g., activity that may occur infrequently (such as anal intercourse) compared with more frequent activities (such as penile-vaginal intercourse) [Graham et al. (2003)]. For this reason, in studies relying on retrospective reports researchers often justify intervals of up to three months (when self-administered questionnaires are used) as intervals longer than that lead to a decline in accuracy [Wiederman (1999); Schroder et al. (2003)]. This issue can be resolved with the use of diaries from the participants, in which they record the sexual activity in question for a specified time (depending on the specific interests of the study) [Leigh et al. (1998); Graham et al. (2003)]. However, this method requires considerably more commitment and effort from the participant [Weinhardt et al. (1998)].

Low literacy is another issue for sexual health research, especially in high-risk populations in which STI transmission is more common [Schroder et al. (2003)]. Therefore, the assessment method should be adapted accordingly, in order to reduce errors due to misunderstandings and uncertainty. Good examples of assessments for low-literacy populations are the audio-presentations of the research questions; however, if these are administered by an interviewer rather than audio-assisted, this would make participants no longer anonymous [Weinhardt et al. (1998); Schroder et al. (2003)].

The next section focuses on possible sex education interventions.

2.1.4 Sex Education and Sexual Health Interventions

More than one million sexually transmitted infections are acquired every day worldwide [WHO (2016)]. The best method for preventing the spread of these infections is the correct and consistent use of a condom [Jemmott et al. (1992); Holmes et al. (2004)]. However, people, especially young people [Cooper (2002); Chanakira et al. (2014)], are engaging in risky sexual behaviours such as having sex with multiple partners, having condomless sex, or using condoms incorrectly or inconsistently [Crosby et al. (2005); Baxter et al. (2011)]. For this reason, there are several strategies and intervention programs in place to encourage consistent and correct condom use and safer sexual behaviours.

There are two main categories of intervention programs used by various different countries over the last few decades: comprehensive sex education programs that include information about the benefits and consequences of sex, STIs and contraception to abstinence-only programs that attempt to delay sexual debut. Abstinence-only messages teach that sex should be delayed until marriage, abstinence is the only morally

correct option and acceptable behaviour, and discussion of contraception methods is typically limited to statements about ineffectiveness [Kohler et al. (2008)]. On the other hand, comprehensive programs include abstinence messages (such as abstinence being the best method for avoiding STIs), but also provide information on contraception methods to prevent pregnancy, condoms to prevent STIs and information on a variety of sexuality related topics (such as sexual expression, human development, relationships etc.) [Kohler et al. (2008)].

There is a concern amongst some people that sex education programs will encourage teenagers to start engaging in sexual activities earlier. Cohen et al. [Cohen et al. (2012)] and Kirby et al. [Kirby (2001)], however, provided evidence that this fear is not justified; their studies revealed that teenagers who participated in sex education programs did not have earlier onset of sexual activity. Some parents reported that they believed that sex education programs should start early at school and give age-appropriate information to the students, such as differences in male and female bodies, sexual assault and the correct names for genitalia [Cohen et al. (2012)]. As students progress from primary school to secondary school, their sex education should develop more and give them more information, based on the foundation they have received earlier on. In support of this, Ku et al. [Ku et al. (1992)] found that adolescents who received sex education had adopted a safer sexual behaviour such as more frequent condom use and fewer sexual partners. Similarly, Jemmott et al. [Jemmott et al. (1992)] found in their studies that those adolescents who received a sexual risk reduction intervention reported engaging in less risky sexual behaviour after the intervention, than those who received the control intervention.

Research by Kantor et al., [Kantor et al. (2008)] shows that abstinence programs not only raise concerns about human rights, as they give very limited information on contraception and STD prevention, but they do not reduce sexual activity in adolescents. Furthermore, fewer young people report using a reliable contraceptive method after they have received abstinence-only education. Previous studies have suggested that abstinence-only programs could give rise to serious sexual health problems [Santelli et al. (2006); Kantor et al. (2008); Kohler et al. (2008)]. Similarly, virginity pledges that encourage adolescents to make pledges to remain virgins until marriage, have been shown to be largely ineffective in preventing STI acquisition [Bruckner and Bearman (2005)]. One reason for this is that virginity is very often culturally associated only with vaginal sex and, consequently, pledgers tend to engage in other risky sexual activities such as oral or anal sex (mostly without a condom) [Bruckner and Bearman (2005); Bearman and Bruckner (2001)].

But what makes an effective sex education program? Kirby et. al [Kirby (2001)] suggested that ineffective sex education programs are generally too broad and are unfocused. On the other hand, effective programs focused on key issues such as contraception, information on risks and how to avoid them through experimental activities, acknowledged

the social and media influences and practiced negotiation skills. Kirby et al. [Kirby et al. (2007)] noted that it is important for sex education programs to meet the needs of the audience taking into account participants' different backgrounds and community values and including a variety of activities to involve the audience and present a logical sequence of topics.

The following section introduces a new method for sex education which makes use of computer simulations.

2.2 Serious Games and Simulation

Games are designed in many different forms, such as single-player/multiplayer, story-based/no story, score/no score, short/long/very long, challenging the body/mind/both, and computer games are developed for various platforms, such as personal computer, console, tablet, mobile phone, internet etc. [McGonigal (2010)]. McGonigal [McGonigal (2010)] suggested four defining features for a game: (1) a goal/purpose/challenge, (2) rules/limitations, (3) feedback system and (4) voluntary participation. The voluntary participation is not always included in scholarly definitions of a game, but it is added in the current one to emphasise the fact that the users of the game knowingly and willingly accept the goal, the rules, and the feedback. Additionally, computer games are described as being interactive [Wouters et al. (2013)].

A *simulation* is software that attempts to represent a real or imaginary environment or system [Reigeluth and Schwartz (1989); Alessi (2000)] and has either a scientific or educational purpose. In both cases, there is usually some inherent reason or benefit for not experiencing the real system directly, such as high cost, high risk, danger, scarcity of events, inaccessibility, available resources and time [Ke (2009)]. Scientific simulations help scientists to study a particular system, such as a doctor studying the effect of a vaccine in a population. These simulations help to test, establish and enhance an existing theory and understanding of a proposed system by easily modifying various variables involved and exploring the resultant changes in the model's behaviour. On the other hand, educational simulations are designed to teach someone about a system by allowing them to observe the consequences of the actions performed through feedback generated by the simulation in real-time and at their own pace [Rieber (1996)].

A *serious game* (sometimes termed e-learning or game-based learning) is a game developed for a primary purpose other than pure entertainment [Michael and Chen (2005); Djaouti et al. (2011)]. Although the words serious and game sound contradictory, the first refers to its educational purpose and not to its content [Johnson et al. (2005)]. This kind of game is used by industries like defence [Zyda (2005)], education [Kebritchi et al. (2010)], scientific exploration [Kelly et al. (2007)], engineering [Ruppel and Schatz (2011)], health care [Kato (2010)], management [Susi et al. (2007)], city planning [Poplin

(2012)] and politics [Djaouti et al. (2011)]. Serious games, in contrast with just normal computer games, introduce the concept of pedagogy through entertainment (making learning fun) [Kirriemuir and McFarlane (2004)]; they are training and teaching vehicles [Susi et al. (2007)].

Simulation games are defined as instruction delivered via a computer program that immerses users in a decision-making exercise in an artificial environment in order to experience the consequences of their decisions [Sitzmann (2011)]. Moreover, simulation games are described as being very motivating and people have reported experiencing a loss of time when engaging with them [Wood et al. (2007)]. A characteristic feature of simulations is that they are reality based, but they can also integrate certain game features such as constraints and competition [Tobias and Fletcher (2007)]. A simulation game functions as a dynamic model of one or more aspects of the real world [McCall (2014)]. For example, the commercial game Civilization, invites players to explore and manipulate digital worlds defined by representations of real-world geography, structures and institution in order to colonise a digitally rendered landscape [Sqire (2005)]. Additionally, simulations are used as interactive trainers with a primary function to prepare the users to act effectively in real-life tasks such as flight simulations, air traffic control, surgery and business simulations [McCall (2014)]. The use of serious game simulations permits the innocuous simulation and exploration [Westera et al. (2008)] of many rare and dangerous physical situations, natural phenomena and environments, which cannot be easily re-produced for training purposes (such as natural disasters, the spread of infections, astronomical phenomena and emergencies) [Girard et al. (2013)]. A simulation game is an analogous but simplified model of a real system that provides a source of experience of the real system in order for the users to realise the impacts of their decisions and motives [Zeigler et al. (2000)].

The difference between a game and a simulation is that a game involves competition. If a simulation enables a learner to compete against themselves by comparing scores over successive attempts at the simulation, or has a game structure imposed on the system, it may be regarded as a kind of game. According to Ke et al., [Ke (2009)] if the focus of a simulation involves the completion of an event only, the simulation will not be considered a game.

Many simulation models are based on a set of differential equations, and examples include disease epidemics [Sirakoulis et al. (2000)], crowd behaviour [Braun et al. (2003)] and traffic management [Klugl and Bazzan (2004)]. However, these kinds of models have disadvantages when an extension needs to be made or when they need to handle heterogeneous populations or entities [Rahmandad and Sterman (2008)]. An alternative popular approach is the *agent-based modelling* (ABM), where individual entities (autonomous agents) and their interactions within a system are explicitly simulated computationally [Crossley and Amos (2011)]. Each agent is assigned a set of rules which determine

their behaviour. The microscopic actions and interactions of agents give rise to macroscopic,"emergent" system-level behaviour [Sudeikat and Renz (2008)]. ABM improves extendibility, ease of understanding, consideration of structure and population variety [Macy and Willer (2002)]. ABM's drawback is the significant amount of computational resource needed to compute the results of a big model [Crossley and Amos (2011)].

There have been many arguments in support of the effectiveness of computer games in learning, such as ease of accessibility and modifying content, low cost per person served together with high level of user-tailoring, high level of interactivity and engagement and ability to use attractive graphics [Hainey et al. (2011); Girard et al. (2013)]. Today's teenagers and young adults were born in a computerised world, in which they are used to interacting with all kinds of software products and games [Girard et al. (2013)]. This generation is known as the 'net generation' [Bekebrede et al. (2011)] and it therefore, seems natural to think that this generation will be very receptive to game-based learning, given that computer games have been part of their everyday lives since a young age. Although many authors seem convinced of the effectiveness of serious games [De Freitas and Oliver (2006); Girard et al. (2013)], there is not enough experimental evidence to support them [Boyle et al. (2016)].

However, simulation serious games are more expensive to develop than other forms of technology-delivered training, with complex simulation games costing between $5 and $20 million to develop [Sitzmann (2011)]. Evidence suggests that traditional online training takes an average of 220 hours to create each hour of instructional content, whereas online simulations require 750 to 1,500 hours to create each hour of instructional content [Summers (2004),Bell et al. (2008)]. If the benefits of simulation games for training are real, people and organisations may realise that investing in simulation games is a sound use of their training budget. However, more research is needed to investigate the actual results and return on investments of simulation games relative to other educational methods [Sitzmann (2011)].

2.3 Simulation for Serious Games and Health

Stapleton [Stapleton (2004)] argued that education through games is more efficient and pleasant than classroom teaching for a number of reasons. Firstly, it is predominantly the player who directs activity in games, whilst it is predominantly the teacher who directs activity in school. This is why serious games suggest a learner-centred approach to learning, in which learners are involved in the learning process (learning through doing) [Kirriemuir and McFarlane (2004)], in contrast with traditional education which suggests a teacher-centred approach where learners are relatively passive. Children and teenagers often find it difficult to properly engage with school exercises [Korteling et al. (2013)] in which the challenge level may not be well adjusted to their individual level

of skill. Sometimes the level is too low and sometimes too high, as in one class there are many students with different skills and it is challenging for the teacher to manage to make all students in the class engage. On the other hand, video games challenge the players appropriately, by adjusting the difficulty level gradually as the player progresses in the game [Dondlinger (2007); Korteling et al. (2013)]. Game developers know well that a game becomes very successful when it is simultaneously not too easy or too difficult for the players. Both of these conditions are very important to take into account when developing a game.

Additionally, students are sometimes discouraged by the school system as they get penalised for the mistakes they make (i.e., they get bad grades). However, players in games are expected to take some wrong decisions and then modify their strategy to do better, re-evaluate the information they have and act more methodically without being discouraged (ideally - unless the game is poorly designed) [Korteling et al. (2013)]. Another important characteristic of educational games is the constant real-time feedback to the user [McGonigal (2010, 2011)]. Gamers know almost instantly how well a certain move or strategy worked towards the goal of the game. It can take the form of points, lives, prizes, levels, score, rank or progress bar. Real time feedback ensures that users are motivated throughout the game by promising that the goal is achievable.

Thaler and Sunstein [Thaler and Sunstein (1975)] explained the concept of using different methods of improving the decisions people make about health, wealth and happiness. This is relevant to the aim of the current research, which was to influence peoples' sexual attitudes towards risky sexual behaviour. Thaler and Sunstein described how people possess two different and distinct psychological systems; the automatic and the reflective. The first one refers to peoples' "gut reaction" and the second one to their conscious thought. "Gut feelings" can be accurate, but people often make mistakes because they rely too much on them [Thaler and Sunstein (1975)]. For example, the automatic system could suggest that "This person is very attractive. She is definitely healthy and trustworthy, as she takes care of herself and has self-respect" while the reflective system responds, "Very attractive women have the chance to have sex with more people! I believe you should use a condom". A similar psychological process that is linked to this theory is the idea of hot and cold cognitions [Schaefer et al. (2003)], which represent the reasoning influenced by the person's emotional state and the cognitive processing that is independent of emotional involvement, respectively. Condom use decisions are often affected by the "heat of the moment" [Ariely and Loewenstein (2006)], making it difficult for people to involve logical and critical thinking.

Sabido [Sabido (2004)] made use of an interesting term that encapsulates a similar idea to the one described in this section: *edutainment* [Charsky (2010)]. After observing the influence of communities caused by the drama they viewed on television, he defined edutainment as the action of using media to entertain as well as convey an educational message to an audience. Very often edutainment is used to inform individuals of ways

to deal with situations or suggest suitable precautions to take [Green and McNeese (2007)]. A very good example of edutainment is how South Africa adopted Sabido's idea to develop the TV soap opera called 'Soul City' [Peltzer and Promtussananon (2003)]. HIV prevention messages are central to its storylines, something extremely important for a country like South Africa, which has more than six million people living with HIV [Hiv and aids estimates south africa (2013)]. Soul City was one of South Africa's most popular soaps for more than a decade (11 seasons since 1994) [Peltzer and Promtussananon (2003)].

Verran et al. [Verran et al. (2014)] explored the idea of using their computer simulation called SimZombie, for educational activities (e.g., workshops in festivals) about the epidemiology of an infectious disease. SimZombie makes use of the fact that both genders show interest in zombies and, therefore, its main focus on outbreaks of vampires, zombies and werewolves helps the public engage more than they would do with a "one-way" mode of communication, such as a leaflet explaining the epidemiology of real disease outbreaks [Verran et al. (2014)]. In the game, ten teams of four to six people (university staff and students, adults, families and young people) had to answer three rounds of questions about monsters, microbiology and general scientific knowledge. After each round their answers were marked by being inputted into the simulation. The simulation is agent based, developed in Java and makes use of three basic classes of individual: susceptible, removed and zombified [Crossley and Amos (2011)]. Zombified individuals attack susceptible individuals who are nearby. Susceptible individuals might defeat a zombified individual with some probability and they might eventually die of natural causes and enter the removed class. These fictional characteristics were used to parallel true disease outbreaks, such as swine flu and HIV. Participants gave feedback to the researchers via a questionnaire afterwards, in which they ranked enjoyment (4.5), organisation (4.1), learning of science (3.5) and likelihood of attending a repeat event (4.5), on a scale from 1 to 5.

PlayForward: Elm City Stories was an important influence to the work carried out for this thesis. It is a recent serious role-playing adventure video game played on the iPad, designed by researchers at Yale School of Medicine and Schell Games, that engages youth with a variety of challenges and choices in fictional, realistic and risky life situations (such as having condomless sex with HIV positive people, substance use etc.) [Fiellin et al. (2017)]. PlayForward consists of an interactive world of avatars where the user creates their own avatar and travels through a series of narratives presenting common social situations whose outcomes bring different risks and benefits (such as deciding whether to join a challenge game played at a party or not). The ultimate goal of the game is to prevent HIV acquisition, gain knowledge and healthier attitudes, by allowing the participants to observe the impact of individual choices made within their social environment of life. In the study, 333 teenagers (between 11-14 years old) were

recruited from 12 urban community-based settings, such as school-based afterschool programs and summer camps. A hundred and sixty six students participated in the game for 12 months and 167 participated in the control condition. Participants who played PlayForward, irrespective of gender and age, demonstrated greater improvements in sexual health attitudes, knowledge, intention to initiate sex, and sexual activity than participants who played other non-intervention games (such as Angry Birds, Dragonbox and Subway Surfer). The findings suggested that serious games can act as an accessible and portable tool to engage and educate young people on sexual health issues. Moreover, the research team of PlayForward highlighted the benefit of extensibility and maintainability of such technology-based interventions, as their design allows for rapidly and inexpensively modifying their content when an update is needed.

The Source [Bouris et al. (2016)] is an alternative reality game that was delivered over 5 weeks to young people aged between 13 and 18 years. Each week focused on a different topic (including sexual health) that was taught using various methods, such as puzzles, board games, digital media tasks, and scavenger hunts. No behavioral outcome data were reported. However, participants enjoyed the tasks and some of them reported that The Source reinforced their decisions to engage in safer sex, although many of them commented that they found the board games boring and not as interactive as the computerised tasks.

Shegog et al [Shegog et al. (2014)] developed a stand-alone web-based game of 13 lessons, called It's Your Game (IYG). IYG lessons, which target early adolescents, include activities like interactive 2D exercises, quizzes, animations, and peer video. An evaluation of this game [Peskin et al. (2015)] showed no significant difference in the delay of sexual activity between intervention and control students; however, there was a significant positive between-group difference on psychological variables related to STI and condom knowledge, perceived norms about sex and condom use self-efficacy.

Re-Mission is an action 3D video game developed in HopeLab California [Beale et al. (2007)] designed to be played by young people undergoing treatment for cancer. The user manipulates an avatar to accomplish missions inside the virtual bodies of 19 different young patients being treated for seven different cancers. Players win by destroying cancer cells and other enemies in the body (such as bacteria, mucositis lesions, stool jags), but they need to be careful not to waste ammunition or cause secondary damage to the body. The authors claim that the efficiency of the game is based on a well-established extension of a social learning theory known as "self-modelling", i.e., the form of observational learning in which individuals observe themselves performing a behaviour successfully on a video/game and then try to imitate the targeted behaviour [Kehle et al. (2002)]. Additionally, the authors note that the self-modelling in Re-Mission is "symbolic", due to the fact that the model is not the learner per se, but an avatar that the learner controls during game play. The player could potentially acquire knowledge from observing the consequences (desired and undesired) of the avatar's actions, and

may apply it to the player's own behaviour in the real world. Patients given access to Re-Mission over a 3-month period showed more improvement on various measures of attitudes and behaviours (such as quality of life, self-efficacy for self-care and adherence to prescribed medication) than did a control group assigned to play a non-cancer game over the same period. Age, gender, video game experience before the study, and baseline knowledge test score were not found to be significantly associated with the degree of knowledge improvement following the intervention.

2.4 Research Question

This thesis aimed to address the following research question: How effective can simulation serious games be as a sex education intervention, and in particular, in influencing condom use intentions and affecting the association between perceived attractiveness and perceived risk?

Therefore, the focus of the design of the interventions in this thesis was to encourage people to use their reflective system more, when making decisions that affect their sexual health (see section 2.3). Agent based models were considered in the following studies, for the benefits they offer compared to alternative simulation models (see section 2.2). These simulation models could give young people the potential to engage with a simulated world of people and their sexual interactions and they could better understand how easy it is for diseases to spread. Attractiveness has tended to be studied from an evolutionary perspective and there is some evidence of gender differences (see section 2.1). Hence, this study experimentally explored the role of attractiveness in sexual health and it was anticipated that men and women might need to be considered separately for better understanding of the underlying associations.

Chapter 3

Feasibility study: Simulation of STI Spread in a Sexual Population

3.1 Motivation

Computer games are today an important part of most young people's leisure times and an increasingly important part of our culture as a whole (see also Chapter 2). Today's children and young adults are extensive users of technology, with 97% of adolescents, from all racial/ethnic groups playing video games, with 50% playing for at least one hour or more per day [Fiellin et al. (2017)]. Although video games have been considered a distraction from more "worthy" activities, such as homework or playing outside, today researchers and teachers are investigating how this powerful new medium can be used to support education at all levels and topics [Kirriemuir and McFarlane (2004)].

According to McGonigal [McGonigal (2011)], the average "gamer" today in a country with a strong gaming culture will have spent 10,000 hours gaming, by the age of 21. By comparison, children in the U.S. spend 10,080 hours in school from fifth grade to high school graduation, if they have perfect attendance. So, there is an entire parallel track of education that could be used to effectively reach youth.

However, Sitzmann [Sitzmann (2011)] suggested that researchers and practitioners should not assume that a simulation game in itself leads to learning. Simulation games should not be used for education simply because the technology exists, but rather, careful consideration is required to determine the training needs of the population and which material should be included in the simulation game [Salas et al. (1998)].

The reason computer simulations and serious games were chosen for this feasibility study was because they have already shown some potential that could be beneficial for some

aspects of young people's sex education (see Chapter 2). Therefore, the motivation and aim for the feasibility study was to build a serious game based on a computer simulation of infection spread.

This work was driven by the following research question; are serious games in the form of computer simulations effective in influencing peoples' sexual behaviour intentions?

3.2 Method

Sample and Recruitment

Men in Southampton and surrounding areas were recruited via social media (Facebook, Twitter), posters at the University (see Appendix A), and community advertisement boards. Potential participants were informed that data would be collected using an electronic quiz in order to investigate the use of a sex education intervention. Inclusion criteria were: heterosexual men, 18-69 years of age and English speaking.

Men who indicated their interest in taking part in the project and who met the eligibility criteria were contacted by e-mail to arrange a time and location for the session. Participants who were ineligible were contacted to explain the reasons they were ineligible and to thank them for their interest in the study.

Data were collected between June and August 2014. All participants were provided with a study information sheet and indicated electronic informed consent (see Appendix A). At the end of the session, participants received a printed copy of the debriefing sheet (see Appendix A). The study took approximately 20 minutes.

There was a very small risk that some participants may have felt uncomfortable or embarrassed answering the questions (although, apart from one question about sexual orientation on the screening questionnaire, there was no question related to their own actual sexual behaviour). For this reason, participants were informed that they did not have to answer all of the questions or use the simulation and could withdraw at any time, without giving reason and without any consequences. Taking part in the study could have raised some participants awareness regarding their own sexual health and about aspects of their sexual behaviour that could put them at risk of contracting STIs. Therefore, in the debrief sheet, participants received information regarding access to services providing advice and support on issues related to sexual health (see Appendix A). The contact details for the researchers and study supervisors were also provided in the study information sheet and debriefing sheet.

The sessions were conducted in private rooms at the University of Southampton to ensure participants comfort and confidentiality. All participant data were confidential i.e., each participant was assigned a code that was used during data analysis.

3.3 Study Design

The Questionnaire and Procedure

The steps of the session's procedure are shown in 3.1. First, the participants filled in the questionnaire (which was in a desktop application format programmed in Java). A screenshot from the questionnaire is shown in Figure 3.2 (see also Appendix B). After that the participants interacted with a game (described below) which showed how STIs can spread in a population, using the same computer. After three trials of using the simulation, the participant completed a further set of questions (to enable before-after comparison) and they were invited to write a few comments on the screen about their experience.

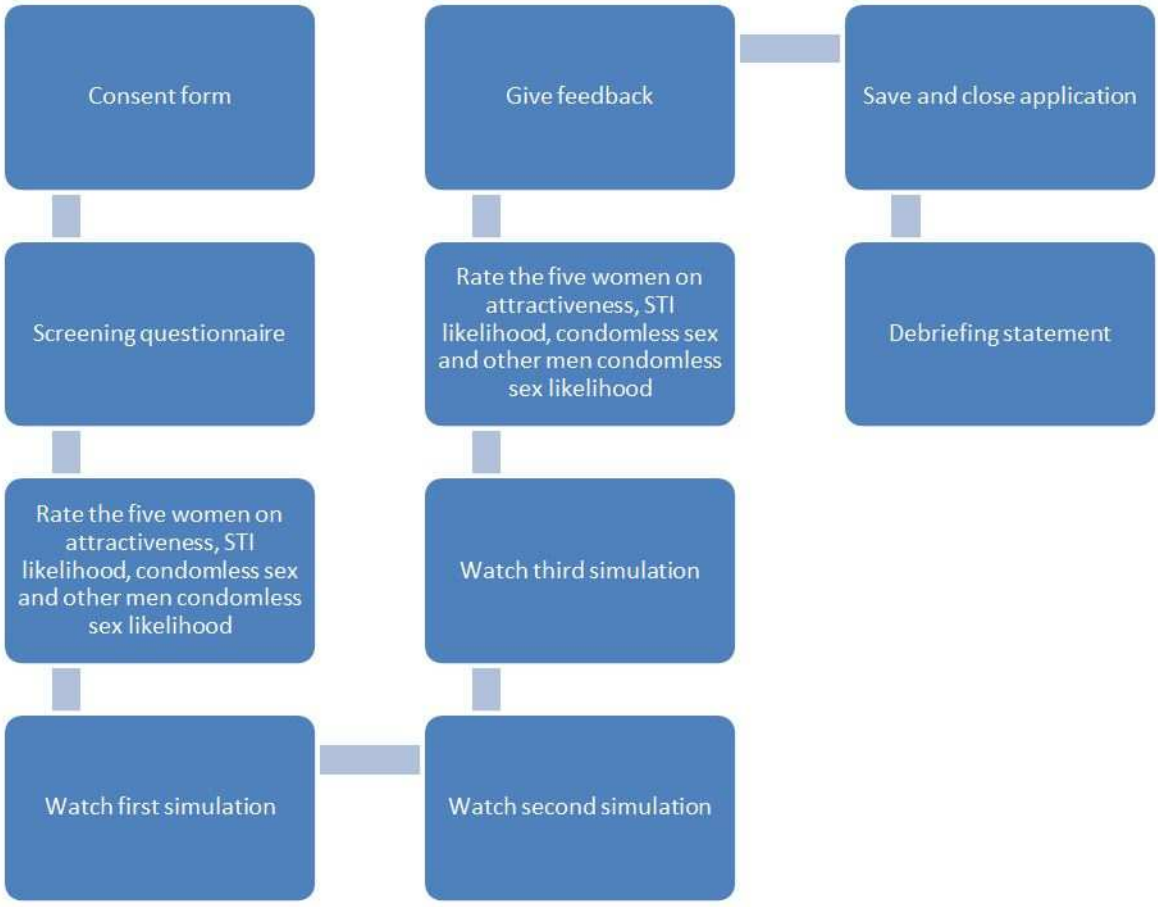


FIGURE 3.1: The session's procedure

In more detail, the brief screening questionnaire included questions related to demographics (age and sexual orientation). Participants were asked to rate the facial attractiveness of 5 women by looking at one facial photograph for each woman. All participants saw the pictures in the same (fixed) order. The pictures were obtained via personal communication with Prof. Cynthia Graham. They were asked whether they think each woman has an STI, whether they (the participant) would have sex with her

without a condom and to estimate the percentage of men like themselves that would have sex with her without a condom. After this, participants interacted with the simulation, which involved watching simulated interactions between people (represented by different coloured dots on the screen, with colours representing STI status and gender, see Figure 3.3 and next section for more details), observed how quickly their own "self" acquired an STI (set according to their reported anticipated level of risk), completed some of the questionnaire items again and then left some written feedback about the experiment on the screen. Observation by the researcher was also used to complement the data gathered through sessions, as it provides contextual data allowing clarification of ambiguous statements. Observation of the participant by the researcher also allows the opportunity to record data that might otherwise be missed. However, as participants completed the study in the presence of a female researcher, their responses may have been influenced [Schroder et al. (2003)]. The Ethics Committee of the University of Southampton approved the protocol (ERGO ref: 11645).

FIGURE 3.2: Screenshot from the questionnaire

The Simulation

As briefly explained above, one of the aims of this study was to develop a serious game, with the main purpose being to educate people about the results of risky sexual behaviours. The game developed for this study did not require a lot of time for the user to play, to reduce the likelihood of participants not completing the study.

Consequently, the user's interaction with the model was kept minimal, but still fun, entertaining and useful. The answers that the user gave during the first round of questions explained above were used to initialise the *world of the game*.

Specifically, twenty copies of each woman were created (stimuli used in the questionnaire) in order to have one hundred women (five times twenty) in the population. Then one

hundred men were created and they adopted the sexual risk level that the user described in his answers. For example, if the user specified that for woman number 1, 70% of men would have condomless sex with her, then 70% of the male agents were initialised with this property. Therefore, when this 70% of men met with woman number 1, they had sex with her without a condom. The user's behaviour towards the women was also recorded and it was taken into account during simulation e.g., when the user met a woman in the simulation that he said he would be prepared to have unprotected sex with, the simulated agents had sex without a condom and if that woman happened to have an STI then the user had a very high chance (equal to 90%) of getting the infection. If a condom was used, no infections were transmitted. A similar procedure was followed with the rest of the men in the population, so as time went by, the number of infected people increased, as at each time step new interactions were made (randomly). Agents had no information about the health status of other agents. No agents left the simulation (died) and no new agents joined the simulation.

Every time the simulation ran, the initial configuration was randomly initialised. In particular, each time, different people got the infection. Also, the percentage of initially infected people was random (when individuals were initialised, there was a 2% chance to become infected). These assumptions were made to make the simulation more interesting and unpredictable, as the users were asked to play three times and compare the different runs. Each simulation run took approximately 60 seconds. More information regarding the agents is presented in the following section.

Representation

Figure 3.3 shows what the model looks like. Unattractive people were represented with squares and attractive people with circles. Infected people were red (see figure 3.3). The user was the blue dot. Whenever two shapes of the opposite gender met at the same position on the screen, they had sex. The decision about whether a condom was used was based on the answers of the user, as explained above. When a grey shape contracted an infection it turned red. When the user got an infection, it turned red, too. The shapes moved randomly in the space provided there. A collision detection algorithm was used in order to update the population with the sexual events that took place and repainted the population at every time step.

The squares and the circles were also determined by the answers that the user gave on the questionnaires. Specifically, the woman with the highest attractiveness score given by the user and the woman with the second highest score are represented as circles. The rest are represented as squares.

This kind of representation was used for the feasibility study in order to make it simple and easy to understand in a few seconds. Although it is not complicated, this representation conveys the main messages of the study; for example, that individuals can get an STI both from attractive and unattractive people (even though they might have initially

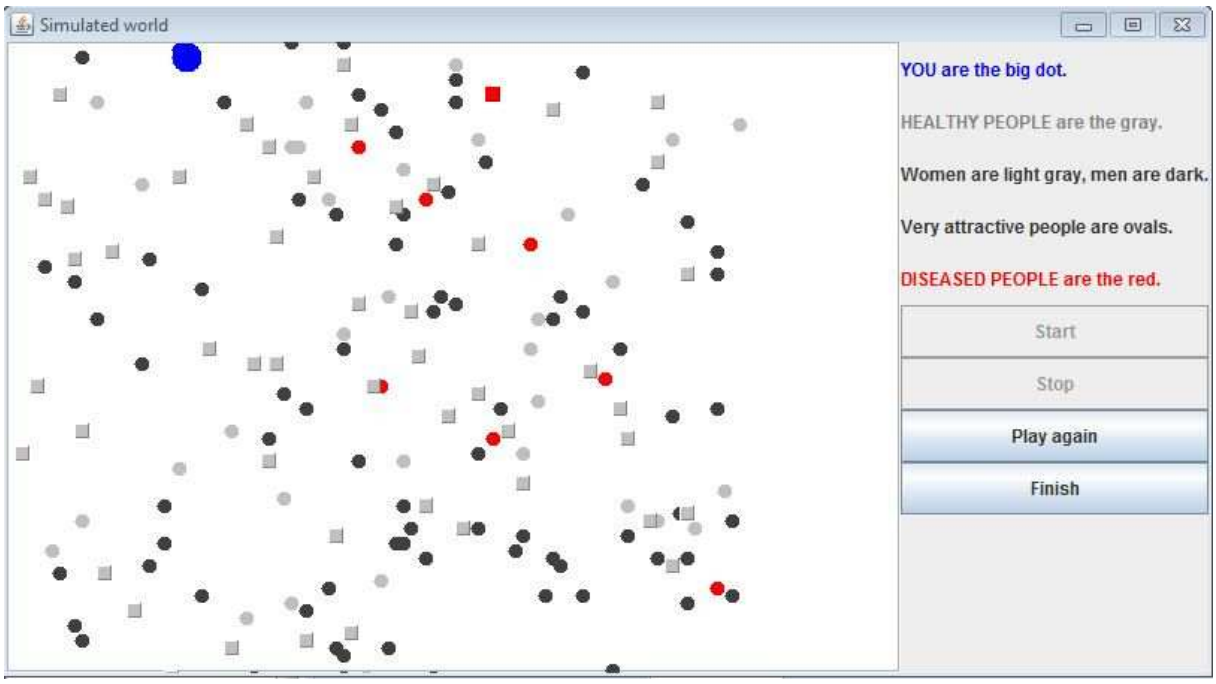


FIGURE 3.3: Screenshot of the simulation, a few seconds after it started running.

assumed that the risk is very low for one of these groups during the initial questionnaire completion, i.e. before interacting with the simulation). Moreover, it shows users that they can actually be at risk (and can possibly turn red) even though they thought that based on their answers they were quite safe.

All the answers from the first questionnaire, the time at which the user got an STI (if they did during any of the three simulation runs), and the answers from the second questionnaire were automatically saved in a log file by the game. There was one log file for each participant, having their unique participant code as a filename. Comments and feedback received during the sessions regarding the model will also be discussed below.

The Code

The code was developed in Java and it was structured in a way (see Appendix C) such that it will be easy to extend in the future with more features, and also it has the potential to be easily converted into a web or mobile application. The code is also publicly available on Bitbucket (https://bitbucket.org/ae2n12/simulations/src/master/).

In order to ensure that the interface was user friendly and easy to understand, we did extensive beta testing with men who meet the eligibility criteria and their feedback was taken into account during the final stage of development.

TABLE 3.1: Mean (SD) scores (n=20) elicited for each of five women, for attractiveness, STI risk, and the willingness of the participant to have sex with the woman without a condom.

Woman	Attractiveness	Likelihood of STI	Sex Without a Condom
1	4.40 (0.88)	0% (0%)	20% (41%)
2	4.60 (0.82)	35% (49%)	25% (44%)
3	2.55 (0.95)	10% (31%)	10% (31%)
4	3.45 (1.4)	35% (49%)	20% (41%)
5	5.60 (0.82)	35% (49%)	50% (51%)

3.4 Results

Twenty one men between 22 and 45 years old participated in this study. One participant was excluded from the analysis, because of their sexual orientation (homosexual), as the current study was focused only on heterosexual men.

Table 3.1 shows how important women's attractiveness was for participants' condom use intentions. Woman number 5 seems to have been the most popular across the participants and she also had the highest likelihood of STI score according to the participants (together with women 2 and 4). However, she also had the highest likelihood of no condom use irrespective of the fact that participants believed that she had a high likelihood of having an STI. Additionally, the percentage of men that would have sex with her without a condom according to the users was also the highest. The same trend can be observed with the second most attractive woman (woman 2). This suggests a trend worth investigating further with more participants and more stimuli (see chapters 4 and 5).

The results also suggest that the simulation can potentially help to reduce the risk intention of the participants, as 40% of the participants indicated lower risk (increased condom use intentions) after they watched the simulation, 55% of the participants kept it the same and 5% indicated increased risk when they were asked about their condom use intentions. These results suggest that this kind of simulation could possibly be used for sexual education purposes with a larger audience in the future (see chapters 6 and 7).

During the sessions with the participants, interesting comments, ideas and feedback were collected which were used to design subsequent studies and understand trends. For example, for an average-attractiveness-ratings woman, men said that they would not like to risk having unprotected sex with her but they believed that the majority of men would because "men are men" as a few of them said. Additionally, eliciting participants' judgements regarding the condom use intentions of other men like themselves may address possible demand characteristics of the study situation, which can

encourage participants to provide a "correct" response to questions directly targeting their own sexual behaviour [Catania et al. (1990a); Tourangeau and Yan (2007)].

Another popular theory that came up from the majority of the participants was that women who were pictured smiling look friendlier, and are more trustworthy and less likely to have an STI. It is therefore something worth investigating and considering when choosing the pictures for similar studies. Additionally, participants tended to judge the STI status of the women based on how white their teeth were or how tidy their hair was. Moreover, men sometimes associated the stimuli with women they knew. For example, "she reminds me of my boss, I do not think she has an STI" or "she reminds me of a movie star who is a bit dodgy" or "she reminds me of someone I used to know that definitely had no STIs". There is evidence in the literature that suggests familiarity leads to judgements of lower STI risk and lower condom use intentions [Kelly and Kalichman (1995)].

Other phrases reported by the participants included "She looks very bossy, I won't have sex with her in general", "I assume that they would tell me if they had an STI", "She looks the kind of person to be safe", "She looks like a hippie, she might have an infection", "She looks very confident - she probably had a lot of sex", "She is too posh to have an STI", "No cold sores, no STI!", "My answers depend on when I had sex last", "Old-fashioned, not adventurous, therefore, no diseases", "She is a safe bet as she is less attractive and a bit older", "She looks very happy to have health problems", "She looks well groomed, so I dont think she has infections", "she seems more promiscuous from her eyes", "Pure face - no experiences!", "I can't tell by the picture", "Because she is a 10, I will have sex with no condom, even if she looks like she has an STI". These comments support previous studies, which indicated that people not only believe they have control over avoiding STIs (optimistic bias), but they also hold stereotypical beliefs about the people infected with an STI [Weinstein (1989)].

Many participants characteristically said that they usually base their condom use decision on the discussion they have with the woman, on the way she behaves in general or even how well she maintains her home. Many of them also acknowledged that their judgements and decisions are affected a lot by the amount of alcohol they have consumed [Cooper (2002)].

A common complaint from the participants was that they could not see the body of the woman as they said that this could potentially change their condom use decision. However, previous studies suggested that for both genders and different relationship types, face ratings were found to be the best predictor of the ratings of combined images with face and body [Currie and Little (2009)] (see also Chapter 2 for more details). Additionally, one participant reported that he found it difficult to concentrate on a fast-moving simulation of dots that represented a population of people.

3.5 Discussion

Evaluation

To a large extent this first study successfully accomplished its goal, i.e. to serve as a feasibility study for subsequent research and to investigate whether using serious games in the form of computer simulations for sexual health issues is something that has potential. An additional aim that was successfully accomplished was to identify improvements that needed to be made to the questionnaire and to the interview procedure. We did obtain very useful feedback and some helpful insights from both the sessions with the participants. As discussed above, there was a change in hypothetical sexual risk that participants reported before and after watching the simulation. Future studies aim to increase the percentage of participants who lower their risk.

Furthermore, the following studies described in the next chapters aim to address a very important question born from this study. Did the simulation affect participants' opinions on sexual risk or did this happen because of the nature of the session (questionnaire, information sheets etc.) that made them reflect on their behaviour? Will an educational video achieve the same results? What does the simulation have to offer as an extra to the above? In order to answer the above questions we might need to separate the participants' sample into two groups and perform a social experiment with a simulation for the first group and without a simulation (or with any other intervention) for the second group (see chapter 7 for more details).

Future Work

In summary, interesting patterns emerged from this study. However, in order to be able to infer trends and correlations on this topic the experiment needed to be repeated with a larger sample. In order to do this, the next aim was to transform the desktop application used for this study into a web application (see chapter 6). By doing this participants were able to complete the session wherever they wanted without the need for the researcher to be present.

Additionally, more stimuli were required to make sure that the patterns observed are not biased by the particular choice of women's pictures (see chapter 4). A very important future step is repeating the social experiment with heterosexual women (using male stimuli - see chapter 5), bisexual men and women (using male and female stimuli) and homosexual men and women (with male and female stimuli, respectively).

Further, questions were rephrased to capture more accurate responses. For example, instead of asking "Would you have sex with this woman without a condom?" we asked "How likely are you to have sex with this woman without a condom?" and provided the participant with a visual analogue scale instead of a yes/no button (see chapters 4 and

5). Also, this study used a scale of 1 to 7 for attractiveness, which seemed to confuse the participants who preferred to rate women on a scale from 1 to 10 or from 1 to 100.

Furthermore, many improvements could be made to the simulation model such as the representation/visuals in order to be more attractive (see chapters 6 and 7); and the way that simulated sex events were taking place. In this model, individuals were wandering around in the simulation world in a random fashion and when they met at the same position with another individual they had sex with them. We could possibly implement a more sophisticated walk, based on attractiveness, for example. Another interesting extension of the simulation would be to represent different STIs with different colours (for example, chlamydia with yellow, HIV with red colour etc.) and also introduce different probabilities of infection based on real STI transmission rates (low realism of current simulation). Moreover, the order of the pictures in the questionnaire could be randomised to remove any response bias that might arise from the current arrangement.

It is believed that for the think aloud sessions where the researcher is present the results are affected by the gender of the researcher [Yardley et al. (2010)]. Therefore, it would be interesting to repeat the sessions with a male researcher present, rather than a female and observe the potential differences in the answers [Pini (2005)].

Finally, more questions about the participants' sexual lives in future research may be worth including in the screening questionnaire as previous studies [Albarracin et al. (2001)] suggested associations between the participants' intentional sexual behaviour and the participants' sexual life (if they are sexually active, how often they have sex, when was the last time they had sex, if they are happy with their sex life, if they are in a relationship, use of condoms, etc. - see chapters 4-7)

Conclusion

In summary, this feasibility study aimed to explore the viability of using simulations as an intervention to show the implications of risky sexual behaviour. A questionnaire was designed and used to recruit 21 participants in order to examine how attractiveness is related to sex with and without a condom. Findings indicated a potential trend between attractiveness and intentions to have condomless sex. The simulation did not require a lot of time for the user to understand and interact with. For the initialisation of the simulated world, the answers that the user gave during the questionnaire completion were used. A primary aim of this work was to examine peoples' reactions to the simulation intervention developed. This happened by observation but also by asking them questions about their hypothetical sexual behaviour afterwards. Approximately half of the participants changed their hypothetical sexual behaviour (condom use intentions) after using the simulation.

Chapter 4

Does Attractiveness Influence Condom Use Intentions in Heterosexual Men? An Experimental Study

4.1 Introduction

The impression that a person's appearance makes strongly influences their interactions within their social environment. Facial attractiveness, in particular, has been the subject of extensive research in the human behavioural sciences as it dramatically influences social experience [Lorenzo et al. (2010)], including decisions about sexual behaviour [Hong et al. (2006); Weeden and Sabini (2007); Hennessy et al. (2007)].

Recent evidence by Nedelec and Beaver [Nedelec and Beaver (2014)] supported the hypothesis that there is an association between perceived physical attractiveness and health. Specifically, their findings, which were consistent across men and women, showed that the more attractive a person was rated by participants, the less likely they were to be diagnosed with a neuropsychological disorder or a chronic disease. Although some chronic diseases can affect an individual's attractiveness directly (by affecting the skin, for example), other conditions, such as the majority of sexually transmitted infections (STIs), might not necessarily be expected to impact on a person's attractiveness directly. Despite this, it has been shown that people feel that they are able to judge the presence or absence of an STI/HIV on the basis of visual appearance alone [Clark et al. (1996)].

Fishbein et al. [Fishbein et al. (2004)] and Henderson et al.[Henderson et al. (2005)], focused on the association between romantic attraction and health risks by asking male and female participants to rate attributes that are often used to describe romantic

partners, such as "physical build" or "emotionality", on their importance for partner selection. They reported that the more a participant was attracted to a person with "risky" features, the less likely they were to consider that the person presented a health risk. Also, high sensation seekers rated potential partners as more attractive and less risky than low sensation seekers did. However, these studies did not address the effect of the participants' own perceived attractiveness on their judgements of risk and attraction and did not consider how these judgements related to condom use intentions in the context of casual sex.

Although there is consistent evidence of links between attractiveness and sexual behaviour, the mechanisms underlying these relationships have not been elucidated. Another unexplored issue is whether the relationships between attractiveness and sexual behaviour differ by gender. The current study focused on how the perceived facial attractiveness of women by heterosexual men affected their willingness to have condomless sex and perceptions of STI risk. Similar work by Dijkstra et al. [Dijkstra et al. (2000)] found that 72 male undergraduates asked to rate pictures of women and consider a brief description of their personality were more motivated to have sex with a physically attractive woman even though they believed that she was more likely to have an STI. However, condom use intentions were not evaluated. Agocha et al. [Agocha and Cooper (1999)] did address this issue directly, finding that physical attractiveness was not a direct predictor of condom use intentions in a sample of psychology undergraduates. However, path analysis revealed that the total indirect effects of physical attractiveness on intentions to use condoms were five to six times larger than those for sexual health information about the target. More recent work by Epstein et al. [Epstein et al. (2007)], which involved an internet study displaying a picture and a biography for a randomly assigned target, also supported the hypothesis that a potential partner's physical attractiveness has an impact on intentions to have sex in both men and women. However, no significant direct effects of physical attractiveness on intentions to have condomless sex or on perceived STI risk were found.

Although the above studies give some insight into the relationships between facial attractiveness, perceived risk and condom use intentions, their findings were not entirely consistent, in many cases only one or two pictures of the opposite sex were rated by participants, and not all of the studies considered the context of demographic variables and sexual history. The current study extends research in this area by eliciting men's condom use intentions towards 20 women, and evaluating these not only with respect to the perceived attractiveness of the women, but also the participants' perceptions of their own attractiveness, their sexual history, including their typical condom use behaviour, and their perceptions of other men's condom use intentions.

It is important to consider participant's self-rated attractiveness when analysing condom use intentions, since self-perceived attractiveness may influence sexual preferences [Little et al. (2001)], perceived STI risk [Dijkstra et al. (2000)], and also mating decisions,

as individuals tend to choose partners who physically resemble them or appear to have similar facial features [Little et al. (2006)]. Moreover, eliciting participants' judgements regarding the condom use intentions of other men like themselves may address possible demand characteristics of the study situation, which can encourage participants to provide a "correct" response to questions directly targeting their own sexual behaviour [Catania et al. (1990a); Tourangeau and Yan (2007)]. Finally, in order to consider the possible influence of demographics and sexual experience on condom use intentions, the possible effects of participant age, satisfaction with their sex lives, their number of sexual partners and the age of their first sexual intercourse should be explored. All of the aforementioned variables were addressed in the current study.

The primary purpose of the current study was better to understand the relationship between perceived attractiveness and condom use intentions in heterosexual men and to gain insight into the relationship between perceived attractiveness, demographics, sexual history and perceived sexual health status. The research questions were: 1. Does the perceived attractiveness of a potential sexual partner affect sex and/or condom use intentions? 2. Does a participant's own perceived attractiveness affect their sex and/or condom use intentions? 3. Does heterogeneity in the association between perceived sexual health status and perceived attractiveness influence condom use intentions? 4. Do demographic or sexual experience variables predict condom use intentions?

4.2 Methods

Participants

Data were collected at the University of Southampton between January and May 2015. Men in Southampton and surrounding areas were recruited via social media (Facebook, Twitter), posters at the University and on community advertisement boards, and advertisements on the University's online participant recruitment site (eFolio). Potential participants were informed that data would be collected using questionnaires in order to investigate the influence of attractiveness on sexual attitudes and intentions and they were screened for eligibility via email. Inclusion criteria were: 18-69 years of age; English speaking; heterosexual male. Fifty-one men, attended the study, they were screened and all met the inclusion criteria. All of them agreed to participate in a face-to-face session in a university location and provided electronic informed consent.

Measures

The study employed an electronic questionnaire to collect all participant data. A draft questionnaire was initially trialled on five pilot study participants and was then refined on the basis of their feedback during individual think aloud sessions, in which they explained what they could and could not understand and also how participation made

them feel. The final questionnaire comprised three sections (see also Appendix D): (1) participants' demographic information and judgement of their own attractiveness, (2) information regarding the participant's own sex life, (3) five judgements on each of twenty women on the basis of a single full frontal facial photograph (enough women to give variability and not too many in order for the session to be very long and tiring for the participants). The order of the 100 test items in section 3 was fully randomised for each participant.

In the rest of the paper, we use a series of single-letter labels to identify key variables associated with six categories of questionnaire items introduced in parentheses on their first mention below.

Demographics and own attractiveness

Participants were asked about their age and ethnicity, and then asked to rate their own attractiveness (O) on a scale from 0 to 100, with 0 indicating 'very unattractive' and 100 indicating 'very attractive'.

Sexuality Variables

Participants' satisfaction with their sex life was assessed by the following item, 'Thinking about your sex life in the last year, how much do you agree or disagree with the following statement: "I feel satisfied with my sex life" '. Response options ranged from '1' (strongly agree) to '5' (strongly disagree).

Participants also indicated whether they were attracted to men, women, neither or both, their relationship status, and how many lifetime sexual intercourse partners they had had. Three further yes/no questions were asked: 'As far as you know, have you ever had an STI?', 'As far as you know, do you currently have an STI?' and 'As far as you know, are you allergic or sensitive to latex, non-latex condom and/or lubricants?'. Finally, participants were asked: "Which one of the following percentages describes better the proportion of occasions of intercourse you have not used a condom in your lifetime?", "Which one of the following percentages describes better the proportion of occasions of intercourse you have not used a condom in the past twelve months?" and "How easy would it be for you to identify whether a woman has an STI, without asking?". Answers ranged from 0% to 100%, in six intervals with boundaries at 10%, 30%, 50%, 70%, 90%, and 100%.

Ratings of facial photographs

Participants were asked to provide five ratings for each of 20 women on the basis of a single black and white photograph of the woman's face taken from the Extended Cohn-Kanade (CK+) database [(Lucey 2010)]: 'Please rate the attractiveness of the following woman' (A); 'If you were single, how likely would you be to have sex with this woman should the opportunity arise?' (S); 'If you were single and you were to have sex with

this woman, how likely is it that you would use a condom?' (C); 'Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?' (M); and 'How likely is this woman to have an STI?' (I). Participants indicated their answer to each question by moving a slider between 0 and 100. These 100 items were presented in fully randomised order, i.e., the five questions regarding a particular woman were not presented together or in a particular order, and, similarly, the twenty questions regarding a particular rating (e.g., attractiveness) were not presented together or in a particular order. Prior to commencing the task, a simultaneous presentation of all 20 faces was shown to enable the participants to anchor their judgements.

Stimuli selection and procedures

The Extended Cohn-Kanade (CK+) database [Lucey et al. (2010)] includes facial image data from 210 men and women aged 18-50 years. The dataset includes 81% Euro-American, 13% Afro-American, and 6% "other" participants. For this study, 20 female faces with neutral expression were chosen at random and were displayed in black and white.

Procedure

After providing electronic informed consent, each participant completed the self-administered electronic questionnaire on a university computer (taking between 25 and 30 minutes). A researcher was present during the session in case the participant needed clarification of any questions, but they were not able to see participants' responses. Each participant received £4 ($\approx 6US\$$) at the end of the session. The Ethics Committee of the University of Southampton approved the protocol (ERGO ref: 13607).

Data analysis

To identify factors influencing condom use and interactions amongst them, a series of bivariate associations (Pearson's correlation coefficients) were calculated, followed by a multivariate test of associations (a repeated measures linear mixed model).

4.3 Results

Demographics

Fifty-one heterosexual men, mean age 26.41 years old (SD=7.91, min=19, max=61), completed the session. Twenty participants were white British, seventeen were white 'other' (e.g., Italian), and the remainder identified as Indian, Chinese, any other Asian background, Caribbean, Hispanic and other mixed background.

Sexual experience variables

TABLE 4.1: The percentage of sexual intercourse episodes in which condoms were NOT used reported by 47 participants (i.e., excluding four participants who had never had sexual intercourse) during their lifetime and during the last 12 months.

% Condomless Sex	<10%	<30%	<50%	<70%	<90%	100%
Lifetime	14	6	7	11	5	4
Past 12 Months	20	2	6	4	4	11

In response to the statement: "I feel satisfied with my sex life", 5 (9.8%) participants agreed strongly, 25 (49%) agreed, 10 (19.6%) neither agreed nor disagreed, 8 (15.6%) disagreed, 2 (4%) disagreed strongly and 1 (2%) preferred not to say. All of the participants reported that they were exclusively attracted to women except one who reported that he was attracted to both men and women. Twenty three (45.1%) participants were single, 21 (41.2%) were in an exclusive relationship, 4 (7.8%) were in an open relationship and 3 (5.9%) were married. None reported having an STI at the time of the session, and 5 (9.8%) participants reported having an STI in the past. The average number of lifetime sexual partners was 9.65 (SD=10.95, min=0, max=60) and the mean age at first sexual intercourse was 18.3 years old (SD=3.4, min=14, max=30). None of the participants reported suffering from an allergy to latex, non-latex condoms and/or lubricants. Reported rates of condomless sexual intercourse are presented in Table 4.1.

Participants' ratings

In analysing participants' ratings, we distinguished between considering the data associated with each of the women being rated, aggregating over the participants' ratings, and considering the data associated with each participant, aggregating over the women that he rated. For example, were some women judged to be more attractive than others on average, considering the participants as a group? This set of values will be denoted A_w (See Table 4.2 for ratings). Alternatively, did some participants find the set of 20 women in the study more attractive than other participants did, considering the women as a group? This set of values will be denoted C_p.

Associations between participants' ratings of the 20 women

First, we constructed average ratings for each woman and considered relationships amongst these. The more attractive a woman was judged to be on average, A_w, the more likely participants would be willing to have sex with her, S_w(r=0.985, df=18, p<0.0001). Further, the more attractive a woman was judged to be, A_w, the less likely men were to intend to use a condom during sex, C_w(r=-0.785, df=18, p<0.0001). Consequently, average condom use intentions, C_w, tended to be lower for women that participants were, on average, more willing to have sex with, S_w(r=-0.795, df=18, p<0.0001).

On average, participants judged that more men like themselves would have sex without a condom, M_w, to a greater extent with women that the participants judged, on average, to be more attractive, M_w(r=0.970, df=18, p<0.0001), and with whom the

TABLE 4.2: The mean participant ratings for each female photograph (Scale 0-100).

Woman	A_w	C_w	I_w	M_w	S_w
1	30.5	87.3	44.9	27.2	31.9
2	18.7	89.0	32.2	19.8	16.5
3	38.3	86.7	36.9	27.8	33.1
4	40.7	83.4	26.1	29.9	42.3
5	40.9	85.2	33.3	31.3	41.2
6	46.3	85.9	28.5	34.4	45.6
7	69.5	82.1	35.7	46.4	71.3
8	69.1	78.0	24.8	46.0	66.2
9	45.7	84.9	31.8	34.6	46.0
10	53.8	77.3	27.2	34.6	54.4
11	55.5	81.3	24.8	39.1	58.5
12	52.7	82.9	37.4	34.3	56.0
13	47.4	87.2	32.7	31.8	45.4
14	45.2	83.7	27.2	33.1	46.4
15	40.9	86.2	29.7	30.9	39.9
16	35.7	89.5	37.0	29.1	32.1
17	30.5	85.3	30.6	26.3	29.3
18	47.6	83.9	33.8	30.7	49.5
19	46.5	83.0	33.8	33.5	42.7
20	56.2	81.7	28.1	37.4	58.2

TABLE 4.3: Bivariate associations between mean ratings for twenty women (df=18) of their attractiveness, A_w, condom use intentions towards them, C_w, their STI likelihood, I_w, the extent to which men like the participants would be willing to engage in condomless sex with them, M_w, and the willingness of the participants to have sex with them, S_w. Pearson's r values are shown in the upper right half of the table, Spearman's in the lower left: *=p<0.05, **=p<0.01, ***=p<0.001

ρ/r	A_w	C_w	I_w	M_w	S_w
A_w	-	-0.785***	-0.358	0.970***	0.985***
C_w	-0.818***	-	0.553*	-0.730***	-0.795***
I_w	-0.299	0.517*	-	-0.348	-0.353
M_w	0.910***	-0.779***	-0.395	-	0.952***
S_w	0.963***	-0.844***	-0.362	0.917***	-

participants were, on average, more willing to have sex, S_w(r=0.952, df=18, p<0.0001). Consequently, where the average judgement of the number of men willing to have condomless sex with a woman, M_w, was high, participants' average condom use intentions towards the woman, C_w, were lower (r=0.730, df=18, p<0.0001).

Although the average perceived STI likelihood for a woman, I_w, was positively correlated with average condom use intentions towards her, C_w (r=0.553, df=18, p<0.05), it had no significant association with her average perceived attractiveness, A_w, or with participants' average willingness to have sex with her, S_w. These bivariate associations are summarised in 4.3.

Overall ratings of women

TABLE 4.4: Bivariate associations (Pearson's r) between 51 (df=49) participant's overall ratings. Significance levels are indicated: *=p<0.05, **=p<0.01, ***=p<0.001

ρ/r	A_p	C_p	I_p	M_p	S_p
A_p	-	-0.126	0.094	0.067	0.855***
C_p	-0.018	-	-0.041	-0.313*	-0.14
I_p	0.068	-0.003	-	-0.544***	0.154
M_p	0.009	-0.300	0.494**	-	0.102
S_p	0.837***	-0.089	0.178	0.057	-

Next, for each participant we averaged over their ratings of the 20 women and considered relationships amongst these overall ratings. Participants who tended, overall, to rate the twenty women as more attractive, A_p, tended to be more willing to have sex, overall, S_p(r=0.855, df=49, p<0.0001). Participants who judged that men like themselves were more willing, overall, to have condomless sex with the twenty women, M_p, also tended to believe that, overall, the twenty women had a higher likelihood of having an STI, I_p(r=0.544, df=49, p<0.001) and themselves had higher overall condom use intentions, C_p(r=0.313, df=49, p<0.05). However, overall judgement of STI likelihood was not related to overall condom use intentions. These relationships are summarised in Table 4.4.

Influence of perceived own attractiveness and ability to detect STIs

The more attractive a participant judged himself to be, O_p, the more he believed that, overall, other men like him would not use a condom during sex, M_p(r=0.491, df=40, p=0.001) and the less likely he was, overall, to intend to use a condom himself, C_p(r=0.355, df=40, p=0.02).

Participants' confidence in their ability to detect whether a potential sexual partner had an STI without asking was significantly negatively correlated with their overall tendency to rate women as more attractive, A_p(r=0.295, df=49, p=0.036), and more likely to have an STI, I_p(r=0.323, df=49, p=0.02), and was also associated with overall lower condom use intentions in themselves, C_p(r=0.403, df=49, p=0.003), and men like themselves, M_p(r=0.292, df=49, p=0.038). Participants who were more confident in their ability to detect STIs without asking also tended to rate themselves as more attractive (r=0.612, df=40, p<0.0001).

Influence of age, ethnicity and sexual experience variables

Participants more satisfied with their sex life tended to provide lower overall attractiveness ratings, A_p(r=0.373, df=49, p=0.006). Neither a participant's age, ethnicity, number of lifetime sexual partners, nor their relationship status, had an association with their overall ratings. Of the 47 participants who had indicated that they had experienced sexual intercourse, those that reported having had an STI gave higher overall ratings of attractiveness, A_p(r=0.346, df=45, p=0.017), willingness to have sex, S_p(r=0.308, df=45, p=0.035), and rates of condomless sex in men like themselves, M_p(r=0.312,

TABLE 4.5: Bivariate associations (Pearson's r) between 51 (df=49) participant demographic and sex experience variables (left column) and their mean ratings of 20 women. (Four participants indicating that they had not had sexual intercourse were excluded from the bottom four analyses, i.e., df=45.) Significance levels are indicated: *=p<0.05, **=p<0.01, although r is significant (at p<0.05) for Age by S_p, Spearman's ρ (0.04) is not significant (p=0.78) suggesting outlier participants have had a disproportionate influence on the association.

r	A_p	C_p	I_p	M_p	S_p
Age	0.212	-0.249	0.156	0.270	0.276
Satisfaction with Sex Life	-0.373**	0.086	-0.193	-0.154	-0.178
No. Sex Partners	-0.193	-0.084	0.274	0.197	-0.044
Relationship Status	0.163	-0.056	-0.075	0.152	0.207
Past STI	0.346*	-0.256	-0.080	0.312*	0.308*
Age at First Intercourse	0.211	0.183	-0.125	-0.142	0.180
Condomless Sex In Lifetime	-0.038	-0.301*	-0.228	-0.047	-0.201
Condomless Sex In Last 12 Months	0.050	-0.201	-0.099	0.150	-0.094

df=45, p=0.016). Age at first sexual intercourse and rate of condomless sex over the last 12 months were not significantly related to the participants' overall ratings, but participants' lifetime rate of condomless sex was negatively associated with overall condom use intentions towards the women that they rated in the study, C_p(r=-0.301, df=45, p=0.04). These relationships are summarised in Table 4.5.

Linear Mixed Model

A linear mixed model with repeated measures was constructed in order to carry out a multivariate analysis addressing the question: what linear combination of factors best explains the variation in participants' condom use intentions across the twenty women rated. The main benefit of a linear mixed model is that it enables repeated measures to be handled (in this case the twenty women rated), and deals with the possibility that participants may vary in the overall level and variability of their condom use intentions.

The set of participant condom use intention ratings (C_p) was the outcome variable, with the repeated measures being the individual women rated. Four participants who had indicated that they had not had sexual intercourse were excluded in order to include sexual experience variables related to sexual activity (e.g., age at first sexual intercourse). All demographic and sexual experience variables and ratings variables were included as main effects except those for which there was no variation in the participant sample (i.e., allergy to latex and current STI) . Willingness to have sex ratings were excluded from the model due to their very strong collinearity with attractiveness ratings (r=0.8). The model thus attempted to identify a single set of relationships that could account for all participants' patterns of condom use intentions.

Variables significantly associated with higher condom use intentions towards a woman were lower ratings of her attractiveness, A_p(p<0.0005), higher ratings of her STI likelihood, I_p(p<0.0005), and lower estimates of the number of men who would have condomless sex with her, M_p (p<0.0005). Demographic and sex experience variables that were significantly associated with a participant's reporting higher condom use intentions were being either married or in an exclusive relationship (p=0.002), being less satisfied with sex life (p=0.016), lower age (p=0.001), higher number of sexual partners (p=0.001), higher age of first intercourse (p=0.003), lower lifetime rates of condomless sex (p<0.0005) but higher rates of condomless sex in the last 12 months (p<0.041), and lower confidence in their ability to determine, without asking, whether a woman had an STI (p=0.001). The participant's STI history was not significant.

Participant heterogeneity analysis

Note that while the above analyses have revealed relationships between average ratings, they are quite insensitive to between-participant heterogeneity. This means they are not suited to answering questions such as: do the condom use intentions of participants that are more attracted to women that they regard as at higher risk of an STI differ from those of participants that are attracted to "safe" women? The following analyses address this deficiency by considering within-participant correlations between ratings (e.g., the correlation between condom use intentions and STI risk for each participant).

Some within-participant correlations were very consistent, e.g., the average correlation between a participant's attractiveness ratings and their willingness to have sex ratings was r_{AS}=0.76, with 45 participants exhibiting a correlation greater than 0.8. However, in other respects, participants were more heterogeneous. In particular, while the average correlation between a participant's attractiveness ratings and their STI likelihood ratings was close to zero, 21 participants had strong preferences for either "safe" or "risky" women, with r_{AI} correlations either greater than 0.4 or less than -0.4.

The extent to which a participant was attracted to more risky sexual partners (i.e., the correlation between a participant's attractiveness ratings and their STI likelihood ratings) had no influence on the correlation between their condom use intentions ratings and their willingness to have sex ratings. Men who were attracted to high risk women and men who were attracted to low risk women both had lower condom use intentions towards the women that they were attracted to (cf. the flat distribution of points in the lower half of Figure 4.1A). Consequently, participants more willing to have sex with safer women had lower condom use intentions towards safer women, whereas participants more willing to have sex with riskier women tended to have lower condom use intentions towards those high risk women (cf. the diagonal distribution of points in Figure 4.1B, with risk seekers in the bottom right quadrant).

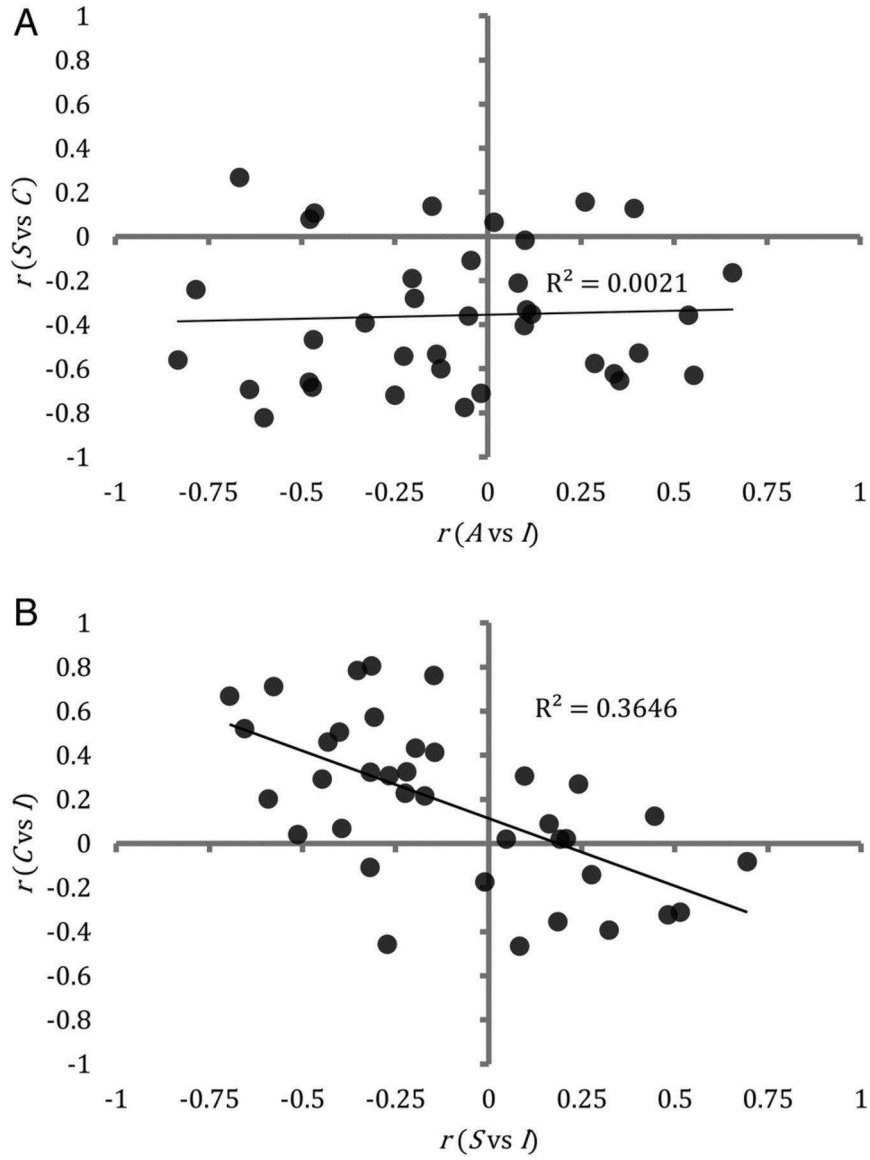


FIGURE 4.1: Scatterplots showing trends in the ratings of individual participants. Each point represents data from one participant: (A) the extent to which a participant tended to be attracted to women whom he judged to be likely to have a sexually transmitted infection (horizontal axis) had no influence on the extent to which he intended to use condoms with women he was willing to have sex with. (B) The extent to which a participant tended to be more willing to have sex with women whom he judged to be more likely to have asexually transmitted infection (horizontal axis) was significantly associated with his tendency to have lower condom use intentions towards those high-risk women (R^2=0.3646, df=49, p<0.0001).

4.4 Discussion

This study suggests that there is a strong correlation between perceived attractiveness and condom use intentions in heterosexual men. Participants are more willing to have sex with attractive women, but are less inclined to use condoms when they do so. Agocha et al. [Agocha and Cooper (1999)] found that male participants perceived women of high attractiveness as less risky and reported that they were less likely to discuss risk-relevant

topics with them. Conceivably, such men might believe that attractive women take care of themselves more than less attractive women do, and therefore that they are healthier and pose less of a health risk, legitimising their reduced condom use intentions. However, this hypothesis is undermined by Dijkstra el al.'s finding [Dijkstra et al. (2000)] that participants perceived highly attractive women to be more promiscuous and more likely to have an STI than less attractive women. Conversely, Epstein et al. [Epstein et al. (2007)] did not find a significant effect of perceived attractiveness on condomless sex intentions or perceived STI likelihood.

It seems possible that these diverse findings stem from genuine diversity in the male population. The current study found no overall relationship between judgements of STI likelihood and judgements of attractiveness. On average, men are not more attracted to women they judge to be at lower risk of STI. Instead, participants varied significantly in this respect, with some men significantly more attracted to women they judged to be free of STIs and some men significantly more attracted to women that they judged to be more likely to have an STI. If condom use intentions in men reflect their judgements of STI risk, then we might expect these intentions to differ along this risk-seeking/safe-seeking dimension. This is, however, not the case. Men who are more attracted to 'riskier' women are just as disinclined to wear a condom when they have sex with these women as men who are more attracted to 'safer' women. This leads to behaviour that appears irrational from the perspective of avoiding infection: men attracted to riskier women are more inclined to use condoms with the safer women who they are less attracted to, rather than the risky women who they are more willing to have sex with. This underlines the fact that people are often fully aware of the 'rational' responses (in a health promotion sense) but their actual behaviour does not necessarily follow suit [Ingham (1994)].

The tendency of participants to have reduced condom use intentions towards women with whom they are willing to have sex is surprising in the light of their judgement that a greater number of men like themselves would be willing to have condomless sex with these women, which implies that these women are at high risk of STIs. This observation did not translate into higher perceived risk, either in terms of increased overall condom use intentions towards more 'attractive' women or increased overall expectations of infection in 'attractive' women. This finding agrees with Fishbein et. al [Fishbein et al. (2004)], who found that risk information about a partner is sometimes ignored when the partner is attractive. Previous studies on this concept [Downing-Matibag and Geisinger (2009)] refer to the idea that people who under normal circumstances would take the necessary precautions against STIs might make poor judgments because of high levels of sexual arousal or alcohol use [Aguinaldo and Myers (2008)]. Additionally, there is plenty of evidence that participants across a variety of populations [Herrmann et al. (2014, 2015)] reliably indicated that they would be less likely to use immediately available condoms with those whom they most want to have sex with (versus those whom they least want to have sex with) [Herrmann et al. (2016)]. Moreover, the fact

that people often underestimate their personal probability of facing unpleasant events or outcomes (such as contracting an STI) could be interpreted in terms of unrealistic optimism [McKenna (1993)] and should be considered when designing a sex education intervention.

This study also sheds some light on the sexual risk taking of men based on their own perceived attractiveness. Men who judged themselves to be more attractive were less likely to intend to use a condom, and also estimated higher rates of condomless sex in men like themselves. This is unlikely to be due to these men having had more sexual experiences than men who are less confident of their attractiveness, since reporting a high number of sexual partners was associated with higher condom use intentions. Alternatively, attractive men may feel that they can influence their partner not to use a condom to a greater extent than less attractive men, who might be more worried that if their partner does not agree to condom use, they might not have a high chance of success with them or other women.

People form beliefs about STI risk during first encounters [Schmalzle et al. (2011)]. These judgements can be made within milliseconds [Renner et al. (2012)], and they are based on a wide variety of factors [Masaro et al. (2008)]. However, prior to this study, the influence on condom use intentions of participants' confidence in their judgements had not been thoroughly investigated. Participant confidence in their ability to judge whether a potential sexual partner had an STI on the basis of appearance was found to be significantly positively correlated with participants' tendency to rate women as less attractive and as more likely to have an STI, and with lower condom use intentions in themselves and men like themselves, and higher self-perceived attractiveness.

Condom use intentions were positively correlated with reported lifetime condom use, which suggests that participants responded to the hypothetical survey scenarios in a manner that reflected to some extent their real sexual behaviour.

Although we might have expected to find little variability in participants' ratings in a study with strong normative demand characteristics (for example, participants might feel that they are expected to use condoms when they have sex with women), the data revealed a wide variety of behaviour and intentions, organised around strong trends and patterns despite the relatively small sample. Moreover, men varied considerably in their attitudes to sexual behaviour, condom use and risk. This suggests that tailored sex education interventions, to target particular groups of people might be useful; for example, a message that is appropriate for men who report that they are attracted to women who are likely to be free from infection may not be effective for men who are attracted to women that they believe are more likely to have an STI (see Figure 4.1A and Figure 4.1B). More generally, it may be profitable to explore interventions that target the tensions between some of the beliefs exhibited by the participants here; for instance, the fact that participants believed that many men like themselves would most

like to have unprotected sex with the kind of women that the participants themselves find attractive. This intervention could take the form of a computer game, which adapts its content based on the target group or individual. As younger people are very familiar with computer and video game playing, they may find it easier to engage with this kind of sex education intervention and, therefore, they could better understand the risks and their misconceptions [Dondlinger (2007)]. Education through games can be effective as it is predominantly the player who directs activity and therefore the learners are involved in the learning process, in contrast with traditional education, which suggests a teacher-centred approach where learners are relatively passive.

Future research could also investigate whether individual differences in variables known to influence risk taking, such as sexual sensation seeking [Kalichman and Rompa (1995)] and sexual excitation/inhibition [Bancroft et al. (2009)], might mediate the relationship between attractiveness and condom use intentions.

Limitations

Participants completed the study in the presence of a female researcher which may have influenced their responses as has been shown in previous studies [Schroder et al. (2003)]. Future studies should control for this possible confounding effect. Also, the degree to which participants were sexually aroused was not recorded during the study. Sexual arousal could dramatically influence their condom use intentions [Ariely and Loewenstein (2006)]. Another limitation was the small and relatively homogeneous sample; however, 51 men and 20 stimulus women provided over 1000 data points for each measure. Finally, participants' reported condom use intentions in this study may or may not resemble their actual usual condom use behaviour since condom use behaviour may not correlate highly with condom use intentions [Sheeran and Orbell (1998)] due to the influence of contextual factors such as alcohol.

Notwithstanding these limitations, this study is the first to explore the relationship between perceived attractiveness and condom use intentions in heterosexual men, including their self-ratings of attractiveness and previous sexual experiences.

Conclusions

In summary, this study extends the literature by investigating the association between own perceived attractiveness, sex and condom use intentions. Additionally, the associations between age, sex life satisfaction, STI history, reported condom use with sex, and condom use intentions were explored. Male perceptions of attractiveness influence their condom use intentions; such risk biases could profitably be discussed during sex and relationships education sessions in educational settings.

Contributors:

AE led the study design, conducted the research and prepared early drafts of the article. SB, CAG and RI helped with the design of the study. SB and NS helped with the statistical analyses. All authors read and commented on drafts of the article and approved the final version.

Chapter 5

Does Attractiveness Influence Condom Use Intentions in Heterosexual Women? An Experimental Study

5.1 Introduction

In Chapter 4 a strong correlation between the perceived facial attractiveness of women and the condom use intentions of heterosexual men was presented. Participants in this study were more interested in having sex with more attractive women, but they also reported lower condom use intentions towards the women that they found more attractive. Additionally, condom use intention was higher when participants estimated that it was more likely that women had an STI. Women that were rated as less attractive were also rated as more likely to have an STI. Further, the more confident participants were in their judgements or the more attractive they judged themselves to be, the lower their condom use intentions were overall.

Sparling and Cramer [Sparling and Cramer (2015)] found that participants showed greater risk-taking intentions with hypothetical partners they had rated as more appealing. However, this study did not address the effect of one's own perceived attractiveness on judgements of risk and attraction. Considering participants' self-rated attractiveness when analysing condom use intentions could be useful, because self-perceived attractiveness may influence sexual preferences [Little et al. (2001)], perceived STI risk [Dijkstra et al. (2000)], and also mating decisions, as individuals tend to choose partners who physically resemble themselves and/or appear to have similar facial features [Little et al. (2006)]. In Chapter 4 the findings indicated that men who judged themselves to be

more attractive reported lower condom use intentions overall and also estimated higher rates of condomless sex amongst "men like themselves". This observation is associated with research related to the Information-Motivation-Behavioural Skills model [Fisher and Fisher (2002)], which suggests that people's perceptions of condom use norms in their own social group relate to their own condom use intentions. It is worth determining whether the same is true among women, particularly since heterosexual women, as receptive partners, are at greater risk for STI/HIV transmission, [Hernandez et al. (2006)].

The current study investigated how heterosexual women's perception of men's facial attractiveness was associated with their perception of STI risk and their willingness to have condomless sex. Similar work by Lennon and Kenny [Lennon and Kenny (2013)] reported that women's physical attractiveness ratings of men were a strong positive predictor of their willingness to have unprotected sex, even when they believed that attractive men were more likely to have an STI. Women reported higher willingness to have sex with attractive partners, despite any potential risk to their sexual health. As an alternative to simple ratings of attractiveness and willingness to have sex, Rupp et al. [Rupp et al. (2009a)] used fMRI techniques to measure the brain activity of twelve single heterosexual women, none of whom was using any hormonal contraception, while they viewed photographs of male faces. These stimuli were paired with information regarding the potential health risk posed by each man as a sexual partner, operationalised as the number of sexual partners and frequency of condom use. Women reported that they would be more likely to have sex with low-risk men rather than high-risk men. However, in a similar study from the same research group [Rupp et al. (2009b)], the female participants judged men with masculinised faces to be both riskier and more attractive than men with feminised faces. Therefore, women want to have sex with low risk men, but they also want to have sex with more attractive men, even though they also believe more attractive men to be higher risk.

Although these studies give some insight into the relationships between facial attractiveness, perceived risk, and condom use intentions, the findings have not been entirely consistent and have not considered the possible impact of demographic variables and sexual histories of the raters. The current study extended research in this area by eliciting women's condom use intentions towards 20 men and evaluating these, not only with respect to the perceived attractiveness of the men, but also the participants' perceptions of their own attractiveness, their own sexual history, including their typical condom use behaviour, and their perceptions of their peers' (other women's) normative condom use intentions.

Finally, in order to consider the possible influence of demographics and sexual experience on condom use intentions, the effects of participant age, sexual satisfaction, number of sexual partners and age of sexual debut should be explored. These variables indicated interesting correlations for heterosexual men [Eleftheriou et al. (2016)] and they should

also be investigated for women, as they may also initiate condom use conversations. The current study also aimed to explore the deployment of condom use resistance tactics [Davis et al. (2014)] as another factor to indicate sexual risk taking in our sample. Wegner et al [Wegner et al. (2017)] found that heterosexual women who endorsed condom use resistance tactics were more likely to see themselves as lower risk for STIs, while simultaneously objectively reporting greater incidence of infection in their history. This is well aligned with other past research which has also indicated that perceptions about condoms and their use strongly predict consistency of condom use [Crosby et al. (2013)].

The primary purpose of the current study was to expand our understanding of the relationship between perceived attractiveness and condom use intentions in heterosexual women and to explore possible associations between perceived attractiveness, demographics, sexual history, perceived sexual health status and condom use resistance tactics. We sought to address the following research questions: 1. Does the perceived attractiveness of a potential sexual partner affect sex and/or condom use intentions? 2. Does a participant's own perceived attractiveness affect their sex and/or condom use intentions? 3. Do demographic or sexual experience variables predict condom use intentions?

5.2 Methods

Participants

Data were collected online between February and April 2017. Women in the United Kingdom were recruited via social media (Facebook, Twitter), posters at the University of Southampton and on community advertisement boards, and advertisements on the University's online participant recruitment site (eFolio). Women in Canada were recruited from the University of Guelph, using an advertisement posted on the course website for a variety of first and second year courses. Potential participants were informed that data would be collected using questionnaires in order to investigate the influence of attractiveness on sexual attitudes and intentions. Eligible participants had to be between 18 and 69 years of age, English speaking, and identify as heterosexual female. Five hundred and seventy-four women attempted the questionnaire; 85 did not complete the full study, so the final analytical sample was 489 participants.

Measures

All data were collected using an online questionnaire. A draft questionnaire was initially trialled on eight pilot study participants and was refined based on their feedback [Yardley et al. (2010)] (see also Appendix E). The final questionnaire comprised four sections: 1. Participants' demographic information and judgement of their own attractiveness, 2. Information regarding the participant's own sexual experience and safer sex practices,

3. Five judgements of each of twenty men using a single full frontal facial photograph. The order of the 100 test items in section 3 was fully randomised for each participant.
4. The Condom Use Resistance Scale.

In the remainder of the paper, we use a series of single-letter labels to identify key variables associated with the six categories of questionnaire items introduced in parentheses on their first mention below.

Demographics reporting and own attractiveness ratings

Participants were asked about their age, ethnicity, and occupation, and then asked to rate their own attractiveness (O) on a scale from 0 to 100, with 0 indicating 'very unattractive' and 100 indicating 'very attractive'.

Sexuality Variables

Participants' sexual satisfaction was assessed using the following item: "Thinking about your sex life in the last year, how much do you agree or disagree with the following statement: 'I feel satisfied with my sex life' ". Response options ranged from 1 (strongly agree) to 5 (strongly disagree).

Participants also indicated whether they were attracted to men, women, neither, or both, their current relationship status, and their number of lifetime sexual partners. Four further yes/no questions were asked: "As far as you know, have you ever had an STI?", "As far as you know, do you currently have an STI?", "As far as you know, are you allergic or sensitive to latex, non-latex condoms and/or lubricants?" and "Have you used a condom the last time you had sex?" Finally, participants were asked: "Which one of the following percentages describes better the proportion of occasions of intercourse you have not used a condom in your lifetime?", "Which one of the following percentages describes better the proportion of occasions of intercourse you have not used a condom in the past six months?" and "How easy would it be for you to identify whether a man has an STI, without asking?". Answers ranged from 0% to 100%, and were grouped into six intervals: 0-10%, 11-30%, 31-50%, 51-70%, 71-90%, and 91-100%.

Ratings of facial photographs

Participants were asked to provide five ratings for each of 20 men on the basis of a single photograph of the man's face taken from the Psychological Image Collection at Stirling (PICS) database [PICS (2014)]: "Please rate the attractiveness of the following man" (A); "If you were single, how likely would you be to have sex with this man should the opportunity arise?" (S); "If you were single and you were to have sex with this man, how likely is it that you would use a condom?" (C); "Out of 100 women like you, how many would have condomless sex with this man should the opportunity arise?" (M); and "How likely is this man to have an STI?" (I). Participants indicated their answer to each question by moving a slider between 0 and 100. These 100 items were presented in fully

randomised order, i.e., the five questions regarding a particular man were not presented in a particular order and, similarly, the twenty questions regarding a particular rating (e.g., attractiveness) were not presented in a particular order. Prior to commencing the task, a simultaneous presentation of all 20 faces was shown to enable participants to anchor their judgements.

Stimuli selection and procedures

The Psychological Image Collection at Stirling (PICS) database [PICS (2014)] includes various datasets. The dataset "Aberdeen" was used for this study, which includes 687 colour faces from Ian Craw at Aberdeen. The twenty pictures used for this study were chosen at random to avoid biases.

Condom Use Resistance Tactics Scale

The Condom Use Resistance Tactics Scale (T) has obtained strong evidence of reliability and validity [Davis et al. (2014)]. Thirty response items were used in order to answer the question "Since the age of 14, how many times have you successfully avoided using a condom with a man who wanted to use one by". Example items include "Getting him so sexually excited that he agreed to have sex without a condom" and "Telling him how upset you would be if you did not have sex because you did not have a condom". The items describe a variety of resistance tactics and can be categorised into ten subscales, each with three items: Reassurance (e.g., "Reassuring him that you were 'clean' so that he would have sex without a condom", α=0.80), Seduction (e.g., "Getting him so sexually excited that he agreed to have sex without a condom", α=0.89), Sensitivity (e.g., "Telling him you didn't want to use a condom because sex doesn't feel as good with one on", α=0.92), Direct Request (e.g., "Asking him to not use a condom during sex", α=0.90), Relationship and Trust (e.g., "Telling him that you trusted each other so that he would have sex without a condom", α=0.82), Emotional Consequences (e.g., "Telling him how angry you would be if he insisted on using a condom", α=0.64), Deception (e.g., "Pretending that you had been tested and did not have any STDs", α=0.73), Condom Sabotage (e.g., "Agreeing to use a condom but intentionally breaking the condom when putting it on", α=0.90), Withholding Sex (e.g., "Refusing to have sex with him if you had to use a condom", α=0.98), and Physical Threat (e.g., "Preventing him from getting a condom by staying on top of him", α not available as two of the three elements were not endorsed by participants).

Procedure

After providing electronic informed consent, each participant completed the self-administered online questionnaire (taking between 25 and 30 minutes). University of Southampton psychology students and University of Guelph students enrolled in the Couple and Family Relationships course received 4 or 2 (respectively) course credits for their participation.

This protocol was approved by the Ethics Committee of the University of Southampton (Ergo ref: 25115).

Data analysis

To identify factors influencing condom use and interactions amongst them, a series of bivariate associations (Pearson's correlation coefficients) were calculated, followed by a multivariate test of associations (a repeated-measures linear mixed model).

5.3 Results

Demographics

Four hundred and eighty one heterosexual women, mean age 19.7 years old (SD=1.4, range=18-32) completed the questionnaire fully. Of these, 361 (74%) participants were Canadian, thirty-eight (8%) were British and the remainder identified as residents from various European (e.g., France), South American (e.g., Colombia), African (e.g., South Africa) and Asian (e.g., China) countries.

Sexual experience variables

In response to the statement: "I feel satisfied with my sex life", 105 (21.4%) participants agreed strongly, 197 (40.2%) agreed, 81 (16.5%) neither agreed nor disagreed, 72 (14.7%) disagreed, 21 (4.3%) disagreed strongly and 9 (1.8%) preferred not to say. Four hundred and twenty three (86.3%) participants reported that they were exclusively attracted to men, 50 (10.2%) reported that they were attracted to both men and women, 9 (1.8%) reported that they were attracted to women and 2 (0.4%) reported that they were not attracted to either men or women. Two hundred and thirty-nine (48.8%) participants were single, 231 (47.1%) were in an exclusive relationship, 7 (1.4%) were in an open relationship, 1 (0.2%) was married and 5 (1%) chose 'other'. One participant (0.2%) reported currently having an STI, and 20 (4.1%) participants reported having had an STI in the past. The majority of participants (89%) reported at least one sexual partner. Of these, the median number of lifetime sexual partners was 2 (min=1, max=30) and the median age at first sexual intercourse was 17 years old (min=12, max=23). Twenty-four (4.9%) participants reported an allergy to latex, non-latex condoms and/or lubricants. Reported rates of condomless sexual intercourse are presented in Table 5.1.

Condom Resistance Tactics

Half of the women (n=245) reported using at least one tactic. The four most frequently reported condom resistance tactics were the following: "Getting him really aroused and then starting to have sex without a condom" (n=132), "Getting him so sexually excited that he agreed to have sex without a condom" (n=81), "Reassuring him that you were

clean (i.e., did not have any STIs) so that he would have sex without a condom" (n=79) and "Telling him you didn't want to use a condom because sex doesn't feel as good with one on" (n=73).

Participants' ratings

In analysing participants' ratings, the data were considered in two ways: first, by considering the data associated with each of the male faces rated, aggregated over the participants' ratings, and, second, considering the data associated with each participant, aggregated over the men that she rated. For example, we first examined whether some men were judged to be more attractive than others on average, considering the participants as a group. This set of values is denoted by A_M (see Table 5.2 for ratings). Second, we assessed whether some participants found the set of 20 men in the study more attractive than did other participants, considering the men as a group. This set of values is denoted by A_P.

Associations between participants' ratings of the 20 men

We constructed average ratings for each man and considered relationships amongst these. The more attractive a man was judged to be on average, A_M, the more likely participants would be willing to have sex with him, S_M(r=0.987, df=478, p<0.001). Further, the more attractive a man was judged to be, A_M, the less likely women were to intend to use a condom during sex, C_M (r=-0.582, df=478, p=0.007). Consequently, average condom use intentions, C_M, tended to be lower for men that participants were, on average, more willing to have sex with, S_M(r=-0.57, df=478, p=0.009).

On average, participants judged that more women like themselves would have sex without a condom, M_M, with the men that they judged, on average, to be more attractive, A_M(r=0.992, df=478, p<0.0001), and with whom they were, on average, more willing to have sex S_M(r=0.981, df=478, p<0.0001). Consequently, where the average judgement of the number of women willing to have condomless sex with a man, M_M, was high, participants' average condom use intentions towards the man, C_M, were lower (r=-0.572, df=478, p=0.008).

However, the average perceived STI likelihood for a man, I_M, had no significant association with average condom use intentions towards him, C_M, or with his average perceived attractiveness, A_M, or with participants' average willingness to have sex with him, S_M. These bivariate associations are displayed in Table 5.3.

Overall ratings of men

For each participant, we averaged their ratings of the 20 men and evaluated relationships amongst these overall ratings. Participants who tended, overall, to rate the twenty men as more attractive, A_P, also tended to be more willing to have sex S_P(r=0.768, df=487, p<0.001) and were less willing to use a condom C_P(r=-0.157, df=487, p<0.001).

Participants who judged that women like themselves would be more willing, overall, to have condomless sex with the twenty men, M_P, also tended to believe that the twenty men had a higher likelihood of having an STI, I_P (r=0.145, df=487, p<0.001) and themselves had lower overall condom use intentions, C_P(r=-0.304, df=487, p<0.001), higher willingness to have sex, S_P(r=0.643, df=487, p<0.001) and higher judgements of attractiveness overall, A_P(r=0.556, df=487, p<0.001). Overall judgement of STI likelihood, I_P, was also positively correlated with higher overall condom use intentions, C_P(r=0.113 df=487, p<0.05).

Influence of perceived own attractiveness and ability to detect STIs

The average value for own attractiveness ratings was 67.4 (SD=20.0). The more attractive a participant judged herself to be, O_P, the more she believed that, overall, men are likely to have a STI, I_P(r =0.103, df=487, p=0.05).

Participants' confidence in their ability to detect whether a potential sexual partner had an STI without asking was significantly negatively correlated with their overall willingness to have sex, S_P(r =0.156, df=487, p=0.001), positively correlated with the likelihood of having an STI, I_P(r =0.122, df=487, p=0.007), and was also associated with overall lower condom use intentions in themselves, C_P(r=-0.218, df=487, p<0.001), and women like themselves, M_P(r=0.114, df=487, p=0.012).

Influence of age and sexual experience variables

Age did not correlate with attractiveness ratings, willingness to have sex, condom use intentions or STI likelihood. However, sexual experience variables (such as reported condom use) present significant trends. These relationships are displayed in Table 5.4.

Influence of condom resistance tactics

Of the 30 items considered, some showed significant correlations with attractiveness, sex and condom use intentions, sexual health status and own perceived attractiveness; the majority, however, did not show any strong associations. The relationships are displayed in Table 5.5.

Linear mixed model

A generalised linear mixed model (GLMM) with repeated measures was constructed in order to carry out a multivariate analysis addressing the question "What linear combination of factors best explains the variation in participants' condom use intentions across the 20 men rated?" The main benefit of a GLMM is that it enables an examination that incorporates repeated measures (in this case the ratings of the 20 men) and individual variance in participants' condom use intentions.

Participant condom use intention ratings was the outcome variable, with the repeated measures being the individual men rated. All demographic and sexual experience variables and rating variables were included as main effects. The model thus attempted to identify a single set of relationships that could account for all participants' patterns of condom use intentions.

It was found that women showed significantly higher condom use intentions with: men who they rated as less attractive ($p<0.0005$), men who they rated as less likely to carry or transmit an STI ($p<0.0005$), men with whom they were less interested in having sex ($p<0.0005$) and when they estimated that fewer of their peers would also have condomless sex with him ($p<0.0005$). Demographic and sexual experience variables did not emerge as significant predictors, except for the relationship status of the participant: women in steady relationships reported significantly lower condom use intentions ($p<0.05$).

5.4 Discussion

The results of the current study demonstrated a strong association between perceived attractiveness (of a potential partner and of self) and condom use intentions in heterosexual women. Participants were more willing to have sex with more attractive men, but were less inclined to use condoms when they do so. These findings are consistent with those of the previous study (see chapter 4) [Eleftheriou et al. (2016)] on the influence of attractiveness on condom use intentions in a heterosexual male population. The current study found no overall relationship between judgements of STI likelihood and judgements of attractiveness, as was also the case for heterosexual men in the previous study [Eleftheriou et al. (2016)]. This result was not consistent with the study by Rupp et al. [Rupp et al. (2009a)], which suggested that women have a sexual preference for high-risk men. Previous research has also highlighted the fact that people use unimportant or irrelevant factors, [Gold et al. (1992); Keller (1993)] such as personality or attractiveness to judge partners' relative safety.

It is worth noting that women showed similar response patterns as men did. Adding to this, Skakoon-Sparling and Cramer's findings [Skakoon-Sparling et al. (2016)] also suggested that, in situations where there are strong sexually visceral cues, both men and women experiencing strong sexual arousal may have lower inhibitions and exhibit riskier behaviour.

People form beliefs about STI risk during first encounters [Schmalzle et al. (2011)], that these judgements can be made within milliseconds [Renner et al. (2012)], and that they are based on a wide variety of factors [Masaro et al. (2008)]. However, prior to this study, the influence of women's confidence in their judgements on condom use intentions had not been thoroughly investigated. Participant confidence in their own ability to judge

whether a potential sexual partner is infected with an STI on the basis of appearance was significantly positively correlated with their tendency to be willing to have sex and with overall lower condom use intentions than participants with lower confidence. A similar pattern in heterosexual men's confidence in their judgements and condom use intentions was observed in the previous study [Eleftheriou et al. (2016)].

Moreover, in the current study, we found that participants reported lower condom use intentions towards men with whom they were willing to have sex. This result (which was also found for heterosexual men [Eleftheriou et al. (2016)]) was surprising when we considered that these same women also judged that a greater number of women like themselves would also be willing to have condomless sex with these men. This judgement should imply that these men were at higher risk for STI transmission, since they would presumably be engaging in more unprotected sex with more partners (other women like the rater). However, this observation did not translate into higher perceived risk in terms of increased overall condom use intentions towards more attractive men, or a correlation between attractiveness and STI likelihood. This finding agreed with Fishbein et al. [Fishbein et al. (2004)] and Williams et al. [Williams et al. (1992)], who found that risk information about a partner is sometimes ignored when the partner is attractive. Moreover, this finding also seemed more logical when we considered that each participant perceived themselves as unlikely to currently be infected with an STI (and in fact only 4% of our sample had ever been diagnosed with an STI) - thus, when a participant imagined 100 women like herself, she possibly similarly estimated that these women would also be unlikely to be an STI transmission risk [Downing-Matibag and Geisinger (2009)]. This may have led to participants failing to use this concept as a risk cue.

Understanding and considering the linkage between condom use and attractiveness allows us to improve the design of a sex education intervention, which will aim to help people recognise their misconceptions and reflect on their intentions compared to their actual behavior. It may be useful to explore interventions [Eleftheriou et al. (2017)] that target the tensions between some of the beliefs exhibited by the participants here; for instance, the fact that participants believed that many women like themselves would most like to have unprotected sex with the kind of men that the participants themselves find attractive. The fact that people often underestimate their personal probability of facing unpleasant events or outcomes could be interpreted in terms of unrealistic optimism [McKenna (1993)] and could be addressed appropriately using a sex education intervention. For example, a virtual reality game that focuses on the users and their immersion and engagement with a simulated population could potentially challenge the users' perception of invulnerability, as they face various people and scenarios that affect their health throughout the game [Zeng et al. (2017)].

Future research could investigate whether individual differences in variables known to influence risk taking, such as sexual sensation seeking [Kalichman and Rompa (1995)]

and sexual excitation/inhibition [Bancroft et al. (2009)], might mediate the relationship between attractiveness and condom use intentions.

Strengths and Limitations

The degree to which participants were sexually aroused was not recorded during the study. Sexual arousal could dramatically influence condom use intentions [Skakoon-Sparling et al. (2016)]. Moreover, the fact that some women might have been using hormonal contraception, which might affect condom use intentions [Cushman et al. (1998)], was not investigated. Women who were not exclusively attracted to men, were also included in the analysis. A one-item measure was used to rate sexual satisfaction, instead of a validated scale. Another limitation was the relatively homogeneous sample and the fact that this was primarily a student sample and their knowledge and attitudes may not generalise to other populations. However, evidence suggests that student samples do not intrinsically pose a problem for a study's external validity [Druckman and Kam (2009)] and also STIs and HIV pose a considerable and increasing health threat among young people [Milhausen et al. (2013)]. Finally, participants' reported condom use intentions in this study may or may not resemble their actual usual condom use behaviour [Sheeran and Orbell (1998)] due to the influence of contextual factors such as alcohol. On the other hand, previous research has shown evidence that condom use was related to intentions [Albarracin et al. (2001)] and therefore, intentions are worth investigating.

Notwithstanding these limitations, this study is the first to explore the relationship between perceived attractiveness and condom use intentions in heterosexual women, including their self-ratings of attractiveness, previous sexual experiences, and condom resistance tactics.

Conclusions

In summary, this is the first study that extends the literature by investigating the association between own perceived attractiveness, sexual health status, condom resistance, sex and condom use intentions in a female population. Additionally, the associations between age, sex life satisfaction, STI history, reported condom use with sex, and condom use intentions were explored. Female perceptions of attractiveness influence their condom use intentions; such risk biases could profitably be considered and discussed during sex and relationships education sessions in educational settings.

Contributorship Statement

AE led the study design, conducted the research and prepared early drafts of the article. SB, CG, SS and RI helped with the design of the study. SS also helped with the data collection at the University of Guelph. All authors read and commented upon drafts of the article, and approved the final version.

TABLE 5.1: The percentage of sexual intercourse episodes in which condoms were NOT used reported by participants excluding participants who did not respond to these questions and those who have not had sex yet) during their lifetime, during the last 6 months and the last time they had sex.

Lifetime	166	54	34	56	69	54
Past 6 Months	205	25	30	14	42	115
	Condom Used	Not Used				
Last time	240	229				

TABLE 5.2: The mean participant ratings for each male photograph (Scale 0-100). The standard deviation is shown in parentheses.

Man	A_M	C_M	I_M	M_M	S_M
1	25.2 (24.8)	87.9 (26.4)	44.5 (22.9)	18.7 (23.4)	16.1 (23.3)
2	14.9 (19.8)	90.5 (24.3)	51.1 (25.3)	14.6 (21.8)	9.0 (18.9)
3	19.4 (21.2)	88.8 (25.3)	45.8 (24.2)	16.4 (22.7)	12.9 (19.8)
4	24.6 (23.8)	88.1 (25.5)	48.7 (23.1)	19.5 (23.3)	15.1 (21.0)
5	27.1 (25.2)	88.0 (24.6)	51.6 (24.0)	19.8 (23.3)	18.4 (24.1)
6	19.3 (22.4)	89.2 (25.5)	56.6 (26.4)	16.1 (22.8)	13.3 (21.7)
7	22.3 (22.0)	88.4 (24.9)	41.2 (23.0)	17.3 (22.0)	14.8 (21.4)
8	15.7 (21.0)	89.0 (26.0)	37.0 (24.3)	13.5 (20.5)	9.3 (18.0)
9	12.6 (18.1)	89.6 (26.1)	38.6 (25.5)	12.4 (19.9)	7.7 (16.4)
10	38.6 (26.6)	87.6 (23.5)	43.1 (22.2)	25.9 (26.3)	28.2 (27.8)
11	13.5 (19.1)	88.4 (27.2)	47.6 (24.3)	12.9 (20.3)	8.4 (17.4)
12	17.3 (19.2)	88.2 (26.1)	50.4 (25.0)	15.0 (21.3)	9.9 (18.4)
13	14.0 (18.4)	88.9 (26.1)	38.1 (24.0)	13.7 (20.6)	9.3 (18.2)
14	12.7 (17.5)	88.4 (26.9)	41.7 (24.5)	12.7 (19.5)	7.8 (16.1)
15	28.0 (24.8)	87.2 (25.2)	44.1 (22.8)	19.9 (23.1)	20.5 (25.5)
16	25.8 (24.4)	87.1 (26.4)	46.5 (23.6)	19.4 (23.6)	18.8 (24.6)
17	26.8 (24.2)	85.4 (27.9)	47.5 (22.9)	20.1 (24.4)	18.0 (23.2)
18	14.2 (19.4)	87.8 (27.8)	49.9 (24.3)	13.2 (20.3)	7.3 (15.6)
19	24.0 (24.1)	88.8 (24.9)	48.0 (23.3)	17.5 (22.2)	15.1 (21.9)
20	17.8 (20.5)	89.0 (26.0)	45.3 (24.5)	15.0 (22.2)	10.2 (17.2)

TABLE 5.3: Bivariate associations between mean ratings for twenty men (df=478) of their attractiveness, A_M, condom use intentions towards them, C_M , their STI likelihood, I_M, the extent to which women like the participants would be willing to engage in condomless sex with them, M_M, and the willingness of the participants to have sex with them, S_M. Pearson's r values are shown in the upper right half of the table, Spearman's in the lower left: *=$p < 0.05$, **=$p < 0.01$, ***=$p < 0.001$

ρ/r	A_M	C_M	I_M	M_M	S_M
A_M	-	-0.582**	0.127	0.992***	0.987***
C_M	-0.663**	-	-0.040	-0.572**	-0.571**
I_M	0.168	-0.090	-	0.158	0.084
M_M	0.983***	-0.644**	0.188	-	0.981***
S_M	0.970***	-0.611**	0.084	0.962***	-

TABLE 5.4: Bivariate associations (Pearson's r) between 489 (df=487) participant demographic and sex experience variables (left column) and their mean ratings of 20 men. Significance levels are indicated: *=$p < 0.05$, **=$p < 0.01$

r	A_P	C_P	I_P	M_P	S_P
Age	0.004	0.045	-0.089	-0.063	-0.030
Satisfaction with Sex Life	-0.119**	-0.001	0.043	-0.046	-0.121**
No. Sex Partners	0.011	-0.040	-0.022	0.089	0.038
Relationship Status	-0.059	-0.116*	-0.005	-0.074	-0.051
Past STI	-0.025	0.04	0.033	0.016	-0.010
Present STI	-0.041	0.029	0.011	-0.021	-0.035
Age at First Intercourse	0.018	0.118*	-0.100*	-0.062	-0.037
Condomless Sex In Lifetime	0.012	-0.140**	0.081	0.128**	0.054
Condomless Sex In Last 6 Months	-0.055	-0.129**	0.058	0.075	-0.010
Condomless sex with more than 2 partners in the past 6 months	0.008	-0.158**	0.098*	0.119**	0.093
Condom use last time you had sex	0.066	0.062	-0.099*	-0.022	0.016
Latex allergy	-0.070	0.001	0.012	-0.009	-0.068

TABLE 5.5: Bivariate associations (Pearson's r) between 489 (df=487) condom resistance tactics factors (left column) and their mean ratings of 20 women. Significance levels are indicated: *=$p < 0.05$, **=$p < 0.01$

r	A_P	C_P	I_P	M_P	S_P	O_P
Seduction	-0.123**	0.015	0.062	0.084	0.092*	0.176**
Reassurance	-0.026	-0.011	0.046	0.037	0.083	0.086
Sensitivity	-0.010	0.000	0.000	0.039	0.039	0.066
Direct Request	-0.038	0.010	0.066	0.062	0.015	0.048
Relationship Trust	-0.075	-0.028	0.001	0.051	0.103*	0.083
Emotional Consequences	0.019	0.020	0.041	0.045	0.075	0.066
Deception	-0.052	0.037	0.069	0.057	0.028	0.017
Sabotage	-0.085	0.113*	0.136**	0.100*	0.056	-0.014
Withholding sex	-0.096*	0.127**	0.135**	0.108*	0.065	-0.010
Physical Threat	-0.113*	0.085	0.121**	0.073	-0.013	0.104*

Chapter 6

Using Computer Simulations for Investigating a Sex Education Intervention: An Exploratory Study

6.1 Introduction

Background

STIs are ongoing concerns and therefore, many strategies and intervention programs have been developed to encourage consistent and correct condom use; these interventions have met with varied levels of success [Scott-Sheldon et al. (2011)].

There are several reasons for variation in the impact of interventions. First, a "one-size-fits-all" approach is unlikely to be effective with all the intended recipients, given that they will vary in age, sexual preferences, sexual experience, and sexual attitudes [Shegog et al. (2007); Kirby and Laris (2009); Eleftheriou et al. (2016)]. Kirby and Laris [Kirby and Laris (2009)] noted that it is important for a sex education program to meet the needs of the audience, taking into account different backgrounds and community values. Recent research has shown that personality traits, as well as perceived attractiveness, can significantly affect the perception of sexual risk [Henderson et al. (2005)]. Henderson et al [Henderson et al. (2006)] demonstrated how individuals high in Sensation Seeking (SS), compared with those lower in SS, rate potential partners as more attractive and are more willing to have sex with those partners, but they feel that they are less likely to contract an STI. Results of a similar study showed that participants who were engaged in a wider range of potentially risky sexual behaviors were characterised by higher Sexual Sensation Seeking Scale (SSS) [Gutiérrez-Martínez et al. (2007)]. These results support the idea

that sex education programs may benefit from the inclusion of components aimed at teaching young people to satisfy their preferences for SSS through sexual behaviors involving minimum risk.

In addition to SSS, another measure that might be relevant is Sexual Inhibition (SI), particularly a subscale from the Sexual Inhibition/Sexual Excitation Scales (SIS/SES), which assesses sexual inhibition due to performance consequences (Sexual Inhibition Subscale 2, SIS2). In a sample of gay men, Bancroft et al [Bancroft et al. (2003)] showed that condomless anal sex was more likely among those who scored lower on sexual inhibition due to the "threat of performance consequences" (eg, threat of an STI). In samples of both heterosexual men and women, research has supported the association between scores on SIS2 and sexual risk taking behavior [Carpenter et al. (2008); Bancroft et al. (2004)].

Second, some people feel less vulnerable to STIs based on their belief that they can ascertain whether a potential partner is likely to be infected or not on the basis of the way that they look or some other superficial characteristic. It has been shown that men feel that they would be able to make judgments about other people's sexual health status based on perceived attractiveness [Thaler and Sunstein (1975); Eleftheriou et al. (2016)]. In one study, participants believed that judgments of sexual unfaithfulness could be made of the face alone, without consideration of behavioral cues [Rhodes et al. (2013)]. Hence, one main aim of sex education programs, but one that has been seldom addressed in interventions to date, should be to challenge this false sense of security.

Third, many sex education programs have been described, particularly by young people, as being "boring" or "irrelevant" to their needs [Bouris et al. (2016)]. Carswell et al [Carswell et al. (2012)] emphasised the importance of web-based sex education interventions, pointing out how attractive they are for young people, as they offer a confidential and convenient medium for accessing health information, avoiding the embarrassment of discussions with teachers and health providers, and overcoming potential boredom by using an interesting game format. DeSmet et al [DeSmet et al. (2015)] and D'Cruz et al [D'Cruz et al. (2015)] highlighted the importance of certain game design features that should be considered when developing a game for sex education, such as individual tailoring, goal-setting, narrative or story, audiovisual effects, interactivity, challenge on different levels, rewards, and immediate feedback.

Bearing in mind these three issues, one direction in which sexual health interventions could profitably develop involves the use of serious games. There has been some previous research exploring the use of games for sex education (see Chapter 2). Although previous studies have suggested potential positive benefits of serious games in health education, very little research has been carried out to investigate the influence of computer simulations for sex education specifically. As it is possible that the benefits of such games will vary according to age [Boulos et al. (2015)], gender [Bouris et al. (2016)], and

sexual attitudes [Eleftheriou et al. (2016)], it would be useful to investigate the possible impact of these variables.

Aim of This Study

The primary purpose of this study was to explore the potential of computer simulation as a serious game for sex education and how the effects of a serious game might be moderated by personality traits, age, and gender. The research questions were (1) Do gender, age, and personality traits influence levels of confidence in evaluating sexual risk? (2) Does a simulation in the form of a serious game influence participants' confidence regarding the assessment of sexual risk? and (3) Do gender, age, and personality traits influence the impact of the serious game in altering participants' confidence in evaluating sexual risks?

6.2 Methods

Sample and Recruitment

Men and women in Southampton and surrounding areas were recruited via social media (Facebook, Twitter), posters at the University, and community advertisement boards. Potential participants were informed that data would be collected using an electronic quiz in order to investigate the use of a serious game in the form of a computer simulation for sex education. The posters contained the following information: "I would like to see how you will perform in a game we have developed for sex education." Inclusion criteria were 18-30 years of age and English speaking. A total of 42 men, 22 women, and 2 participants who chose "other" for the question on gender were screened and all met the inclusion criteria.

Data were collected in May 2016. Participants with total completion time of less than 2 minutes were excluded from the experiment to remove noise from those who did not read the questions and provided random guesses. In total, 22 participants fully completed the experiment online at home, with a further 44 doing so in the lab. All participants were provided with a study information sheet and indicated electronic informed consent. The study took approximately 25 min.

Study Design

This was a web-based questionnaire study (that used between and within subject analyses). The study employed a quiz to collect data. A draft quiz was initially trialed on 6 pilot study participants and was then refined on the basis of their feedback during individual "think aloud" sessions. "Think aloud" is a commonly used protocol for usability testing of an intervention [Yardley et al. (2010)].

Measures

The final questionnaire comprised four sections: (1) demographic information, (2) the participant's sexual risk evaluations, 3 personality trait questionnaires (SSS [Kalichman and Rompa (1995)] and SIS2 of the SIS/SES - Short Form [Carpenter et al. (2011)]), and (4) the Term on the Tides quiz (see also Appendix F). The order of the 10 test questions in the quiz was fully randomised for each participant.

Demographics and Sexual Behavior

Participants were asked about their age, ethnicity, gender, and sexual orientation. Ethnicity options included white, black, Asian, mixed, and other. Gender options were "male", "female", "other", and "prefer not to say", and for sexual orientation (preference), "men", "women", "both", or "none".

Personality Traits Questionnaires

The SSS [Kalichman and Rompa (1995)] assesses the tendency to seek out varied, novel, and complex sexual experiences and the desire to take personal, physical, and social risks in order to enhance sexual sensations. A sample item is "I am interested in trying out new sexual experiences". The SSS can be used with both men and women, and shows good construct validity and internal consistency (Cronbach α=0.83 for men and Cronbach α=0.81 for women) [Kalichman and Rompa (1995)]. Questions were answered on a 4-point scale, ranging from 1 (not at all like me) to 4 (very much like me). The sums of the scores are calculated to produce a total score on SSS, with a higher score indicating higher levels of the trait.

The SIS2 assesses individual propensity to inhibit arousal because of threat of performance consequences (such as contracting an STI) [Carpenter et al. (2011)]. This scale is one of three subscales of the SIS/SES - SF. A sample item is "If I realise there is a risk of catching a sexually transmitted disease, I am unlikely to stay sexually aroused". SIS/SES-SF can be used with both men and women, shows good construct validity and test-retest reliability [Carpenter et al. (2011)]. Response options range from 1 (strongly disagree) to 4 (strongly agree); after suitable recoding, scores are summed to produce a total score, with a higher score indicating higher levels of inhibition.

Evaluation of Sexual Risk

Participants were asked to respond to the following statement: "Risks taken during unprotected sex are easy to evaluate". Response options ranged from 1 (strongly agree) to 5 (strongly disagree). This item was used as a measure of the participants' confidence in evaluating sexual risk.

Participants also rated their level of agreement with this statement: "The risk that someone takes when they have unprotected sex depends on the risk taking behavior of the other people in the sexual population". Response options ranged from 1 (strongly

agree) to 5 (strongly disagree). This item was included to assess the extent to which participants felt that they were in control of potential risky situations.

Both items were completed before (t_1), and immediately after (t_2), completion of the Term on the Tides quiz.

Game Description: Term on the Tides

The quiz concerns a cruise called Term on the Tides, developed for this study, where the user of the game is asked to answer some questions about the sexual health status of people on the cruise, at different stages of the simulation (developed in Java).

The storyboard was introduced with the following: "You embarked on a singles love cruise sailing from Mykonos down to Ibiza. The ship is full of heterosexual single men and women who are looking for easy, no-strings attached sexual encounters with each other. Passengers have not been medically examined and therefore are unaware of whether are carrying a sexually transmitted disease or not. The journey time to your destination is 1 week. The ship is fully prepared for any lengthy journey and it is well-stocked with food and supplies including an inexhaustive supply of condoms. Due to the nature of the cruise, everyone is unconcerned with forming a relationship. So whether they will choose to have sex with someone, with or without a condom, is purely based on physical appearance." The main task of the participants was to give the right answer to 10 questions or scenarios regarding the sexual health status of certain people on the cruise.

The scenarios presented in the questions were based on the responses of male participants in a previous study [Eleftheriou et al. (2016)], regarding their reported condom use intentions according to their perceptions of women's attractiveness. These responses were used in order to produce the profiles of the people in the simulation (Figure 6.1). Each person's profile had two characteristics: (1) how their condom use intentions and their judgments of STI likelihood varied with the attractiveness of a potential sexual partner, and (2) how the STI likelihood judgments of the person varied with the attractiveness of a potential sexual partner. For example, the Type A man shown in Figure 6.1 tends to use condoms less with women he finds more attractive (therefore he gets a "-" sign in the first box of his profile) and also believes that STI status is not associated with perceived attractiveness (therefore he gets a "=" in the second box of his profile). As nine different profiles could be created using combinations of the three symbols ("+", "-", "="), nine different types of men were created and several copies (clones, ie, people with similar behavior) of those were included in the simulation. The number of clones of each type used was proportional to the number of participants in the first study [Eleftheriou et al. (2016)] who fitted those types, based on their responses. In total, there were 100 men in the simulation.

A summary of attractiveness ratings given by each man in the previous study to each woman was shown to the users throughout the game (Figure 6.2). The profiles of the women were chosen in a similar way to that described above for men, with the difference being that we constructed the female profiles based on how men rated female pictures in the first study [Eleftheriou et al. (2016)]. Ten types of women were chosen and we tried to include as much variability in attractiveness and STI ratings as possible. Ten clones of each one of those profiles was included in the simulation, leading to a total of 100 simulated women.

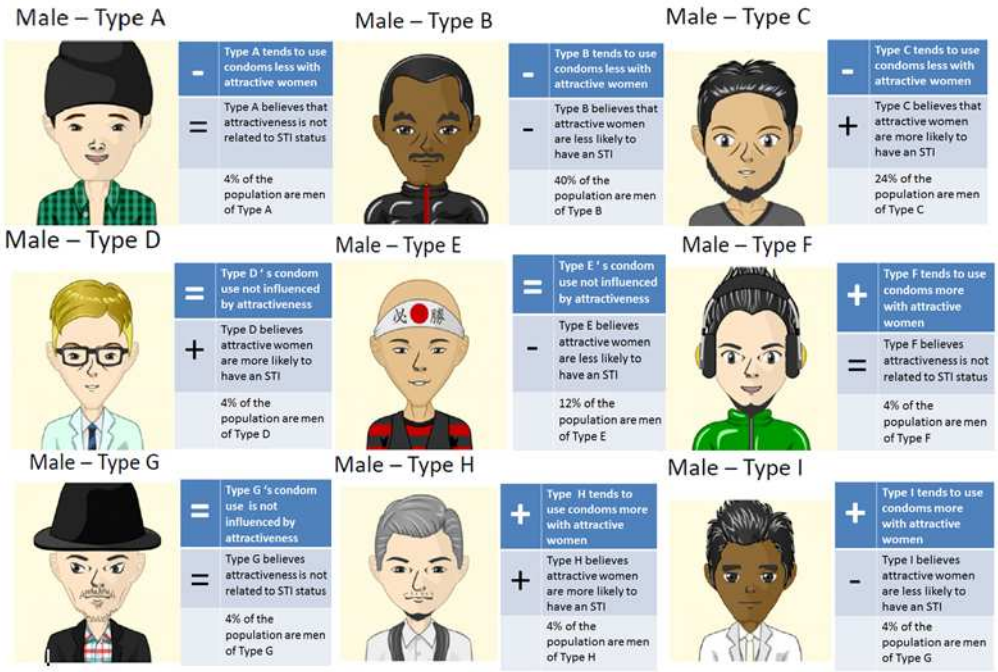


FIGURE 6.1: Male profiles in the computer simulation. Each type has two symbols to describe his personality. For the top one, a "+" indicates that a person uses condoms more with women that they find attractive, a "-" indicates that a person uses condoms less with women that they find attractive, and an "=" indicates that condom use is not affected by attractiveness. The bottom symbol represents the belief of a person with regards to the relationship between sexually transmitted infection (STI) risk and attractiveness: "+" means the person believes that attractive women are more likely to have an STI, "-" means that they believe attractive women are less likely to have an STI, and "=" means that the person believes that attractiveness is not related to STI.

There were various different framings used and each one of them clearly specified the precise situation of the people in the simulation. For example, in one, the user is asked to predict the outcome of an encounter between a man of Type A and a Type 4 woman versus an encounter between a man of Type A and a Type 7 woman (see Figure 6.4). When participants were able to correctly judge which sexual interaction was most risky, they were awarded 1 point. Ten scenarios were presented; therefore, the score for someone who did not make any correct estimates would be 0 and for someone who accurately answered all scenarios would be 10.

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

FIGURE 6.2: Attractiveness table. A "+" indicates that the specified man is attracted to the specified woman, a "-" indicates that the man specified is not attracted to the specified woman, and an "=" means that the man does not find the woman either attractive or unattractive.

The final stage of the game was the feedback provided to the users. Users watched a series of encounters between men and women in the simulated population, and they received information on how well they managed to estimate risk in each scenario, by receiving an overall score for the quiz and appropriate feedback to each question (see Figure 6.5).

In order to determine the correct answers to the questions, the computer simulation makes use of the attractiveness and condom use intentions of each person on the cruise. At the beginning of each simulation, infections are allocated to the population at random. People have the chance to meet each other and decide (1) whether to have sex or not, and, if they decide to have sex, (2) whether to have sex with or without a condom, based on the variables of attractiveness and condom use intentions specified for their type. There is a very high chance of an STI transmission when someone has condomless sex with another person who carries an infection. An average over 100 simulations was used for this quiz (see figure 6.3).

In order to account for possible biases stemming from the appearance of the images used for each type of person in the game, a random selection of pictures was allocated at the beginning of the game, from a selection of three different versions (white, black, and Asian faces).

Procedure

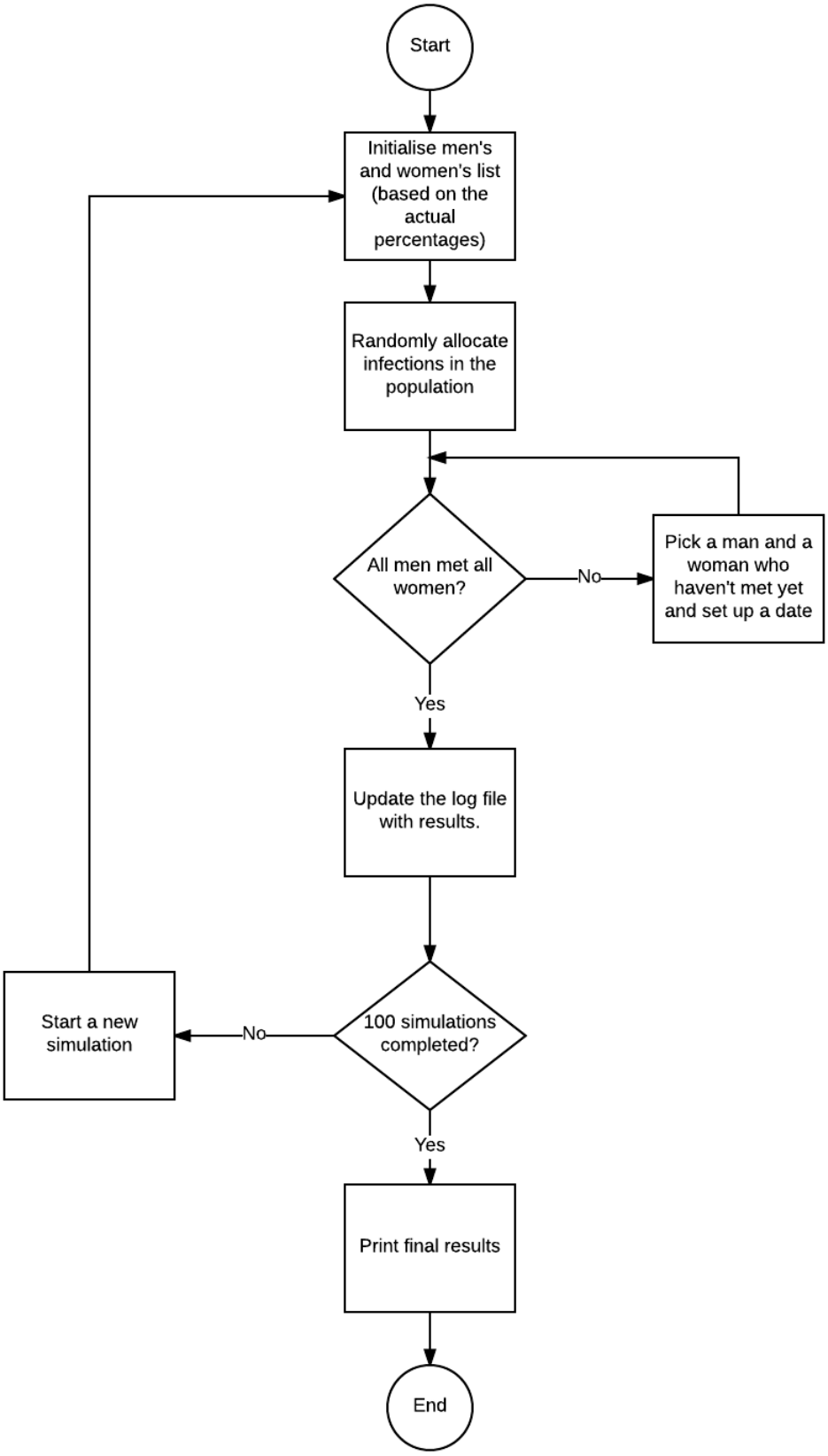


FIGURE 6.3: The algorithm for the simulation

After providing informed consent, each participant completed the self-administered questionnaires followed by the quiz. A £100 Amazon voucher was offered as an incentive to the person with the highest score on the quiz. The Ethics Committee of the University of Southampton approved the protocol (ERGO ref: 17008).

Data Analysis

To identify factors influencing the confidence ratings and the levels of change of confidence of evaluating sexual risk, a series of bivariate associations (Pearson correlation coefficients) and independent t-test were conducted between the main variables examined (age, gender, personality traits, quiz score, and confidence of evaluating sexual risk before and after the game). Matched pairs t-test was used to test whether participants' confidence in evaluating STI risk changed from t_1 to t_2, that is, before and after the simulation.

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

FIGURE 6.4: Example question: Is a type A man more likely to get an infection from a Type 4 woman or a Type 7 woman?

6.3 Results

Descriptive Statistics

Demographics

A total of 66 participants (42 men, 22 women, and 2 "other") had a mean age of 22.5 years (SD=3.3, min=18, max=29). The majority of participants were identified as white (80%, 53/66) and as heterosexual (approximately 88% [58/66]; see Table 6.1).

Personality Variables

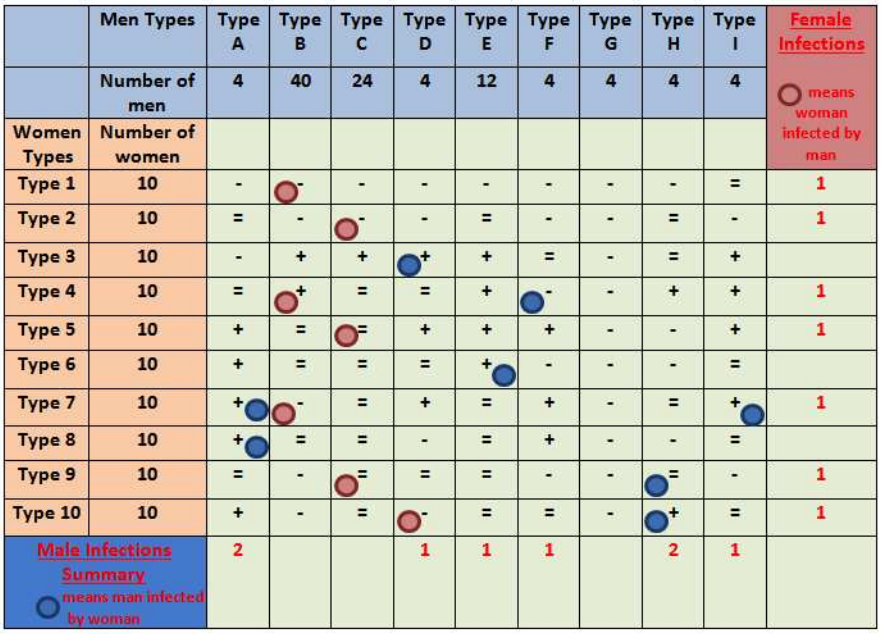


FIGURE 6.5: Feedback given to the participants.

TABLE 6.1: Sample demographics

Ethnicity	N	%
White	53	80
Black	3	5
Asian	7	10
Mixed	1	2
Other	2	3
Gender		
Men	42	64
Women	22	33
Prefer not to say	2	3
Age		
18-24	46	70
25-30	20	30

On the SSS, the mean score for men was 23.1 and for women was 22.5. Higher scores indicated greater sexual sensation seeking. There was no significant gender difference in this measure (t_{62}=0.42, ns).

On the SIS2, the higher a participant scored, the higher the propensity for sexual arousal to be reduced in the face of threats of performance consequences. The mean SIS2 score for women (12.9) was significantly higher than that for men (11.2) (t_{62}=3.05, P<0.005).

Research Question 1: Do Gender, Age, and Personality Traits Influence Levels of Confidence in Evaluating Sexual Risk?

At t_1, women believed that risk was easier to assess than did men, with the mean ratings 3.82 and 3.25, respectively (t_{62}=1.99, P=0.05); however, the belief that risk depends on the other people did not differ between men and women (t_{62}=0.19, ns).

Age showed no significant correlations with participants' confidence in evaluating risk (r=0.11, n=66, ns) or their belief that risk depends on others in the population (r=-0.05, n=66, ns).

At t_1, no significant correlations between SSS or SIS2 and participants' confidence in evaluating sexual risk (r=0.15 and r=0.10, respectively, n=66, ns) or in believing that the sexual risk depends on others in the population (r=0.15 and r=0.13, respectively, n=66, ns) were found.

Research Question 2: Does a Simulation in the Form of a Serious Game Influence Participants' Confidence Regarding the Assessment of Sexual Risk?

In response to the statement "Risks taken during unprotected sex are easy to evaluate," the mean score before the game was 3.47, and after the game it was 2.98. A matched pairs t-test showed that the change in confidence was significant (t_{63}=5.81, P<0.001). Before the intervention, 56% agreed that it was easy to evaluate risk, whereas only 44% did so after the intervention. Similarly, 24% disagreed before the game compared with 38% after the game.

In response to the statement "The risk that someone takes when they have unprotected sex depends on the risk taking behavior of the other people in the sexual population", the mean score before the game was 3.74, and after the game it was 3.77. A matched pairs t-test revealed that the difference between these mean scores was not significant (t_{65}=0.27, ns).

Research Question 3: Do Gender, Age, and Personality Traits Influence the Impact of the Serious Game in Altering Participants' Confidence in Evaluating Sexual Risks?

There was a significant gender difference in the impact of the game on confidence ratings; women had a greater reduction in confidence regarding their perceived ability to evaluate sexual risk than did men (mean change scores for men 0.30 and 0.82 for women; t_{60}=3.11, P<0.005). There were no gender differences in change scores for believing that risk depends on other people (mean change scores for men 0.05 and -0.18 for women; t_{62}=0.92, ns). Age did not correlate with either of the risk measures (for easy, r=0.12, n=64, ns, and for risk depends on others, r=-0.18, n=60, ns).

Similarly, there was no correlation between the changes in confidence ratings concerning assessment of sexual risk before and after the game, and scores on SSS or SIS2 (r=-0.06, n=64, ns and r=0.11, n=64, ns, respectively). Finally, there was also no correlation between the changes in confidence ratings concerning sexual risk depending on others

before and after the game, and scores on SSS or SIS2 (r=0.20, n=66, ns, and r=-0.03, n=66, ns, respectively).

Additional Results on Quiz Scores

The average score on the quiz across the 66 participants was 5 out of 10 (min=2, max=8; the mean for men was 5.1, and 4.8 for women; t_{62}=0.79, ns). There were no differences in scores according to age (r=-0.13, n=66, ns) or whether participants completed the study at home or in the laboratory (r=0.20, n=66, ns). Anecdotal reports after the study indicated that many participants found the game very interesting and thought provoking, but also quite challenging.

No significant correlation was found between scores on the quiz and confidence in evaluating sexual risk at t_1 (r=-0.06, n=66, ns and r=-0.07, n=66, ns, for risk for self and risk for others, respectively), or the change in confidence regarding risk-assessment between t_1 and t_2 (r=-0.01, n=64, ns and r=-0.06, n=66, ns, respectively).

6.4 Discussion

Principal Findings

This study sheds some light on the use of computer simulations as a serious game for sex education. There was a significant change in participants' confidence in evaluating sexual risk in the Term on the Tides game. Before they played the game, the majority of the participants believed that it was easy to evaluate the risks of unprotected sex. The serious game challenged individuals' confidence to evaluate risks and, as a result of this, approximately 40% of participants reported lower confidence after playing the game than they did at the t_1 baseline. The fact that overall confidence in evaluating risks reduced after the participants had engaged with the game illustrates a potentially positive public health outcome. It would be expected that lower confidence in evaluating sexual risks would lead to greater caution in sexual encounters.

Age and the personality trait variables-SSS and SIS2-were not correlated with the confidence of evaluating risk or with the level of change in confidence before and after the game. Gender, however, did have an effect, as women demonstrated a bigger shift in confidence of evaluating sexual risk than men. This finding agrees with a previous study on The Source, an alternative reality game [Bouris et al. (2016)], which suggested that women were influenced more by engaging in the game than men. Brüll et al [Brüll et al. (2016)] argued that males prefer the use of more explicit terminology to describe sexual activity in a game than females.

The difficulty of a game is a major determinant of the influence that it has on users, mainly because users get discouraged if the game is very difficult or they get bored if

it is too easy [Juul (2009); Qin et al. (2009)]. Although in this case participants were not asked directly to comment on the difficulty of the game, we observed that many reflected on the experience and discussed with the researcher what they had learned from the game. Most of them found it "challenging", and may have been motivated to continue because the person with the highest score would win an Amazon voucher.

Future research should investigate the effect of age on the influence of a sex education game using a bigger sample, as there were not enough older participants in this study to report findings regarding this variable with confidence. Additionally, the relationship status and relationship power of the participants should be investigated, as this might significantly change the way they associate with the characters of the game and therefore their evaluation of sexual risk [Pulerwitz et al. (2002)]. Moreover, different ways to enhance immersion in the game should be examined, in order to keep the interest of the users high and keep them engaged with the educational activity for as long as possible; for example, by using a virtual reality (360) simulation, which will challenge the users' sexual health knowledge and attitudes on various difficulty levels using a somewhat less artificial and sterile environment or characters [Shegog et al. (2015)]. Sexual arousal during the sex education game could also be investigated as it is a factor that influences condom use in real-life contexts [Ariely and Loewenstein (2006)].

This study is a step toward the design of tailored and relevant sex education interventions, as called for by DeSmet [DeSmet et al. (2015)] and D'Cruz [D'Cruz et al. (2015)]. Although this study includes several features recommended by these authors, for example, goal-setting, narrative, and so on, it might be profitable to explore greater interactivity and the use of audiovisual stimuli.

Strengths and Limitations

Some limitations of the study need to be acknowledged. Participants were not asked systematically about the difficulty of the game and therefore we only have anecdotal information about this variable. Also, we used a relatively small convenience sample and no behavioral outcomes or behavioral theory were assessed. Notwithstanding these limitations, this study is the first to explore the influence of computer simulations in the form of a serious game for sex education in relation to risk perception, and to investigate the impact that individual difference variables (age, gender, and personality) may have on the outcome. The results would be particularly useful for serious games designers for sex education as they provide some limited but promising insight into which aspects of games-tailoring could be beneficial and worth investigating further.

Conclusions

Computer simulations, presented in the form of a serious game, had an impact on participants' confidence in evaluating sexual risk, especially for women. This suggests that serious games developed for use in this setting should be further investigated and

perhaps gender-tailored. Working toward these goals might contribute to a reduction in STI rates. Personality traits and age were not related to the change in participants' confidence in evaluating sexual risks before and after engaging in the game.

Authors' Contributions

AE led the study design, game development, conducted the research, and prepared early drafts of the article. SB, CG, and RI helped with the design of the study and the game development. RI and AE carried out the analyses. All authors read and commented on drafts of the article, and approved the final version.

Chapter 7

Comparing the Use of Computer Simulations for Sex Education with Other Interventions: An Experimental Study

7.1 Introduction

Although previous studies have suggested potential positive benefits of engaging interventions in health education, very little research has been carried out to investigate the influence of computer simulations for sex education specifically. As it is possible that the benefits of such games will vary according to age [Boulos et al. (2015)], gender [Bouris et al. (2016)] and sexual attitudes [Eleftheriou et al. (2016)], it would be useful to investigate the potential impact of these variables.

Kashibuchi and Sakamoto [Kashibuchi and Sakamoto (2001)] recruited Japanese high school students to watch educational videos and engage in two game conditions, in order to compare their respective effectiveness. In the first game condition, participants were in the role of their own sex (e.g., male), while in the second, they played the roles of a different sex (e.g., female). The videos' contents matched the educational content of the game, i.e., the importance of independence, responsibility, discussion of intimate relationships, the importance of contraception, etc. The authors found that playing the game while envisioning oneself as a member of a different sex enhanced the students' understanding of issues related to sexual behaviour as strongly as watching educational videos. Additionally, playing the games was more effective than simply watching the videos in improving students' understanding of sexual risks.

The aim of this study was to explore the effectiveness of different modes of sex education interventions, including a computer simulation. Specifically, we aimed to assess the degree of influence of different sex education interventions on reported barriers to condom use.

Simulation, leaflets, serious games and quizzes, are types of interventions that have been investigated in the past, but it is not yet clear which vehicle is the most successful. In order to move this field ahead, it is important to investigate what makes a sex education intervention successful, and what style of engagement with sex education materials is effective in reducing barriers to condom use. Additionally, it is important to learn how factors such as immersion, interaction, mental challenge, presentation of risk statistics and scenarios improve outcomes. The current study aimed to answer the following research questions: 1) to what extent are gender, age, and/or personality traits associated with the impact of intervention on reported change in barriers to condom use? 2) does exposure to a sex education simulation influence participants' reported barriers to condom use in comparison to other types of intervention? and 3) is there an association between participants' perceptions about the effectiveness of condoms in preventing STIs and the type of sex education intervention received?

7.2 Methods

Sample and recruitment

Men and women in Southampton and surrounding areas were recruited via social media (Facebook, Twitter), posters at the University of Southampton, and community advertisement boards. University students at the University of Guelph were recruited from an undergraduate psychology course. Potential volunteers were informed that data would be collected using an electronic quiz in order to investigate the use of various sex education interventions. Inclusion criteria were being between 18 and 69 years of age and fluent English speaking.

Data were collected between August and November 2017. All participants were provided with a study information sheet and indicated electronic informed consent. The study took approximately 20 minutes. Psychology students at the University of Southampton received three research participation credits for their time and psychology students at the University of Guelph received one bonus point towards their final grade. The Ethics Committee of the University of Southampton approved the protocol (ERGO ref: 25761).

Study design

This cross-sectional study employed online questionnaires to collect data. A draft was trialled on four pilot study participants and was then refined based on their feedback,

given during individual 'think aloud' sessions. 'Think aloud' is a commonly-used protocol for usability testing of an intervention [Yardley et al. (2010)].

Participants who indicated their interest in taking part in the project completed online questionnaires; these included demographic questions (see below), two sexual behaviour questionnaires (the SIS/SES-SF [Carpenter et al. (2008)], the SSS [Kalichman and Rompa (1995)]) and the Condom Barrier Scale (CBS) [St. Lawrence et al. (1999)]. Then, participants were assigned to one of three randomly assigned conditions: a leaflet, a quiz and a computer simulation. Finally, participants answered the question: "Are people who wear a condom most of the time safe from STIs?". The CBS was again completed at the end of the session (see also Appendix G).

Demographics

Participants were asked about their age, ethnicity, gender, and sexual orientation. Ethnicity options included White, Black, Asian, mixed, and other. Gender options were 'male', 'female', 'other' and 'prefer not to say', and for sexual orientation (preference), 'men', 'women', 'both' or 'none.'

Sexual Behaviour Questionnaires

The Sexual Sensation Seeking Scale (SSS) [Kalichman and Rompa (1995)] assesses the tendency to seek out varied, novel and complex sexual experiences and the desire to take personal, physical, and social risks in order to enhance sexual sensations. A sample item is "I am interested in trying out new sexual experiences". The SSS can be used with both men and women, and shows good construct validity and internal consistency (α=0.83 for men and α=0.81 for women) [Kalichman and Rompa (1995)]. Questions were answered on a four-point scale, ranging from 1=not at all like me to 4=very much like me. The sums of the scores are calculated to produce a total score on Sexual Sensation Seeking, with a higher score indicating higher levels of the trait.

SIS/SES-SF assesses on sexual excitation factor (SES) and two inhibition-related factors: one relevant to the threat of performance failure (SIS1) and one relevant to the threat of performance consequences (SIS2). It can be used with both men and women and shows good construct validity and test re-test reliability [Carpenter et al. (2008)]. A sample item is "If I realise there is a risk of catching a sexually transmitted disease, I am unlikely to stay sexually aroused." Response options range from 1=strongly disagree to 4=strongly agree; after suitable recoding, scores are summed to produce a total score, with a higher score indicating higher levels of inhibition.

Finally, CBS is an instrument measuring perceived barriers to condom use for prevention of HIV and other sexually transmitted diseases [St. Lawrence et al. (1999)]. It can be used with both men and women and it obtained strong evidence of reliability and validity [Crosby et al. (2017)]. A sample item is "If a partner asked me to use a condom, I would

think that he didn't trust me." Response options range from 1=strongly disagree to 5=strongly agree.

Simulation

The simulation was developed in Java specifically for this study and it involved a group of 26 people who had the opportunity to meet each other and possibly have sex. At the start of the simulation, three individuals have an STI (randomly assigned) and are unaware of this fact. The 26 people are otherwise identical except that they vary in their condom use.

Individuals are labelled from A to Z in order of their tendency to want to use a condom. Individual A is **least** likely to want to use a condom during a sexual encounter. Individual Z is **most** likely to want to use a condom during a sexual encounter. In the simulation, individuals meet at random; decide whether to have sex and whether to use a condom (see Figure 7.1).

Participants watched two scenarios. In the first scenario, a condom is used only if both people want to use a condom. In the second scenario, no condom is used only if both people do not want to use a condom. At the end of each scenario, they watch a summary of the infections in the population (see Figure 7.2). Red colour indicates the people who have an STI.

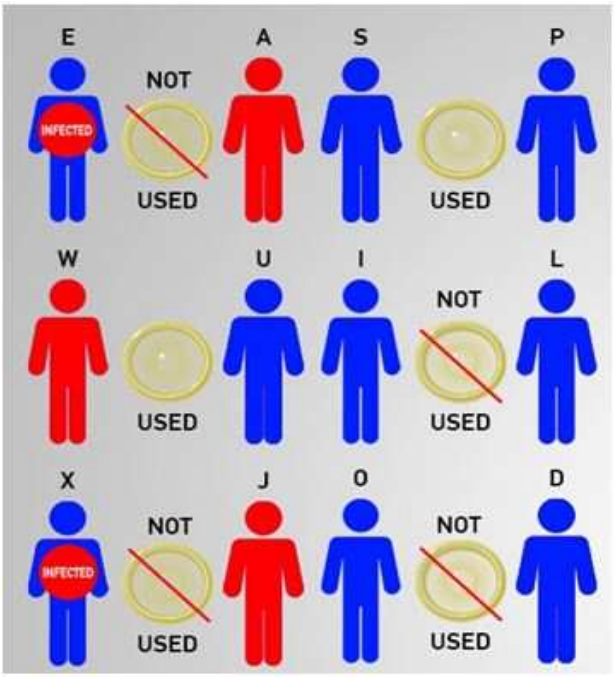


FIGURE 7.1: Example sex encounters in the simulation population

Quiz

This section concerned a population of 6 people (A, B, C, D, E and F). Before any sexual encounters between them, there is only one person who is HIV+ (person living with

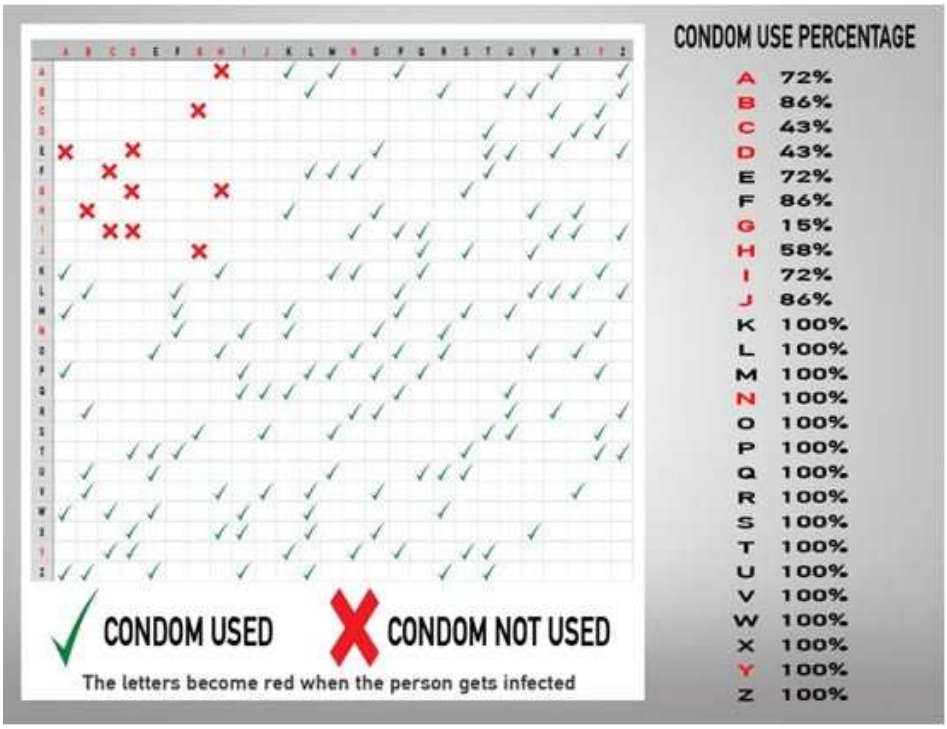


FIGURE 7.2: Summary table shown at the end of the simulation

HIV). This person is randomly assigned at the beginning of each simulation scenario. Participants need to find out who this person is, by examining the two fluid exchanges (condomless sexual encounters) shown at time T1 and T2. Please note that the number of infected people at the end of the scenario is more than one and these are shown at the bottom (Figure 7.3). Participants were tasked with identifying the person who initially had the virus in this scenario. They were asked to do this for 5 different scenarios. At the end, they received feedback on their accuracy.

Leaflet

'Open your eyes to STIs' published by the NHS [NHS (2017)], was the title of the leaflet (approximately 900 words). It provides figures and statistics of different STIs in the UK, information about the symptoms, and where to get tested. Example phrases include: "In 2014, there were more than 6,000 new cases of HIV in the UK. Men who have sex with men are most at risk of getting HIV, along with black African men and women born in sub-Saharan African countries." And "If you have sex without a condom, the odds of catching an STI are increased. You can't tell by looking at someone whether they've got an STI or not." This leaflet was chosen for this study, as it was a clear, concise and simple to understand text, recently published by the NHS on the topic of STIs.

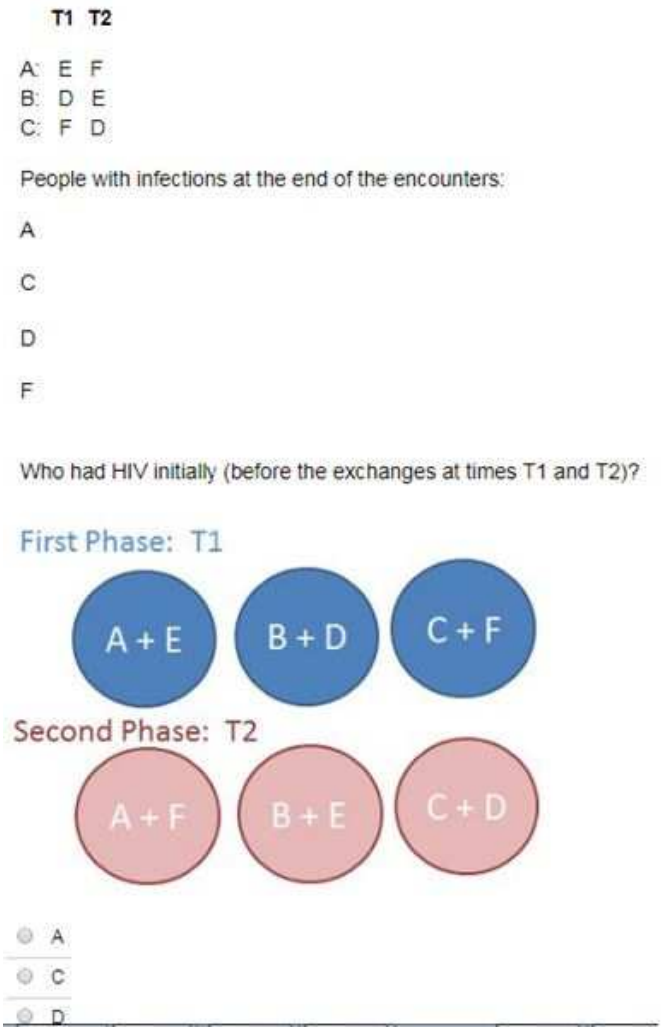


FIGURE 7.3: The encounters in the population. The first phase (T1) finds A having condomless sex with E, B with D and C with F. The second phase (T2) finds A having condomless sex with F, B with E and C with D.

7.3 Results

Data analysis

To identify factors influencing the responses to the CBS, a series of bivariate associations (Pearson's correlation coefficients) and independent t-tests were conducted between the main variables examined (such as age, gender, personality traits and condition used). Paired samples t-tests were used to compare CBS values before and after the interventions.

Demographics

The 326 participants (67 men, 258 women and 1 other) had a mean age of 20.51 years old (SD=3.80, min=18, max=51). The majority of participants identified as heterosexual

(approx. 87%) and British (approx. 69%). The rest identified as other white, Chinese, other Asian, African, Indian and mixed backgrounds.

Personality variables

On the Sexual Sensation Seeking Scale (SSS), the higher a participant scored, the higher their need for varied, novel and complex sexual experiences, and the greater their willingness to take personal, physical and social risks in order to enhance sexual sensations [Kalichman and Rompa (1995)]. The mean score for men was 25.46 (SD=5.25) and for women was 23.11 (SD=5.16). There was a significant gender difference on this measure (t=3.25, df=304, p<0.005).

On the Sexual Inhibition Scale (SIS), the higher a participant scored, the higher the propensity for sexual arousal to be reduced in the face of two types of threat: threat of performance failure (SIS1) and threat of performance consequences (SIS2). The mean SIS1 score for women was 9.51 (SD=1.84) and for men 8.85 (SD=2.18); there was a significant gender difference (t=-2.53, df=319, p<0.05). The mean SIS2 score for women was 12.64 (SD=1.99) and for men it was 11.39 (SD=2.43), indicating a significant gender difference (t=-4.41, df=306, p<0.001).

On the Sexual Excitation Scale (SES), which measures sensitivity to sexual excitation, the mean score for women was 15.31 (SD=3.00) and for men it was 16.81 (SD=3.06). There was a significant gender difference (t=3.56, df=294, p<0.001).

On the Condom Barrier Scale (CBS), the higher a participant scores on this scale, the higher are the perceived barriers to condom use. The mean CBS score before sex education intervention was, for women, 30.06 (SD=8.81) and, for men it, was 30.40 (SD=6.88), indicating no significant gender difference (t=0.29, df=320, ns).The mean CBS score after sex education intervention (irrespective of type of intervention), for women (26.42, SD=8.23) was not significantly lower than that for men (26.64, SD=6.58) (t=0.20, df=315, ns).

Considering the entire sample, there was a significant difference between the average CBS scores before (mean=30.11, SD=8.50) and after the interventions (mean=26.46, SD=7.92), (t=19.58, df=314, p<0.001). Similarly, for men, there was a significant difference between the average CBS scores before (mean=30.36, SD=7.03) and after the interventions (mean=26.64, SD=6.58), (t=7.97, df=63, p<0.001). The same result held for women with, means 30.01 (SD=8.84) and 26.38 (SD=8.24), respectively, (t=17.89, df=249, p<0.001).

Research question 1: Are gender, age, and/or personality traits associated with the impact of intervention on the change in perceived barriers to condom use?

Men did not exhibit a significantly different change in their scores on the CBS than women, with the mean ratings for men and women -3.72 (SD=3.74) and -3.62 (SD=3.20), respectively (t=-0.20, df=312, ns). The change in CBS scores before and after sex education interventions was negatively correlated with CBS before intervention (r=-0.365, n=315, p<0.0001), with SES (r=-0.155, n=288, p=0.008), SSS (r=-0.131, n=300, p=0.023) and SIS1 (r=-0.113, n=313, p<0.05). This means that the lower the participants' initial barriers to condom use, the lower their sexual excitation seeking, sexual sensation seeking and threat of performance failure were, the more they reduce condom barriers. Age and SIS2 were not significantly correlated with CBS change.

Research question 2: Does exposure to a sex education simulation influence participants' reported barriers to condom use in comparison to other styles of intervention?

In total, 132 participants (36.5%) completed the simulation intervention (18 men, 113 women and 1 other, mean age=20.24, SD=2.48), 131 (36.2%) completed the quiz (34 men and 97 women, mean age=20.49, SD=3.89) and 63 (17.4%) read the leaflet (15 men and 48 women, mean age=21.09, SD=5.47). The type of condition completed was not a significant predictor of CBS change.

The mean score of CBS change (CBS after - CBS before) for simulation was -3.93 (SD=3.11) and for all other conditions considered together -3.46 (SD=3.43). However, there was no significant difference between the two groups (t=1.23, df=313, ns). In particular, the mean score of CBS change for the quiz was -3.35 (SD=3.15) and for the leaflet it was -3.71 (SD=3.98).

Pearson correlations were also used to assess change for each intervention according to participant's scores on the SSS, SES, SIS1 and SIS2. A significant correlation of CBS change with SES (r=-0.263, n=126, p<0.005) and CBS change with SSS (r=-0.200, n=126, p<0.05), was only found for the quiz. This means that participants in the quiz condition, who were high sensation seekers and high in sexual excitation, were influenced less by the intervention. Mann Whitney U tests were also used to investigate whether the change of CBS scores was significantly larger for men (or women in the case of the leaflet) in each condition. No significant difference was found. Also, Mann Whitney U tests were used to investigate whether the change of CBS scores for a population (men or women) was significantly larger in a specific condition rather than another (binary comparisons were performed between the three conditions, e.g., whether males were doing significantly better in the simulation condition, compared to the leaflet condition). No significant difference was found either.

Research question 3: Is there an association between participants' perceptions about the effectiveness of condoms in preventing STIs and the type of sex education intervention received?

Table 7.1: Mean CBS scores change (before-after interventions)

Mean CBS change (SD)	Simulation	Quiz	Leaflet
Males	-4.56 (4.63)	-3.91 (3.15)	-2.10 (3.52)
Females	-3.81 (2.81)	-3.15 (3.14)	-4.15 (4.01)
All	-3.93 (3.11)	-3.35 (3.15)	-3.71 (3.98)

A hundred and thirty-one (40.2%) participants answered "no" to the question "Are people who wear a condom most of the time safe from STIs?", 193 (59.2%) answered "yes" and 2 (0.05%) gave no response. Fifty-six percent of men and 60% of women answered "yes". The type of condition completed was not related to the participants' perception of safety. Fifty eight percent of participants in the simulation, 64% of participants in the quiz and 54% of participants in the leaflet condition answered "yes".

7.4 Discussion

This study provides evidence of the effectiveness of interactive sexual education interventions over the traditional methods used in classrooms. The findings are in line with previous studies. [Bouris et al. (2016); Brüll et al. (2016); Eleftheriou et al. (2017)]. Participants in the current study had lower scores on a measure that assesses perceived barriers to condom use after interacting with the sex education interventions.

The change in perceived barriers was not significantly different across the three conditions. These findings indicated that the type of intervention used did not play a crucial role in influencing attitudes and behaviours. As long as people engaged with a session with a sex education purpose, they tended to report safer attitudes at post-test than at pre-test. This might be due to the fact that any of the interventions included in the current study encouraged participants to reflect on their strategies and attitudes. It did not seem that any specific intervention convinced them or frightened them more than any of the others presented. However, if several interventions are equally effective when encountered, then the interventions that are most interesting and capture the attention of participants are more likely to be effective overall, because they are likely to be encountered. It would have been interesting to have assessed engagement and/or interest at the end of the study to enable comparison across the conditions.

This finding needs to be further explored in a more diverse sample with different types of interventions and different scales of evaluating changes in condom use attitudes alongside other key outcome measures. Additionally, repeated exposure to interventions might be required to produce a significant change in attitudes or behaviour [Wouters et al. (2013)]. For example, repeated exposure to simulations that have variability built into them could be easier to achieve than repeated exposure to leaflets which could get monotonous more quickly.

In the current study, no significant gender difference was found on the condom barriers measure pre- to post-interventions, which is at odds with existing literature suggesting the importance of gender considerations for tailoring sex education interventions [Bouris et al. (2016); Eleftheriou et al. (2017)]. Tailoring based on the personality types of the participants may be more important, as SES, SSS and SIS1 were found to be significant factors influencing the outcome of the interventions. Our findings suggest that an intervention developed for teenagers in general might not be as effective for people who score higher on sexual excitation seeking, sexual sensation seeking and sexual inhibition due to the threat of performance failure.

Future research should further investigate the effect of age on the influence of a sex education intervention using a larger sample with more age variability. As there were no participants under 18 years in the current study, we are not able to report any findings regarding age differences with confidence. Future work with a large and more diverse sample is needed to support or refute the evidence of previous studies that younger people find it easier to engage with technology than older adults [Griffiths et al. (2004); Barnard et al. (2013)]. Additionally, relationship status and relationship power of participants should be investigated, as this might significantly change the way that people consider sexual risk [Pulerwitz et al. (2002)]. Future research should also ask participants to evaluate how much they enjoyed (or were engaged by) each intervention attempted, in order to directly investigate this variable in association with the intervention's efficiency.

This study is a step toward the design of tailored and relevant sex education interventions, as called for by Desmet [DeSmet et al. (2015)] and D'Cruz [D'Cruz et al. (2015)]. Although this study included several features previously recommended, for example, goal-setting (e.g., solving the quiz) and narrative (e.g., the simulation), it might be profitable to explore greater interactivity (such as VR 360 simulations) and personalisation, in order to make computer simulations a sex education candidate worth spending more time and money on.

Strengths and Limitations

Some limitations of the study need to be acknowledged. Participants' actual behavioural changes after each intervention have not been assessed/compared, as only their perceptions and attitudes towards condoms were assessed. Furthermore, a single attempt to deliver an intervention to change deep-rooted behaviours is unlikely to succeed [Carolan et al. (2018)]. Another limitation was the relatively homogeneous sample, comprising mainly university students; and their knowledge and attitudes may not generalise to other populations. Evidence from previous studies, however, suggests that student samples do not intrinsically pose a problem for a study's external validity [Druckman and Kam (2009)] and also STIs and HIV pose a considerable and increasing health threat to young people [Milhausen et al. (2013)]. Also, there was no control treatment, i.e no group receiving no intervention. Finally, participants' reported condom use attitudes in

this study may or may not resemble their actual usual condom use behaviour since condom use behaviour may not always correlate highly with condom use attitudes [Sheeran and Orbell (1998)]. Notwithstanding these limitations, this study is the first to compare the influence of computer simulations as a sex education intervention over other types of interventions, and to investigate the impact that individual difference variables (age, gender and personality) have on the outcome.

Conclusions

Computer simulations could be an effective sex education intervention to reduce people's barriers to condom use. However, they did not prove to be significantly more effective than other more traditional types of intervention. Over all the interventions, efficiency was associated with the individual's sexual sensation seeking and sexual excitation seeking.

Contributorship Statement

AE led the study design, simulation and quiz development, conducted the research, carried out the data analyses and prepared early drafts of the article. SB, CG and RI helped with the design of the study and the simulation/quiz development. SS helped with the participants' recruitment. All authors read and commented upon drafts of the article, and approved the final version.

Chapter 8

Discussion and Conclusions

The aim of this final chapter is to discuss the main findings, results, observations, experiences and lessons learned during this research work. In order to address perceptions about attractiveness and sexual risk, computer-based sex education interventions such as simulations and serious games were considered. Computer games have been proven to be an effective potential learning tool for more than three decades with great motivational benefits for young people, and represent a powerful innovation in the field of training and education [Malone (1981); Rieber (1996); Gee (2003)] (see also Chapter 2).

Therefore, the first study's (Chapter 3) purpose was to serve as a feasibility study of this work and examine whether there is any potential at all in applying computer simulations in this area, as there was little evidence of this approach being taken in previous literature. This proved to be very useful, as it not only indicated the presence of certain trends (such as the judgements of sexual risk based on attractiveness, familiarity, etc), but also the fact that there is potential for using simulations to assist people in reflecting on the risks inherent in some sexual behaviour. It also enabled the collection of rich qualitative information regarding the experience that participants had with both the questionnaire and the simulation. Their feedback was taken into account during the design and implementation of the subsequent studies. For example, participants found it difficult to concentrate on a fast-moving simulation of dots that represented a population of people. Feedback from participants led to consideration of several potential improvements: representing people with avatars instead of dots, imposing a more organised pattern of movement rather than random "bouncing", having a narrative or a story and providing feedback on what happened during the simulated interactions. The subsequent studies made use of the information gained from the feasibility study (such as designing appropriate questionnaires for data collection, developing code for simulations, working with graphics, advertising the study, recruiting participants, analysing and describing data). Although the feasibility study was a small-scale study, it had a strong impact on how efficiently and successfully the other four studies were implemented, completed, presented and published. Additionally, the feasibility study revealed that in order to

build serious game interventions we needed more data from real participants in order to calibrate a useful simulation. Therefore, it motivated the work carried out in chapters 4 and 5. The feasibility study had several limitations (see Chapter 3 for more details), but it was an important stepping stone.

Chapter 4 aimed to further investigate the association of attractiveness with condom use. This study extended the feasibility study in a few ways. Firstly, it used more stimuli and more participants than the feasibility study, in order to strengthen the validity of the results obtained. Secondly, stimuli and questions were presented in a random order to remove any biases. Thirdly, more variables were considered, such as the self-perceived attractiveness of the participant (see Chapter 4 for more details). Fourthly, it did not include any computing interventions, as it took approximately half an hour to complete and it was, therefore, decided to separate these tasks into two different studies (see Chapter 6).

Hence, after modifying the questionnaire accordingly in order to recruit women, the study was carried out again with a few important changes (see Chapter 5). Firstly, we increased the sample size in order to collect data sufficient for stronger conclusions. Secondly, we investigated what condom resistance tactics women use in order to avoid condom use. Thirdly, we recruited people from two different countries, in order to investigate the impact of cultural factors. Fourthly, the questionnaire was administered online. This study confirmed that very similar principles exist for both men and women with regards to the significant impact of perceived attractiveness on condom use intentions.

Chapter 6 employed computer simulations for a serious game that challenges the user to answer risk-related questions of a simulated population. It uses cartoons/avatars to represent the people involved, gives detailed and immediate feedback to the participants, and it was suitable for both men and women, homosexual and heterosexual, as it did not involve the user in the simulation. It was introduced as a competition with a prize, which introduced the element of gamification, motivation and fun. Since the game was available online, participants did not have to visit the lab and be observed by the researcher. The study had encouraging results with regards to the use of simulations as serious games for a sex education intervention. In particular, there was a significant change in participants' confidence in evaluating sexual risk in the Term on The Tides game. Before they played the game, the majority of the participants believed that it was easy to evaluate the risks of unprotected sex, but approximately 40% of participants reported lower confidence after playing the game. Women demonstrated a bigger reduction in confidence of evaluating sexual risk than men.

Finally, Chapter 7 aimed to compare the effect of simulations with the effect of other interventions. Its purpose was to make sure that spending time and money to develop

better, more engaging, more advanced, more appealing and latest technology simulations/serious games is actually worth it. If the effects of different interventions are approximately the same, then there is no need to choose a complex approach. There were also a few differences in the development of the simulation. Firstly, the simulation did not include any attractiveness information, in order to make it easier for the participants to follow the narrative. Avatars were replaced by abstract figures in order not to indirectly assign them features (such as attractiveness, social status, and ethnicity) other than their condom use strategy/behaviour. Additionally, it was made shorter and simpler in order not to tire and lose the focus of the participants. It showed two different versions of the simulation, in order for the participants to compare how a small change in behaviour can have a big impact on societal health. Finally, the element of competition and gamification was removed as participants were not challenged to compete with each other, due to time constraints. This study provided evidence of the effectiveness of interactive sexual education interventions, as participants lowered their barriers to condom use after interacting with the sex education interventions. However, the type of intervention used (such as simulation, quiz and leaflet) was not statistically significant with the change in barriers to condom use. It is important to observe here that if all interventions are effective when people engage with them, then the most effective one is the one people want to engage with. There was no significant gender difference, but SES, SSS and SIS1 were found to be significant factors influencing the effectiveness of the interventions.

Previous studies suggest a possible reason for the result of the comparison above. Actively engaging with the training material enhances learning [Salas et al. (1998)] regardless of whether students are participating in a simulation serious game or learning from another instructional method (such as a quiz). Active learning assists students in developing a refined mental model of the training topic [Bell and Kozlowski (2008)]. Thus, the difference in learning between the simulation game and comparison groups should be less when the comparison groups are active while learning the material.

Wrzesien and Raya [Wrzesien and Raya (2010)] assumed that the innovative and entertaining features of an intervention could distract young people from their learning, but hypothesised that learning would become possible again once the novelty of the method had worn off. This observation emphasises why it is vital to achieve a compromise between engaging the users through the features made available by the intervention and keeping their attention focused on learning [Annetta (2010)].

It has also been suggested that simulation games may be an ineffective stand-alone educational tool because people do not naturally learn complex relationships only from experience [Garris et al. (2002); Sitzmann et al. (2006)]. This is consistent with Bell et al.'s, [Bell et al. (2008)] recommendation that simulation games should be embedded in an instructional program. Moreover, learning is enhanced from simulation games,

relative to comparison groups, when users have unlimited access to the simulation game [Sitzmann (2011)].

Considering the studies together as a whole, there are a few comments to be made. Traditional approaches to sex education tend to assume an element of rational behaviour, in the sense that people will try to reduce the risks they take once these risks have been pointed out to them. The research presented in this thesis indicates, in an innovative way, that there are limits to this self-protective and careful approach, as young people report a lower likelihood of condom use with someone they find attractive, yet will often also report a belief that the same person would likely be involved in unprotected sex with other people.

There are a few possible explanations for this finding. From an evolutionary point of view, people want to reproduce with someone they find attractive as they want to produce fit offspring and maximise the quality of the genes they hand down to their children [Jokela (2009)] (even though they might put their own health at risk) [Lennon and Kenny (2013)]. Additionally, people may believe that by having sex with attractive and popular partners they enhance their social status [Blaker and Van Vugt (2014)] and they increase their own mate quality, especially if the risks involved are perceived to be avoidable and manageable [Janz and Becker (1984)]. Furthermore, raising the topic of condom use with a potential sexual partner can be embarrassing and [Mustanski et al. (2014)]. Condoms can be associated with negative aspects of sex [St. Lawrence et al. (1999)], such as pregnancy, STIs, discomfort, etc. The false impression that using a condom is not as important when the potential sexual partner is attractive is clearly self-serving. It removes the need to discuss a potentially awkward topic [Mustanski et al. (2014); Reeves et al. (2016)] that could ruin a sexual encounter. Partners, irrespective of gender, might experience sexual regret when no condom use decision is made and this is inconsistent with their morals and values [Oswalt et al. (2005)]. Additionally, according to the cognitive dissonance theory [Cooper (2011)], if people have inconsistent cognitions after they make a decision to behave in a particular way, they will experience psychological discomfort, or dissonance. This experience could potentially influence their future attitudes; future studies could also explore this variable, in order for researchers to better understand attitudes and intentions.

Whatever the underlying drivers behind the judgements revealed in these studies, the findings have important implications for sex education, as young people need to be well-informed of the different ways in which they - and others - make judgements and decisions regarding sexual risk taking, and need to be supported and encouraged to engage with the realities of their social and sexual lives.

Risk perception has long been thought to play a key role in altering health behaviour decision making and has been considered in many of the psychosocial models of health

behaviour such as the health belief model (HBM) [Janz and Becker (1984)] and the trans-theoretical model of change [Prochaska and Velicer (1997)]. In an attempt to control STI transmission, intervention efforts have primarily focused on providing risk relevant information, and promoting condom use as a means for explaining the risks involved in sexual encounters, increasing knowledge and awareness and reducing STI transmission. In particular, a successful sex education intervention, following the HBM, should aim to address certain topics and questions, such as perceived susceptibility (Am I at risk of contracting an STI?), perceived severity (How bad would the consequences be?), perceived benefits (What can I gain by changing my behaviour?), perceived barriers (What stands in the way of my behaviour change?), self-efficacy (Do I believe I can overcome barriers to make change?) and cues to action (What will give me the motivational support needed to make the final push to change?).

Adding to the above, it is important to stress that knowledge and understanding of sexual risks do not necessarily predict (or are adequate to ensure) safe sexual behaviour, such as consistent condom use. STI public health campaigns have long been based on the assumption that people underestimate their risk because they are unaware of the behaviours that put them at risk. However, Barden-O'Fallon et al. [Barden-O'Fallon et al. (2004)] conducted a randomised study of 1,601 male and female participants aged 15 to 44 years and found that HIV knowledge was not associated with HIV risk perception.

Additionally, although previous studies have suggested potential positive benefits of serious games in health education, very little research has been carried out to investigate the influence of computer simulations for sex education specifically. This is the first study that investigated how the possible benefits of such games vary according to age, gender and sexual attitudes. Computer simulations in the form of serious games had an effect on participants' confidence on evaluating sexual risk, especially for women. Age was not related to the change in participants' confidence in evaluating sexual risks before and after engaging in the game. Interventions' efficiency was associated with the individual's sexual sensation seeking and sexual excitation seeking.

Furthermore, this thesis is the first to compare the influence of computer simulations as a sex education intervention over other types of interventions, and to investigate the impact that individual difference variables (age, gender and personality) have on the outcome. Computer simulations could be an effective sex education intervention to reduce people's barriers to condom use, but in this study they did not prove to be significantly more effective than other more traditional types of intervention.

The interventions explored within this thesis aimed to use the modern tools of education (such as simulations and serious games) successfully applied in other areas, in order to tackle the challenge of misjudged sexual risk perception. They did show encouraging results when used as a sex education intervention; however, there are many aspects that

could be further explored in order to improve the experience and effectiveness of this particular type of intervention.

Firstly, the simulation could be set up differently in order to exhibit various behaviours that mimic reality from a different angle. In particular, the amount of infection in the simulated population should be able to go up and down over time rather than saturating at 100% or going to zero (perhaps by adding the idea of STI check-ups, vaccination and/or medication). This has not been implemented for this research as the aim was to keep the simulation as simple as possible in order for the participants to follow the simulated behaviour without getting tired or spending a lot of time in the laboratory. Key extensions to be explored in future research included:

- To prevent the whole population from becoming infected eventually, we could randomly remove some of them from the population and replace them by random new people every time step (like people moving away from the area or entering a long-term monogamous relationship or becoming sexually inactive, and moving into the area/leaving a long-term monogamous relationship/becoming sexually mature, etc.).
- We could introduce various levels of attractiveness, instead of the binary classification (attractive vs unattractive) used in the previous studies.
- The association between attractiveness, desirability and selectivity should be further explored. For example, a popular scenario could be that attractive people are more desirable and they are more picky, unattractive people are less desirable but they are also less picky.
- It would be interesting to explore how a simulation would behave when we have two types of men/women - those attracted to partners that they think are risky and those attracted to partners they think are safe.

The current design of the simulations explored within this thesis met the "simplest case" principle, as it is vital that the simulation's interface and storyline is designed in such a way to minimise the chance that the user will become disoriented and frustrated [Rieber (1996)].

Learners in serious games learned more, relative to those taught with conventional instruction methods, when the game was supplemented with other instruction methods, when multiple training sessions were involved, and when players worked in groups [Wouters et al. (2013)]. These considerations should be taken into account for future extensions of the work carried out in this thesis, as they were outside of its scope and timeframe. Moreover, Sitzmann [Sitzmann (2011)] concluded that for best educational outcomes, researchers should integrate the game use within a programme of instruction, aim for high level of activity on the part of the learner, provide a debriefing session after

game play and give no limitation to the time available to play the game. Hence, a possible future direction of this work would be a collaboration between the research group involved and schools/universities that could use the simulations and games developed for this thesis, to assist their sex education teaching.

It is important to emphasise that for a health behaviour-change serious game, a combination of expertise is needed for best results, such as expertise in regard to content about the health problem and experience with the behaviour-change intervention design (theory and procedures) [Baranowski et al. (2008)]. Although, initially there would be a broad divide in the understanding, background and even the languages used by these differing sets of professionals, over time, they must learn to effectively communicate and respect each other's contributions, in order for an appropriate intervention to be developed. Finally, developing a serious game is a time-consuming process, with commercial video games taking 3 or more years to develop [Baranowski et al. (2008)], costing millions of pounds. However, as the qualities of commercial computer games increase in sophistication, similarly high expectations will be set for sex education serious games. Consequently, research groups collaborating with animation, gaming and latest technology companies would have higher rates of success in swiftly developing an engaging, motivating, educational sexual health intervention.

Finally, this research successfully brought science to the public. Even from the first publication the meta-level impact of the public was tremendous. The results of this research would be particularly useful for game designers developing sex education programmes as they provide promising insight into which aspects of games-tailoring could be beneficial and worth investigating further.

Appendix A

Experiment Forms

UNIVERSITY OF Southampton

Participant Information Sheet (Version 1, 24/07/2014)

Study Title: Testing an interaction game on relationships

Researcher: Anastasia Eleftheriou, PhD student, Prof Seth Bullock,
Dr Cynthia Graham, Prof. Roger Ingham (project supervisors)

ERGO Study ID number: 11645
RGO reference number: TBC

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

Data will be collected using questionnaires in order to investigate the influence of attractiveness on sexual attitudes and intentions towards engaging in unprotected sexual intercourse. Participants will interact with simulation models which we will develop as part of this project, which will demonstrate the impact of risky sexual behaviour in the population. People will be able to see what the effects of their choices are in this simulated world and how diseases are spread according to the behaviour they exhibit.

Why have I been chosen?

I am looking for male participants, between 18-69 years old. You need to be able to take part in a 15-25 minutes session.

What will happen to me if I take part?

If you are eligible to take part in the study, a face-to face session will be arranged. At the beginning of the session participants will be asked to sign the consent statement. At the end of the session participants will receive a printed copy of the debriefing sheet.
Firstly, the participants will fill in a questionnaire about attractiveness and sexually transmitted diseases. After that the participants will interact with a game which shows how sexually transmitted diseases can spread in a population. After a few trials of using the simulation the participant will complete a further set of questions and will be invited to write a few comments on the screen about their experience.

Are there any benefits in my taking part?
By taking part in this study you will have a chance to contribute to the development of a simulation software which will be used for educational purposes. Your input is invaluable to my research.

Are there any risks involved?
There is a slight chance that taking part in the study may raise your awareness regarding sexual health and some aspects of your sexual behaviour that could put you at risk of contracting sexually transmitted infections. At the end of the study you will receive information on services providing advice and support on issues related to sexual health.

Will my participation be confidential?
All study procedures will comply with the Data Protection Act/University policy. The sessions will be conducted in private rooms (at the University of Southampton) to ensure your comfort and confidentiality.
You will be asked in a consent statement to give permission to use some verbatim quotations from the session to illustrate the data analysis. The quotations would be accompanied by information about your age but not your name or any other identifying information. You may still take part in the study if you do not agree to this.
All data (electronic and hard copy) will be securely stored in line with procedures approved by the University of Southampton. Personal information will not be released to or viewed by anyone other than researchers involved in this project. Data stored will be anonymised. Data you provide will be used only for research. They may also be submitted for publication in a scientific journal or presentation at a scientific conference, or be disseminated to general public as a part of educational activities. No identifiable data (such as your name or date of birth) will be used in any of the listed publications or activities.

What happens if I change my mind?
You can change your mind and withdraw from the study at any time, without giving a reason for your decision.

What happens if something goes wrong?
If you have any concerns in relation to the study or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee Psychology, University of Southampton, Southampton, SO17 1BJ, email fshs-rso@soton.ac.uk
or
The Head of Research Governance at the University of Southampton
02380 595058, rgoinfo@soton.ac.uk

Where can I get more information?
If you would like to find out more about the study, or have some questions that you did not find the answer to please contact Anastasia Eleftheriou at ae2n12@ston.ac.uk.

UNIVERSITY OF Southampton

CONSENT STATEMENT (*Version 1, 24/07/2014*)

Study title: Testing an interaction game on relationships.

Researcher name: Anastasia Eleftheriou, PhD student, Prof Seth Bullock,

Dr Cynthia Graham, Prof. Roger Ingham (project supervisors)

Study reference: 11645 **Ethics reference**: TBC

Please initial the boxes if you agree with the statement:

I have read and understood the information sheet (*Version 1, 24/07/2014*) and have had the opportunity to ask questions about the study. ☐

I agree to take part in this research project and agree for my data to be used for the purpose of this study ☐

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected ☐

I give my permission for anonymous quotes recorded during the session to be used, accompanied by information about my age range (e.g. 20-25) in reports written up about the study (optional). ☐

For students: If you are a student at the University of Southampton and you choose not to participate there will be no consequences to your grade. ☐

Data Protection *I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be anonymised (Data will be coded for the analysis, and only researchers named above would have access to all data).*

Name of participant (print name).....

Signature of participant.....

Date.....

If you have questions about your rights as a participant in this research, or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee,

UNIVERSITY OF Southampton

Debriefing Statement (Version no 1, 24/07/2014)

Testing an interaction game on relationships

The aim of this research was to explore users' experiences and reactions to the simulation prototype and its specific elements such as content, functions, structure, and layout. Specifically, how clear was the information and whether they understood the educational message. It was also important to collect data on facial attractiveness and whether this affects the decisions about whether to use condoms.

Your data will help our understanding on the topic and it will motivate further research.

Once again, the results of this study will not include your name or any other identifying characteristics.

If taking part in this study raised any concerns regarding your personal circumstances you can

- find more information on NHS choices website http://www.nhs.uk/Livewell/Sexualhealthtopics/Pages/Sexual-health-hub.aspx
- find your local GUM clinic http://www.nhs.uk/chq/Pages/972.aspx?CategoryID=68
- or contact your GP for further advice.

If you have any questions or concerns, please feel free to contact me at ae2n12@soton.ac.uk.

Thank you for your participation in this research.

Signature _____ Date _____

Name Anastasia Eleftheriou

If you have questions about your rights as a participant in this research, or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee, Psychology, University of Southampton, Southampton, SO17 1BJ, email fshs-rso@soton.ac.uk or the Head of Research Governance at the University of Southampton 02380 595058, rgoinfo@soton.ac.uk

Influence of Perceived Attractiveness on Sexual Behaviours.

I would like to hear what you think about the influence of perceived attractiveness on sexual health.

I am looking for

- heterosexual male participants
- age 18-69
- fluent in English.

The session will take approximately 25 minutes.

For more information, you can also e-mail me at ae2n12@soton.ac.uk.

Thanks,

Anastasia

Each participant will receive the amount of £4 by the end of the session to cover any expenses.

Appendix B

Feasibility Study Questionnaire

The full list of questionnaires used for this thesis is available in
https://bitbucket.org/ae2n12/simulations/src/master/Surveys/

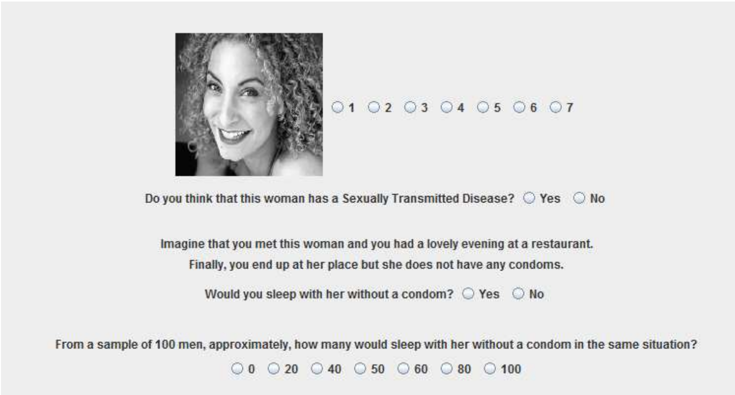
Screening questionnaire (will be completed on paper)

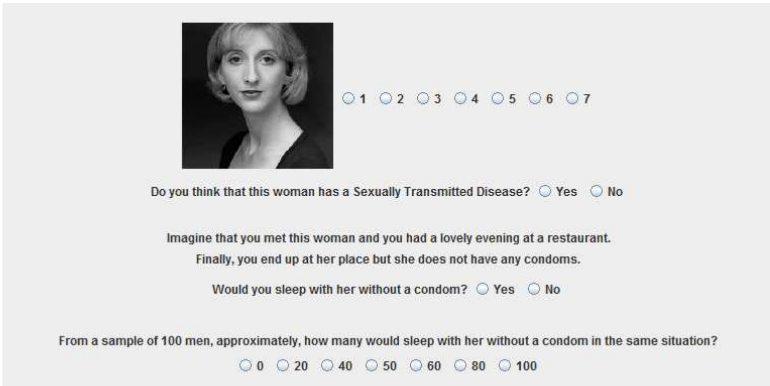
Please answer the following question about yourself. Completion of this questionnaire will take you no longer than 5 minutes.

What is your gender?	Male	Female	Other	
What is your age?				
What is the highest level of education you completed?	Diploma of Higher Education.	Bachelor's degrees.	Master's degrees.	Doctoral degrees.
What is your current occupation?				
Are you attracted by men, women, both or neither?	Men	Women	Both	Neither

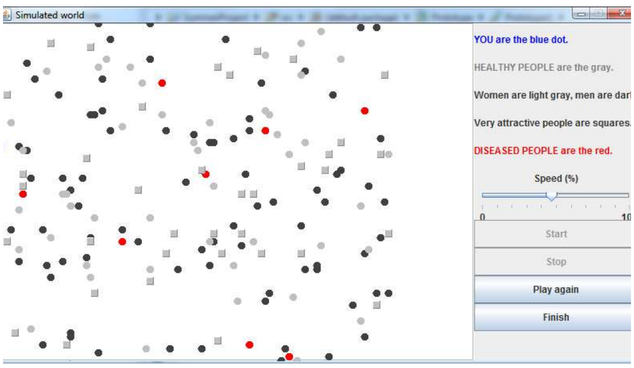
Thank you for completing this questionnaire.

The next phase of the questionnaire will be completed on the laptop using the software I have developed in Java. Screenshots of the questions and the simulation are shown below (Please note that this is not the final version of the format as instead of buttons we are thinking of using sliding Visual Analogue Scales. Also these might not be the final pictures. We have got permission to use these pictures which were used for another research project by Heather Rupp.):


1 2 3 4 5 6 7
Do you think that this woman has a Sexually Transmitted Disease? Yes No
Imagine that you met this woman and you had a lovely evening at a restaurant.
Finally, you end up at her place but she does not have any condoms.
Would you sleep with her without a condom? Yes No
From a sample of 100 men, approximately, how many would sleep with her without a condom in the same situation?
0 20 40 50 60 80 100


1 2 3 4 5 6 7
Do you think that this woman has a Sexually Transmitted Disease? Yes No
Imagine that you met this woman and you had a lovely evening at a restaurant.
Finally, you end up at her place but she does not have any condoms.
Would you sleep with her without a condom? Yes No
From a sample of 100 men, approximately, how many would sleep with her without a condom in the same situation?
0 20 40 50 60 80 100


1 2 3 4 5 6 7
Do you think that this woman has a Sexually Transmitted Disease? Yes No
Imagine that you met this woman and you had a lovely evening at a restaurant.
Finally, you end up at her place but she does not have any condoms.
Would you sleep with her without a condom? Yes No
From a sample of 100 men, approximately, how many would sleep with her without a condom in the same situation?
0 20 40 50 60 80 100
Continue


Simulated world
YOU are the blue dot.
HEALTHY PEOPLE are the gray.
Women are light gray, men are dar
Very attractive people are squares
DISEASED PEOPLE are the red.
Speed (%)
Start
Stop
Play again
Finish

Appendix C

Code Used for Simulations

Key Classes

```
import java.awt.Color;
import java.util.ArrayList;

public class Person {

        private int id;
        private World world; // Reference to the world
        private int x;  // x position
        private int y;  // y postition
        private int facing;     // Direction facing
        private Color color; //Color of the person
        private int attractiveness;
        private boolean boy;  // Is it a boy?
        public boolean[] risk = new boolean[100]; // with which of the stimuli the
                                                  // person will be risky
        public ArrayList<Person> listOfContacts;
        public ArrayList<Person> listOfAllContacts;

        public Person( World w, boolean boy, int attractiveness, int id, boolean[] risk) {
                this.id = id;
                world=w;
                y= w.size()/2;
                x=w.size()/2;
                facing = (int)(Math.random()*8.0);
                this.setBoy(boy);
                color = Color.LIGHT_GRAY;
                this.risk = risk;
                listOfContacts = new ArrayList<Person>();
                listOfAllContacts = new ArrayList<Person>();
                if (boy){
                        //Do nothing
                }
                else{
                        this.attractiveness = attractiveness;
                }

        }
```

```
// Get x position

public int getX() {
        return x;
}

// Get y position

public int getY() {
        return y;
}

public Color getColor() {
        return color;
}

public void setColor(Color c) {
        color = c;
}

public void step(boolean t) {

        // Turn at random
        double random =  Math.random();
        if ( random < 0.33 ) {
                facing = ( facing + 1 ) \% 8;
        } else if ( random < 0.66 ) {
                facing = ( facing + 7 ) \% 8;
        }

        // Take a step
        if ( facing < 3 ) {
                y = ( y - 1 + world.size() ) \% world.size();
        }
        if ( facing > 3 & facing < 7 ) {
                y = ( y + 1 ) \% world.size();
        }
        if ( facing > 1 & facing < 5 ) {
                x = ( x + 1 ) \% world.size();
        }
        if ( facing == 0 | facing > 5 ) {
                x = ( x - 1 + world.size() ) \% world.size();
        }

}

public int getAttractiveness() {

        return attractiveness;
}

public Boolean getBoy() {
        return boy;
}

public void setBoy(Boolean boy) {
        this.boy = boy;
}
```

```
        public int getID() {
                return id;
        }

}
```

Listing C.1: Person representation

```
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
import javax.swing.border.*;

public class Panel extends JPanel implements MouseMotionListener, MouseListener {

        private World world;
        private Person[] people;
        private boolean running;
        private boolean userHasAids;
        private boolean[] userRisk;
        private int womanWithMaxAttractiveness;
        private long timeUntilSTD;
        private ClockLabel l;
        private int stepCnt;
        boolean[][] menRisk;
        int[] attractiveness;
        // Constructor to set the size of the world and set up the panel.

        public Panel(int n, int maxAttractiveness, boolean[][] menRisk, int[] attractiveness) {
                world = new World(n);
                userHasAids = false;
                this.userRisk = menRisk[0];
                l = new ClockLabel();
                this.menRisk = menRisk;
                this.attractiveness = attractiveness;
                add(l);
                makeNewPeople(200);
                setBackground( Color.white );
                setBorder( new EtchedBorder() );
                addMouseListener(this);
                addMouseMotionListener(this);
                setCursor( new Cursor(Cursor.CROSSHAIR_CURSOR) );
                womanWithMaxAttractiveness = maxAttractiveness;
                stepCnt = 0;

        }

        // Method to recreate all new people

        public void makeNewPeople(int n) {
                people = new Person[n];
                boolean boy = true;
                for ( int i=0; i<n; i++ ) {
                        Person person;
                        if (i<100){
                                boy = false;
                                person = new Person(world,boy,attractiveness[i], i, menRisk[0]);
                        }else{
```

```
                        boy = true;
                        person = new Person(world,boy,7, i, menRisk[i-100]);
                }

                double random =  Math.random();
                if ( random < 0.05 ) {
                        //Diseased people
                        person.setColor(Color.YELLOW);
                }
                if ( random < 0.03 ) {
                        //Diseased people
                        person.setColor(Color.green);
                }
                if ( random < 0.01 ) {
                        //Diseased people
                        person.setColor(Color.red);
                }

                people[i] = person;
        }

        Person person = new Person(world, true, 0,100,userRisk);
        person.setColor(Color.BLUE);
        people[100] = person;
        //Just to make sure that I get at least one person with STD
        people[50].setColor(Color.red);
}

// Method to tell the mouse listener that the thread is running.

public void setRunning( boolean t ) {
        makeNewPeople(people.length);
        running = t;
        userHasAids = false;

        if ( running ) {
                setCursor( new Cursor(Cursor.DEFAULT_CURSOR) );
                setTimeUntilSTD(System.currentTimeMillis());
        } else {

                setCursor( new Cursor(Cursor.CROSSHAIR_CURSOR) );
        }
}


// Paint the grid.
public void paint(Graphics g) {

        super.paint(g);

        if (people[100].getColor() == Color.RED && userHasAids == false){
                userHasAids = true;
                JOptionPane.showMessageDialog(
                        this, "You just caught a sexually transmitted disease...");
                setTimeUntilSTD(System.currentTimeMillis() - timeUntilSTD);
                System.out.println(timeUntilSTD);
        }
        // Paint the people
        g.setColor( Color.green );
```

```
        for ( int i=0; i<people.length; i++ ) {
                Person person = people[i];
                g.setColor(person.getColor());
                if (person.getAttractiveness() == womanWithMaxAttractiveness ||
                           person.getAttractiveness() == womanWithMaxAttractiveness-1){
                        g.fillOval(5*person.getX()-5,5*person.getY()-5,10,10);
                }
                else
                        g.fill3DRect(5*person.getX()-5,5*person.getY()-5,10,10, true);
        }

        g.setColor (people[100].getColor());
        g.fillOval(5*people[100].getX()-5,5*people[100].getY()-5,20,20);
}


public void step(boolean t) {
        for ( int i=0; i<people.length; i++ ) {
                people[i].step(t);
        }

        Person[][] position = new Person[world.size()][world.size()];

        for ( int i=0; i<people.length; i++ )   {

                int X = people[i].getX();
                int Y = people[i].getY();

                if(position[X][Y] == null)
                        position[X][Y] = people[i];
                else{
                        Color firstCol = people[i].getColor();
                        if (people[i].getColor() != Color.blue  &&
                            people[i].getColor() != Color.gray  &&
                                people[i].getBoy() && !position[X][Y].getBoy() &&
                                people[i].risk[position[X][Y].getID()]){

                                if (position[X][Y].getColor() == Color.YELLOW ||
                                    position[X][Y].getColor() == Color.RED ||
                                        position[X][Y].getColor() == Color.GREEN ||
                                        position[X][Y].getColor() == Color.black){
                                if (Math.random() < 0.2){
                                        position[X][Y].setColor(Color.black);
                                        position[X][Y].listOfContacts.add(people[i]);
                                }

                                }
                                else {
                                if (firstCol == Color.YELLOW){
                                        if (Math.random() < 0.9){
                                        position[X][Y].setColor(firstCol);
                                        position[X][Y].listOfContacts.add(people[i]);
                                        }
                                        }
                                if (firstCol == Color.GREEN){
                                        if (Math.random() < 0.5){
                                        position[X][Y].setColor(firstCol);
                                        position[X][Y].listOfContacts.add(people[i]);
                                        }
```

```
                                        }
                                    if (firstCol == Color.RED){
                                        if (Math.random() < 0.4){
                                        position[X][Y].setColor(firstCol);
                                        position[X][Y].listOfContacts.add(people[i]);
                                        }
                                        }
                                    }

                                }
                                Color sndCol = position[X][Y].getColor();
                                if (position[X][Y].getColor() != Color.blue &&
                                    position[X][Y].getColor() != Color.gray &&
                                        position[X][Y].getBoy() && !people[i].getBoy() &&
                                        position[X][Y].risk[people[i].getID()]){

                                    if (people[i].getColor() == Color.YELLOW ||
                                        people[i].getColor() == Color.RED ||
                                            people[i].getColor() == Color.GREEN ||
                                            people[i].getColor() == Color.black){
                                        if (Math.random() < 0.2){
                                            people[i].setColor(Color.black);
                                            people[i].listOfContacts.add(position[X][Y]);
                                        }

                                    }
                                    else {
                                    if (sndCol == Color.YELLOW){
                                        if (Math.random() < 0.9){
                                            people[i].setColor(sndCol);
                                            people[i].listOfContacts.add(position[X][Y]);
                                        }
                                    }
                                    if (sndCol == Color.GREEN){
                                        if (Math.random() < 0.5){
                                            people[i].setColor(sndCol);
                                            people[i].listOfContacts.add(position[X][Y]);
                                        }
                                    }
                                    if (sndCol == Color.RED){
                                        if (Math.random() < 0.4){
                                            people[i].setColor(sndCol);
                                            people[i].listOfContacts.add(position[X][Y]);
                                        }
                                        }
                                    }
                                }
                            }
                        }

                        l.update((stepCnt++)/50);
                        repaint();
                }

                public Person[] getPeople(){
                        return people;
                }

                // Mouse listener methods to control drawing on the world.
```

```
        public void mouseClicked( MouseEvent e ) {
        }

        public void mousePressed( MouseEvent e ) {
                if ( !running ) {
                        repaint();
                }
        }

        public void mouseReleased( MouseEvent e ) {
        }

        public void mouseEntered( MouseEvent e ) {
        }

        public void mouseExited( MouseEvent e ) {
        }

        public void mouseDragged( MouseEvent e ) {
                if ( !running ) {
                        repaint();
                }
        }

        public void mouseMoved( MouseEvent e ) {
        }

        public long getTimeUntilSTD() {
                return timeUntilSTD;
        }

        public void setTimeUntilSTD(long timeUntilSTD) {
                this.timeUntilSTD = timeUntilSTD;
        }

        public void resetClockLabel(){
                stepCnt = 0;
        }

        class ClockLabel extends JLabel{

                public void update(int stepCnt) {
                        setText("");
                        //setText( (new Date()).getSeconds()- date + " years");
                        setText("What happened after " + stepCnt + " years...");
                }
        }
}
```

Listing C.2: Simulation Panel

```
import java.io.File;
import java.io.FileNotFoundException;
import java.io.IOException;
import java.io.PrintWriter;
import java.io.UnsupportedEncodingException;
import java.text.*;
import java.util.Calendar;
```

```
import java.util.Date;
import java.util.HashMap;
import java.util.Vector;
import java.awt.*;
import java.awt.event.*;
import java.awt.image.BufferedImage;

import javax.imageio.ImageIO;
import javax.swing.*;
import javax.swing.border.*;

import vtk.vtkDoubleArray;
import vtk.vtkGraphLayoutView;
import vtk.vtkIntArray;
import vtk.vtkLookupTable;
import vtk.vtkMutableUndirectedGraph;
import vtk.vtkNativeLibrary;
import vtk.vtkUnsignedCharArray;
import vtk.vtkVertexListIterator;
import vtk.vtkViewTheme;


public class Prototype extends JFrame implements ActionListener {

        private Panel simulationPanel;  // Display Panel
        private JPanel summaryPanel;
        private JPanel motherPanel;
        private final static String MOTHERPANEL = "MotherPanel";
        private final static String SUMMARYPANEL = "SummaryPanel";
        private CardLayout cardLayout;
        private Runner runner;                                          // Runner for thread
        private Thread thread;                                          // Thread for people
        private JButton random;                                         // New deposits button
        private JButton start;                                          // Start button
        private Person[] people;
        PrintWriter writer;
        int aids;

        /* Load VTK shared librarires (.dll) on startup, print message if not found */
        static {
                if (!vtkNativeLibrary.LoadAllNativeLibraries()) {
                        for (vtkNativeLibrary lib : vtkNativeLibrary.values()) {
                                if (!lib.IsLoaded())
                                        System.out.println(lib.GetLibraryName() + " not loaded");
                        }

                        System.out.println("Make sure the search path is correct: ");
                        System.out.println(System.getProperty("java.library.path"));
                }
                vtkNativeLibrary.DisableOutputWindow(null);
        }

        public Prototype() {

                // Add windon listener for closing
                addWindowListener(new WindowAdapter() {
                        public void windowClosing(WindowEvent e) {
                                dispose();
                                System.exit(0);
```

```
        }
});

cardLayout = new CardLayout();
this.getContentPane().setLayout(cardLayout);

String fileName = (new Date()).getTime() + "SH";

try {
        writer = new PrintWriter(fileName+".txt", "UTF-8");
} catch (FileNotFoundException e1) {
        // TODO Auto-generated catch block
        e1.printStackTrace();
} catch (UnsupportedEncodingException e1) {
        // TODO Auto-generated catch block
        e1.printStackTrace();
}

writer.println("                          SIMULATION RESULTS");
writer.println("                          Participant's code: " + fileName);
writer.println();
writer.println();
writer.println();

start = new JButton("Start");
start.addActionListener(this);


JPanel controlPanel = new JPanel();

controlPanel.setLayout( new GridLayout(12,1) );
JLabel blue = new JLabel("YOU are the big dot.");
blue.setForeground(Color.BLUE);
controlPanel.add(blue);
JLabel gray = new JLabel("HEALTHY PEOPLE are the gray.");
gray.setForeground(Color.GRAY);
controlPanel.add(gray);
JLabel gray3 = new JLabel("Very attractive people are ovals.");
gray.setForeground(Color.GRAY);
controlPanel.add(gray3);
JLabel red = new JLabel ("AIDS");
red.setForeground(Color.RED);
controlPanel.add(red);
JLabel herpes = new JLabel ("HERPES");
herpes.setForeground(Color.GREEN);
controlPanel.add(herpes);
JLabel chlamydia = new JLabel ("CHLAMYDIA");
chlamydia.setForeground(Color.ORANGE);
controlPanel.add(chlamydia);
JLabel gray2 = new JLabel("MORE THAN ONE DISEASE");
gray.setForeground(Color.BLACK);
controlPanel.add(gray2);
controlPanel.add(start);
final JButton stop = new JButton("Stop");
controlPanel.add(stop);
final JButton playAgain = new JButton("Play again");
controlPanel.add(playAgain);
playAgain.setEnabled(false);
final JButton finish = new JButton("Finish");
```

```
controlPanel.add(finish);
finish.setEnabled(false);

// Add controls and display to the main frame
motherPanel = new JPanel();

motherPanel.setLayout( new BorderLayout() );
motherPanel.add("East", controlPanel);

getContentPane().add(motherPanel, MOTHERPANEL);

initialiseSimulation();

cardLayout.show(getContentPane(), MOTHERPANEL);

//Create summary panel
                summaryPanel = new JPanel();
                ModifiedFlowLayout layout1 = new ModifiedFlowLayout();
                summaryPanel.setLayout(layout1);

                JLabel summary = new JLabel("SIMULATION COMPLETED SUCCESSFULLY!");
                summary.setFont(new Font("Serif", Font.BOLD, 28));

                summaryPanel.add(summary);
                JLabel file = new JLabel("You can read the results in the
                detailed log file produced.");
                file.setFont(new Font("Serif", Font.BOLD, 18));
                summaryPanel.add(file);
                JLabel thanks = new JLabel("Thank you very much for your time.");
                thanks.setFont(new Font("Serif", Font.BOLD, 18));
                summaryPanel.add(thanks);

                BufferedImage img = null ;
                try{
                        img = ImageIO.read(new File("src/logo.jpg"));
                }catch (IOException e){}

                Image dimg = img.getScaledInstance(250, 150, Image.SCALE_FAST);
                JLabel pic = new JLabel(new ImageIcon(dimg));

                summaryPanel.add(pic);

                BufferedImage img2 = null ;

                try{
                        img2 = ImageIO.read(new File("src/EPSRC_logo.jpg"));
                }catch (IOException e){}

                Image dimg2 = img2.getScaledInstance(250, 150, Image.SCALE_FAST);
                JLabel pic2 = new JLabel(new ImageIcon(dimg2));

                summaryPanel.add(pic2);


                JScrollPane scrollPane1 = new JScrollPane(summaryPanel);

            scrollPane1.setHorizontalScrollBarPolicy
            (JScrollPane.HORIZONTAL_SCROLLBAR_NEVER);
            scrollPane1.setVerticalScrollBarPolicy
```

```
                (JScrollPane.VERTICAL_SCROLLBAR_AS_NEEDED);
                scrollPane1.createVerticalScrollBar();
                scrollPane1.setBounds(0, 0, 610, 930);
                    scrollPane1.setViewportView(summaryPanel);

                    getContentPane().add(scrollPane1, SUMMARYPANEL);


stop.addActionListener(new ActionListener() {
        public void actionPerformed(ActionEvent e){
                people = simulationPanel.getPeople();
                simulationPanel.setRunning(false);
                runner.stop = true;
                thread.stop();
                stop.setEnabled(false);
                playAgain.setEnabled(true);
                finish.setEnabled(true);
                aids = countPeopleWithAids(people);
                writer.println("The user caught an STD at " +
                (simulationPanel.getTimeUntilSTD())/1000 + " seconds.");

        }

});

playAgain.addActionListener(new ActionListener() {
        public void actionPerformed(ActionEvent e){
                stop.setEnabled(true);
                playAgain.setEnabled(false);
                finish.setEnabled(false);
                simulationPanel.setRunning(true);
                simulationPanel.resetClockLabel();
                runner = new Runner();
                thread = new Thread(runner);
                thread.setPriority( thread.getPriority() - 1 );
                thread.start();
                start.setEnabled(false);
                random.setEnabled(false);
                simulationPanel.setTimeUntilSTD(System.currentTimeMillis());
        }

});

finish.addActionListener(new ActionListener() {
        public void actionPerformed(ActionEvent e){
                String str = "Do you want to exit the simulation? If yes,
                your results will be saved in a log file" + "\n" + "and "
                + "you won't be able to return to this screen. If you
                wish to play again, click No";
                int n = JOptionPane.showConfirmDialog(
        motherPanel, str,
        "Exit",
        JOptionPane.YES_NO_OPTION);
if (n == JOptionPane.YES_OPTION) {
        cardLayout.show(getContentPane(), SUMMARYPANEL);
        displayContactsGraph();
        displayAllContactsGraph();
} else
 {
```

```
                //Do nothing
        }
                }

        });

}


private void initialiseSimulation() {
        int maxAttractiveness = 4;
        //how risky men will be with the women there
        boolean[][] risk = new boolean[100][100];
        risk = initialiseRisk(risk);
        int[] attractiveness = new int[100];
        attractiveness = initialiseAttractiveness(attractiveness);
        simulationPanel = new Panel(100, maxAttractiveness, risk, attractiveness);
        motherPanel.add("Center",simulationPanel);
        String str = "Thank you for your answers." + "\n" + "\n"
                        + "Based on your answers, a simulated world
                        of 100 men and 100 women will launch now to
                        show you "
                    + "\n" + "what can happen in practice if
                    the risk is as you described." + "\n" + "\n"
                     + "Gray dots are healthy people and red dots
                     are people with sexually transmitted diseases."
                     + "\n" + "When people meet there is a chance
                     of having unprotected sex. When one of them
                     is red already, \n there is a "+ "chance that
                     the gray dot will become red (diseased), too."
                     + "\n" + "\n" + "The squares represent not
                     attractive people. Red squares are diseased
                     (same rules apply for diseases)." + "\n" +
                     "\n" + "You will be the blue dot (you are
                     slightly bigger than the rest)." + "\n" +
                     "You only need to start the simulation and
                     watch what will happen." + "\n" +
                         "You are expected to inform the
                         researcher before quiting. You are supposed
                         to have three runs." + "\n" +
                         "Let's see if you will manage to stay
                         healthy (i.e stay blue) until the end." ;
        JOptionPane.showMessageDialog(null, str);
}


private int[] initialiseAttractiveness(int[] attractiveness) {
        //returns an array with women attractiveness rates
        for (int i=0; i<attractiveness.length;i++){
                attractiveness[i] = 7;
        }
        for (int i=0; i<attractiveness.length/2;i++){
                attractiveness[i] = 2;
        }
        return attractiveness;
}


private boolean[][] initialiseRisk(boolean[][] risk) {
```

```
        //Each row shows the risk of each man with each woman.
    //This method initialises the RISK
                for (int i=0; i<risk.length; i++){
                        for (int j=0; j<risk.length;j++){
                                risk[i][j] = true;
                        }
                }

                return risk;
        }


        private int countPeopleWithAids(Person[] people) {
                int count = 0;
                for (int i=0; i<people.length;i++){
                        if (people[i].getColor() == Color.red){
                                count++;
                        }
                }
                return count;
        }

        public static void main(String args[]) {
                System.out.println("Starting simulation...");
                Prototype mainFrame = new Prototype();
                mainFrame.setSize(810, 450);
                mainFrame.move(100,100);
                mainFrame.setTitle("Simulated world");
                mainFrame.setVisible(true);
                mainFrame.setResizable(false);
        }

        // Listener for controls.

        public void actionPerformed( ActionEvent e ) {

                // Create the thread and update the controls.
                if ( e.getSource() == start ) {
                        simulationPanel.resetClockLabel();
                        simulationPanel.setRunning(true);
                        runner = new Runner();
                        thread = new Thread(runner);
                        thread.setPriority( thread.getPriority() - 1 );
                        thread.start();
                        start.setEnabled(false);
                }

        }

        void displayAllContactsGraph(){
                vtkMutableUndirectedGraph g = new vtkMutableUndirectedGraph();
                HashMap<Integer, Integer> mapping = new HashMap<Integer, Integer>();
                HashMap<Integer, Integer> imapping = new HashMap<Integer, Integer>();

                vtkDoubleArray vertexColors = new vtkDoubleArray();
                vertexColors.SetNumberOfComponents(3);
                vertexColors.SetName("customColor");

                double red[] = {1.0, 0.0, 0.0};
```

```
        double green[] = {0.0, 1.0, 0.0};
        double blue[] = {0.0, 0.0, 1.0};
        double yellow[] = {1.0, 1.0, 0.0};
        double black[] = {0.0, 0.0, 0.0};

        for(Person p : people){
                if(p.getColor() != Color.lightGray && p.getColor() != Color.BLUE){
                        int v = g.AddVertex();
                        mapping.put(v, p.getID());
                        imapping.put(p.getID(), v);
                }
        }

        vtkVertexListIterator it = new vtkVertexListIterator();
        g.GetVertices(it);

        while(it.HasNext()){
                int v = it.Next();
                Person p = people[mapping.get(v)];

                double color[];
                if(p.getColor() == Color.RED)
                        color = red;
                else if(p.getColor() == Color.GREEN)
                        color = green;
                else if(p.getColor() == Color.BLUE)
                        color = blue;
                else if(p.getColor() == Color.YELLOW)
                        color = yellow;
                else
                        color = black;

                vertexColors.InsertNextTuple3(color[0], color[1], color[2]);

                for(Person k : p.listOfAllContacts){
                        if (imapping.get(k.getID()) != null)
                                g.AddGraphEdge(v, imapping.get(k.getID()));
                }
        }

        g.GetVertexData().AddArray(vertexColors);

        vtkGraphLayoutView view = new vtkGraphLayoutView();
        view.AddRepresentationFromInput(g);
        view.SetLayoutStrategy("Simple 2D");
        view.SetVertexColorArrayName("customColor");
        view.ColorVerticesOn();

        view.GetRenderer().SetBackground(1.0, 1.0, 1.0);
        view.ResetCamera();
        view.Render();
        view.GetInteractor().Initialize();
        view.GetInteractor().Start();
}

void displayContactsGraph(){
        vtkMutableUndirectedGraph g = new vtkMutableUndirectedGraph();
        HashMap<Integer, Integer> mapping = new HashMap<Integer, Integer>();
        HashMap<Integer, Integer> imapping = new HashMap<Integer, Integer>();
```

```
vtkDoubleArray vertexColors = new vtkDoubleArray();
vertexColors.SetNumberOfComponents(3);
vertexColors.SetName("customColor");

double red[] = {1.0, 0.0, 0.0};
double green[] = {0.0, 1.0, 0.0};
double blue[] = {0.0, 0.0, 1.0};
double yellow[] = {1.0, 1.0, 0.0};
double black[] = {0.0, 0.0, 0.0};

for(Person p : people){
        if(p.getColor() != Color.lightGray && p.getColor() != Color.BLUE){
                int v = g.AddVertex();
                mapping.put(v, p.getID());
                imapping.put(p.getID(), v);
        }
}

vtkVertexListIterator it = new vtkVertexListIterator();
g.GetVertices(it);

while(it.HasNext()){
        int v = it.Next();
        Person p = people[mapping.get(v)];

        double color[];
        if(p.getColor() == Color.RED)
                color = red;
        else if(p.getColor() == Color.GREEN)
                color = green;
        else if(p.getColor() == Color.BLUE)
                color = blue;
        else if(p.getColor() == Color.YELLOW)
                color = yellow;
        else
                color = black;

        vertexColors.InsertNextTuple3(color[0], color[1], color[2]);

        for(Person k : p.listOfContacts){
                if (imapping.get(k.getID()) != null)
                        g.AddGraphEdge(v, imapping.get(k.getID()));
        }
}

g.GetVertexData().AddArray(vertexColors);

vtkGraphLayoutView view = new vtkGraphLayoutView();
view.AddRepresentationFromInput(g);
view.SetLayoutStrategy("Simple 2D");
view.SetVertexColorArrayName("customColor");
view.ColorVerticesOn();

view.GetRenderer().SetBackground(1.0, 1.0, 1.0);
view.ResetCamera();
view.Render();
view.GetInteractor().Initialize();
view.GetInteractor().Start();
```

```
        }


        // Private class in which the simulation actually runs.

        private class Runner implements Runnable {

                private boolean stop;
                // Constructor constants.
                public Runner() {
                        stop = false;
                }

                // Method to start the thread running.
                public void run() {

                        // Continue until stop is pressed.
                        while ( !stop ) {
                                simulationPanel.step(true );
                                try {
                                        thread.sleep( (50) );
                                } catch ( Exception e ) {
                                }
                        }
                }
        }

}
```

Listing C.3: Prototype

```
import java.io.File;
import java.io.FileNotFoundException;
import java.io.PrintWriter;
import java.util.ArrayList;
import java.util.Collections;
import java.util.Random;

public class Simulation {

        static PrintWriter writer;
        static ArrayList<Person> people;

        public static void main(String[] args) throws FileNotFoundException {
                 writer = new PrintWriter(new File("results.txt"));

                 //Create population
                 people = new ArrayList<Person>();
                 for(char c = 'A'; c<='Z'; c++){
                        people.add(new Person(c, c));
                 }

                 writer.println("People initially infected");
                 //Randomly assign infections
                 Random rand = new Random();
                 for (int i=0; i<3; i++){
                        int n = rand.nextInt(26);
                        people.get(n).infected = true;
```

```
                writer.print(people.get(n).name + ", ");
        }

        writer.println();

        //Mating
        ArrayList<Person> copyOfPeople = new ArrayList<Person>();
        copyOfPeople.addAll(people);

        writer.println("***Mating***");
        for (int rep=0; rep<7; rep++){ //Repeat the mating 5 times
                Collections.shuffle(copyOfPeople);
                for (int i=0; i<copyOfPeople.size()-1; i+=2){
                        Encounter e =
                           new Encounter(copyOfPeople.get(i), copyOfPeople.get(i+1));
                        writer.println(e.toString());
                }
        }

        writer.println();
        writer.println("***Summary***");
        for (int i=0; i<people.size(); i++){
                writer.println(people.get(i).toString());
        }

        writer.close();

    }

}
```

Listing C.4: Simulation

Appendix D

Chapter 4 Questionnaire

Sexual Behaviours Study

PARTICIPANT INFORMATION SHEET (*Version 1, 10/12/2014*)

Researcher name: Anastasia Eleftheriou, PhD student, Prof Seth Bullock,

Dr Cynthia Graham, Prof. Roger Ingham (project supervisors)

ERGO Study ID number: 13309

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

Data will be collected using the following questionnaire in order to investigate the influence of attractiveness on sexual attitudes and intentions.

Why have I been chosen?

I am looking for male participants, fluent English speakers, between 18 69 years old. You need to be able to take part in a 25 minutes session.

What will happen to me if I take part?

If you are eligible to take part in the study, a face to face session will be arranged. At the beginning of the session you will be asked to sign the consent statement. At the end of the session you will receive the debriefing statement. You will fill in a questionnaire about perceived attractiveness and sexually transmitted diseases.

Are there any benefits in my taking part?

By taking part in this study you will have a chance to contribute to the development of a simulation software which will be used for educational purposes. Your input is invaluable to my research.

Are there any risks involved?

There is a slight chance that taking part in the study may raise your awareness regarding sexual health and some aspects of your sexual behaviour that could put you at risk of contracting sexually transmitted infections. At the end of the study you will receive information on services providing advice and support on issues related to sexual health.

Will my participation be confidential?

All study procedures will comply with the Data Protection Act/University policy. The sessions will be conducted in private rooms (at the University of Southampton) to ensure your comfort and confidentiality. You will be asked in a consent statement to give permission to use some verbatim quotations from the session to illustrate the data analysis. The quotations would be accompanied by information about your age but not your name or any other identifying information. You may still take part in the study if you do not agree to this. All data (electronic and hard copy) will be securely stored in line with procedures approved by the University of Southampton. Personal information will not be released to or viewed by anyone other than researchers involved in this project. Data stored will be anonymised. Data you provide will be used only for research. They may also be submitted for publication in a scientific journal or presentation at a scientific conference, or be disseminated to general public as a part of educational activities. No identifiable data (such as your name or date of birth) will be used in any of the listed publications or activities.

What happens if I change my mind?

You can change your mind and withdraw from the study at any time, without giving a reason for your decision. However, if you complete the questionnaire and submit your answers, then you can not withdraw after this point. The reason for this is that as soon as your data is saved, it will be anonymised and therefore we will not be able to identify which was your data in order to remove it from the study.

What happens if something goes wrong?

If you have any concerns in relation to the study or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee Psychology, University of Southampton, Southampton, SO17 1BJ, email fshs rso@soton.ac.uk

or

The Head of Research Governance at the University of Southampton 02380 595058, rgoinfo@soton.ac.uk

Where can I get more information?

If you would like to find out more about the study, or have some questions that you did not find the answer to please contact Anastasia Eleftheriou at ae2n12@soton.ac.uk.

CONSENT STATEMENT (*Version 1, 10/12/2014*)

I have read and understood the information sheet (*Version 1, 10/12/2014*) and have had the opportunity to ask questions about the study.

I agree to take part in this research project and agree for my data to be used for the purpose of this study.

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected

For students: If you are a student at the University of Southampton and you choose not to participate there will be no consequences to your grade.

Data Protection I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be anonymised (Data will be coded for the analysis, and only researchers named above would have access to all data).

Section 1. Demographics

Question 1.1

Please write down your unique participant code.

Question 1.2

Please choose your gender.

- ○ Male
- ○ Female
- ○ Other
- ○ I prefer not to say

Question 1.3

What is your date of birth?

24 ▼ / June ▼ / 2016

Question 1.4

Please specify your nationality.

a) Black or Black British
- ○ Caribbean
- ○ African
- ○ Any other Black background within (a)

b) White
- ○ British
- ○ Irish

d) Mixed
- ○ White & Black Caribbean
- ○ White & Black African
- ○ White & Asian
- ○ White & Hispanic
- ○ Any other mixed background

e) Other ethnic groups

- American
- Any other White background

c) Asian or Asian British

- Indian
- Pakistani
- Bangladeshi
- Any other Asian background within (c)
- Chinese
- Japanese
- Hispanic
- Any other ethnic group
- Do not state

Question 1.5

What is your occupation?

Section 2. Sex Life

Question 2.1
The next few questions ask about your sex life in the last year. An individual's sex life includes their sexual thoughts, sexual feelings,
sexual activity and sexual relationships.

Thinking about your sex life in the last year, how much do you agree or disagree with the following statement:
"I feel satisfied with my sex life"

- Agree strongly
- Agree
- Neither agree nor disagree
- Disagree
- Disagree strongly
- I prefer not to say

Question 2.2

Are you sexually attracted to men, women, neither or both?

- Men
- Women
- Neither
- Both

Question 2.3

What is your relationship status?

- Single
- In an exclusive relationship
- In an open relationship
- Engaged
- Married

- ○ Separated
- ○ Other

Question 2.4

As far as you know, have you ever had a Sexually Transmitted Infection?

- ○ Yes
- ○ No

Question 2.4b

Could you specify which one please?

Question 2.5

As far as you know, do you currently have a Sexually Transmitted Infection?

- ○ Yes
- ○ No

Question 2.5b

Could you specify which one please?

Question 2.6

Sexual partners are people who engage in sexual activity together.

How many sexual partners have you had so far (in your lifetime)?

Question 2.7

What age were you when you first had intercourse?

Question 2.8

Which one of the following percentages describes better the proportion of occassions of intercourse you have NOT used a condom in your lifetime?

0% means you always used condom and 100% means you never used condom.

- ○ 0% 10%
- ○ 10% 30%
- ○ 30% 50%
- ○ 50% 70%
- ○ 70% 90%
- ○ 90% 100%

Question 2.9

Which one of the following percentages describes better the proportion of occassions of intercourse you have NOT used a condom in the past twelve months?

0% means you always used condom and 100% means you never used condom.

- 0% 10%
- 10% 30%
- 30% 50%
- 50% 70%
- 70% 90%
- 90% 100%

Question 2.10

Have you had unprotected intercourse (that is, no condom used on one or more occasions) with two or more partners in the past twelve months?

- Yes
- No

Question 2.11

As far as you know, are you allergic or sensitive to latex, non latex condom and/or lubricants?

- Yes
- No

Section 3. Introduction To Main

Question 3.1

Please take a moment to look at the pictures of these women. The following questions will relate to each of them individually.

Section 4. Main

Question 4.1

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.2

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.3

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.4

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.5

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.6

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.7

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.8

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.9

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.10

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.11

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.12

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.13

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.14

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.15

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.16

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.17

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.18

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.19

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.20

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.21

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.22

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.23

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.24

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.25

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.26

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.27

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.28

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.29

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.30

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.31

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.32

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.33

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.34

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.35

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.36

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.37

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.38

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.39

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.40

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.41

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.42

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.43

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.44

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.45

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.46

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.47

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.48

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.49

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.50

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.51

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.52

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.53

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.54

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.55

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.56

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.57

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.58

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.59

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.60

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.61

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.62

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.63

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.64

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.65

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.66

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.67

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.68

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.69

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.70

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.71

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.72

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.73

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.74

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.75

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.76

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.77

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.78

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.79

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.80

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.81

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.82

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.83

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.84

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.85

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.86

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.87

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.88

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.89

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.90

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.91

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.92

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.93

Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.94

If you were single and you were to have sex with this woman, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

0 100

Question 4.95

How likely is this woman to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.96

Please rate the attractiveness of the following woman.

Please move the slider to indicate your answer, between 0% and 100%

0 100

Question 4.97

If you were single, how likely would you be to have sex with this woman should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

Appendix E

Chapter 5 Questionnaire

The full list of questionnaires used for this thesis is available in https://bitbucket.org/ae2n12/simulations/src/master/Surveys/

Influence of Perceived Attractiveness on Risky Sexual Behaviour Study

The aim of this research was to collect data on facial attractiveness and whether this affects the decision about whether to use condoms.

Your data will help our understanding on the topic and it will motivate further research and may be helpful in designing educational materials to improve sexual health..

Once again, the results of this study will not include your name or any other identifying characteristics.

If taking part in this study raised any concerns regarding your personal circumstances you can

- find more information on NHS choices website http://www.nhs.uk/Livewell/Sexualhealthtopics/Pages/Sexual_health_hub.aspx
- find your local GUM clinic http://www.nhs.uk/chq/Pages/972.aspx?CategoryID=68
- or contact your GP for further advice.

If you have any questions please feel free to contact me at ae2n12@soton.ac.uk.

Thank you very much for your participation in this research.

Anastasia Eleftheriou

If you have questions about your rights as a participant in this research, or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee, Psychology, University of Southampton, Southampton, SO17 1BJ, email fshs_rso@soton.ac.uk or the Research Governance Office at the University of Southampton 02380 595058, rgoinfo@soton.ac.uk

(1).eps (1).eps

Sexual Behaviours Study (For MSM and WSM)

PARTICIPANT INFORMATION SHEET (*Version 1, 07/10/2016*)

Study title: *Influence of perceived attractiveness on risky sexual behaviour*

Researcher name: Anastasia Eleftheriou, PhD student, Prof Seth Bullock,

Prof Cynthia Graham, Prof. Roger Ingham (project supervisors)

ERGO Study ID number: 23922

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to indicate consent.

What is the research about?

Data will be collected using questionnaires in order to investigate the influence of attractiveness on sexual attitudes and intentions. This study is being done as part of my PhD at the University of Southampton.

Why have I been chosen?

I am looking for male and female participants, fluent English speakers, between 18 69 years old.

What will happen to me if I take part?

You will fill in a questionnaire about perceived attractiveness and risk perception and intentions online. University of Southampton Psychology students will receive 4 credits for their participation. The study takes approximately 25 minutes.

Are there any benefits in my taking part?

By taking part in this study you will be contributing to the development of a simulation software which will be used for educational purposes. Your input is invaluable to my research.

Are there any risks involved?

(2).eps (2).eps

There is a slight chance that taking part in the study may raise your awareness regarding sexual health and some aspects of your sexual behaviour that could put you at risk of contracting sexually transmitted infections. At the end of the study you will receive information on services providing advice and support on issues related to sexual health.

Will my participation be confidential?

All study procedures will comply with the Data Protection Act/University policy. All data will be securely stored in line with procedures approved by the University of Southampton. Personal information will not be released to or viewed by anyone other than researchers involved in this project. Data stored will be anonymised. Data you provide will be used only for research. They may also be submitted for publication in a scientific journal or presentation at a scientific conference, or be disseminated to general public as a part of educational activities. No identifiable data (such as your name or date of birth) will be used in any of the listed publications or activities.

What happens if I change my mind?

You can change your mind and withdraw from the study at any time, without giving a reason for your decision, until you submit the completed survey (after you do so you will not be able to withdraw your data as it is anonymous).

What happens if something goes wrong?

If you have any concerns in relation to the study or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee Psychology, University of Southampton, Southampton, SO17 1BJ, email fshs rso@soton.ac.uk

or

The Head of Research Governance at the University of Southampton 02380 595058, rgoinfo@soton.ac.uk

Where can I get more information?

If you would like to find out more about the study, or have some questions that you did not find the answer to please contact Anastasia Eleftheriou at ae2n12@soton.ac.uk.

If taking part in this study raised any concerns regarding your personal circumstances you can

- find more information on NHS choices website http://www.nhs.uk/Livewell/Sexualhealthtopics/Pages/Sexual_health_hub.aspx
- find your local GUM clinic http://www.nhs.uk/chq/Pages/972.aspx?CategoryID=68
- or contact your GP for further advice.

Section 1. Demographics

Question 1.1

Please choose your gender.

(3).eps (3).eps

- ○ Male
- ○ Female
- ○ Other
- ○ I prefer not to say

Question 1.2

What is your date of birth?

1 ▼ / January ▼ / 0000

Question 1.3

Please specify your nationality.

a) Black or Black British
- ○ Caribbean
- ○ African
- ○ Any other Black background within (a)

b) White
- ○ British
- ○ Irish
- ○ American
- ○ Any other White background

c) Asian or Asian British
- ○ Indian
- ○ Pakistani
- ○ Bangladeshi
- ○ Any other Asian background within (c)

d) Mixed
- ○ White & Black Caribbean
- ○ White & Black African
- ○ White & Asian
- ○ White & Hispanic
- ○ Any other mixed background

e) Other ethnic groups
- ○ Chinese
- ○ Japanese
- ○ Hispanic
- ○ Any other ethnic group
- ○ Do not state

Question 1.4

What is your occupation?

Section 2. Sex Life

Question 2.1
The next few questions ask about your sex life in the last year. An individual's sex life includes their sexual thoughts, sexual feelings,
sexual activity and sexual relationships.

Thinking about your sex life in the last year, how much do you agree or disagree with the following statement:
"I feel satisfied with my sex life"

- ○ Agree strongly
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Disagree strongly

(4).eps (4).eps

- ○ I prefer not to say

Question 2.2

Are you sexually attracted to men, women, neither or both?

- ○ Men
- ○ Women
- ○ Neither
- ○ Both

Question 2.3

What is your relationship status?

- ○ Single
- ○ In an exclusive relationship
- ○ In an open relationship
- ○ Engaged
- ○ Married
- ○ Separated
- ○ Other

Question 2.4

As far as you know, have you ever had a Sexually Transmitted Infection?

- ○ Yes
- ○ No

Question 2.4b

Could you specify which one please?

Question 2.5

As far as you know, do you currently have a Sexually Transmitted Infection?

- ○ Yes
- ○ No

Question 2.5b

Could you specify which one please?

Question 2.6

Sexual partners are people who engage in sexual activity together.

How many sexual partners have you had so far (in your lifetime)?

Question 2.7

(5).eps (5).eps

What age were you when you first had intercourse?

Question 2.8

Which one of the following percentages describes best the proportion of occasions of intercourse you have NOT used a condom in your lifetime?

0% means you always used a condom and 100% means you never used a condom.

- 0% 10%
- 11% 30%
- 31% 50%
- 51% 70%
- 71% 90%
- 91% 100%

Question 2.9

Which one of the following percentages describes best the proportion of occasions of intercourse you have NOT used a condom in the past twelve months?

0% means you always used a condom and 100% means you never used a condom.

- 0% 10%
- 11% 30%
- 31% 50%
- 51% 70%
- 71% 90%
- 91% 100%

Question 2.10

Have you had unprotected intercourse (that is, no condom used on one or more occasions) with two or more partners in the past twelve months?

- Yes
- No

Question 2.11

As far as you know, are you allergic or sensitive to latex, non latex condom and/or lubricants?

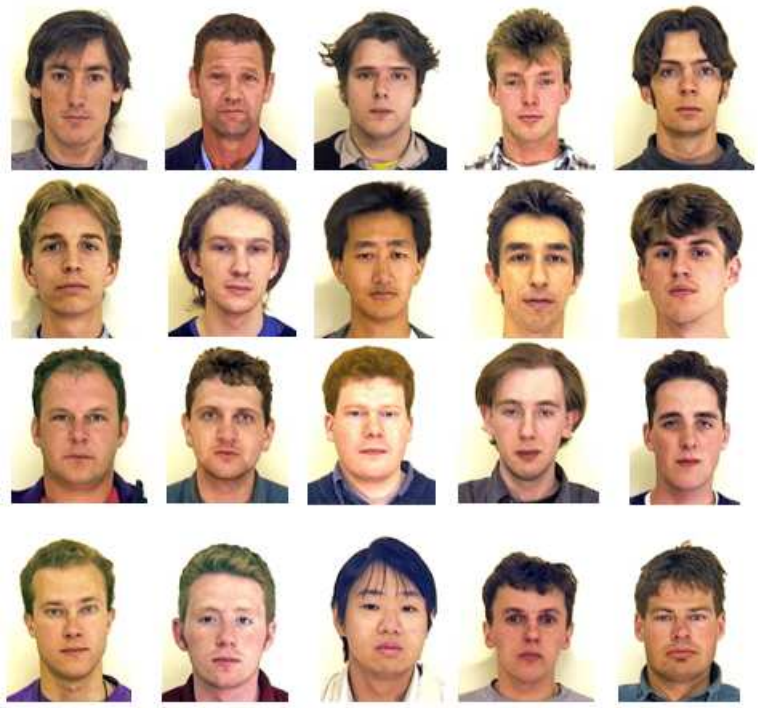
- Yes
- No

Section 3. Introduction To Main

Question 3.1

Please take a moment to look at the pictures of these men. The following questions will relate to each of them individually. You do NOT have to memorise anything now.

(6).eps (6).eps



Section 4. Main

Question 4.1

If you were single and you were to have sex with this man, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

(7).eps (7).eps

0 100

Question 4.2

Please rate the attractiveness of the following man.

Please move the slider to indicate your answer, between 0% and 100%

(8).eps (8).eps

0 100

Question 4.3

How likely is this man to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

(9).eps (9).eps

0 100

Question 4.4

If you were single, how likely would you be to have sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

(10).eps (10).eps

0 100

Question 4.5

Out of 100 people like you, how many would have condomless sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

(11).eps (11).eps

0 100

Question 4.6

Out of 100 people like you, how many would have condomless sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

(12).eps (12).eps

0 100

Question 4.7

If you were single, how likely would you be to have sex with this man should the opportunity

Please move the slider to indicate your answer, between 0% and 100%

(13).eps (13).eps

0 100

Question 4.8

How likely is this man to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

(14).eps (14).eps

0 100

Question 4.9

Please rate the attractiveness of the following man.

Please move the slider to indicate your answer, between 0% and 100%

(15).eps (15).eps

0 100

Question 4.10

If you were single and you were to have sex with this man, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

(16).eps (16).eps

0 100

Question 4.11

Please rate the attractiveness of the following man.

Please move the slider to indicate your answer, between 0% and 100%

(17).eps (17).eps

0 100

Question 4.12

How likely is this man to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

(18).eps (18).eps

0 100

Question 4.13

If you were single, how likely would you be to have sex with this man should the opportunity

Please move the slider to indicate your answer, between 0% and 100%

(19).eps (19).eps

0 100

Question 4.14

Out of 100 people like you, how many would have condomless sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

(20).eps (20).eps

0 100

Question 4.15

If you were single and you were to have sex with this man, how likely is it that you would use condom?

Please move the slider to indicate your answer, between 0% and 100%.

(21).eps (21).eps

0 100

Question 4.16

Please rate the attractiveness of the following man.

Please move the slider to indicate your answer, between 0% and 100%

(22).eps (22).eps

0 100

Question 4.17

How likely is this man to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

(23).eps (23).eps

0 100

Question 4.18

If you were single, how likely would you be to have sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

(24).eps (24).eps

0 100

Question 4.19

Out of 100 people like you, how many would have condomless sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

(25).eps (25).eps

0 100

Question 4.20

If you were single and you were to have sex with this man, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

(26).eps (26).eps

0 100

Question 4.21

Please rate the attractiveness of the following man.

Please move the slider to indicate your answer, between 0% and 100%

(27).eps (27).eps

0 100

Question 4.22

How likely is this man to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

(28).eps (28).eps

0 100

Question 4.23

If you were single, how likely would you be to have sex with this man should the opportunity

Please move the slider to indicate your answer, between 0% and 100%

(29).eps (29).eps

0 100

Question 4.24

Out of 100 people like you, how many would have condomless sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

(30).eps (30).eps

0 100

Question 4.25

If you were single and you were to have sex with this man, how likely is it that you would use condom?

Please move the slider to indicate your answer, between 0% and 100%.

(31).eps (31).eps

0 100

Question 4.26

Please rate the attractiveness of the following man.

Please move the slider to indicate your answer, between 0% and 100%

(32).eps (32).eps

0 100

Question 4.27

How likely is this man to have a Sexually Transmitted Infection?

Please move the slider to indicate your answer, between 0% and 100%

(33).eps (33).eps

0 100

Question 4.28

If you were single, how likely would you be to have sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

(34).eps (34).eps

0 100

Question 4.29

Out of 100 people like you, how many would have condomless sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

(35).eps (35).eps

0 100

Question 4.30

If you were single and you were to have sex with this man, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

(36).eps (36).eps

0 100

Question 4.31

Please rate the attractiveness of the following man.

Please move the slider to indicate your answer, between 0% and 100%

(37).eps (37).eps

0 100

Question 4.32

If you were single, how likely would you be to have sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%

(38).eps (38).eps

0 100

Question 4.33

Out of 100 people like you, how many would have condomless sex with this man should the opportunity arise?

Please move the slider to indicate your answer, between 0% and 100%.

(39).eps (39).eps

0 100

Question 4.34

If you were single and you were to have sex with this man, how likely is it that you would use a condom?

Please move the slider to indicate your answer, between 0% and 100%.

(40).eps (40).eps

Appendix F

Chapter 6 Questionnaire

University of Southampton

Logged in as : x Block 1 of 3

Hello!

Thank you for taking part in this study.

By clicking Next Question, you are agreeing to attempt solving a quiz about Sexual Behaviour and Health!

Please read the Participant Information Sheet.

PARTICIPANT INFORMATION SHEET (Version no 1, 12/03/2016)

Study title: Investigating the use of a serious game for sex education.

Researcher name: Anastasia Eleftheriou, PhD student, Prof Seth Bullock,

Prof Cynthia Graham, Prof. Roger Ingham (project supervisors)

ERGO Study ID number: 17008

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

Data will be collected using an online quiz to investigate the use of serious games simulations for public health issues and, in particular, to explore the use of simulations to access and influence attitudes to sexual behaviour and risk. The study is part of PhD research and the results will form part of the PhD thesis. The results of the study may be published in a scientific journal or presented at scientific conferences, or used for education purposes.

Why have I been chosen?

I am looking for fluent English speakers, between 18-69 years old. You need to fill in a 30 minutes online quiz.

What will happen to me if I take part?

You will attempt a quiz about sexual health. The quiz could either be attempted at home, or at a workshop taking place at the University of Southampton on the 6th of May.

Are there any benefits in my taking part?

By taking part in this study you will have a chance to contribute to the development of a piece of simulation software which will be used for educational purposes. Your input is invaluable to my research. If you are a Psychology student at the University of Southampton, you will receive 4 credits for your participation. The winner of the quiz (the participant with the highest score) will receive an Amazon voucher of £100. In case there is a group of participants having the highest score, the winner will be chosen at random from that group.

Are there any risks involved?

There is a slight chance that taking part in the study may raise your awareness regarding sexual health and some aspects of your sexual behaviour that could put you at risk of contracting sexually transmitted infections. You will receive information on services providing advice and support on issues related to sexual health.

Will my participation be confidential?

All study procedures will comply with the Data Protection Act/University policy. All data will be securely stored in line with procedures approved by the University of Southampton. Personal information will not be released to or viewed by anyone other than researchers involved in this project. Data stored will be anonymised. Data you provide will be used only for research. They may also be submitted for publication in a scientific journal or presentation at a scientific conference, or be disseminated to general public as a part of educational activities. No identifiable data (such as your name or date of birth) will be used in any of the listed publications or activities.

What happens if I change my mind?

You can change your mind and withdraw from the study at any time, without giving a reason for your decision.

What happens if something goes wrong?

If you have any concerns in relation to the study or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee Psychology, University of Southampton, Southampton, SO17 1BJ, email fshs-rso@soton.ac.uk

or

The Head of Research Governance at the University of Southampton 02380 595058, rgoinfo@soton.ac.uk

Where can I get more information?

If you would like to find out more about the study, or have some questions that you did not find the answer to please contact Anastasia Eleftheriou at ae2n12@soton.ac.uk or Prof Roger Ingham at Roger.Ingham@soton.ac.uk, Prof Cynthia Graham at C.A.Graham@soton.ac.uk, Prof Seth Bullock at seth.bullock@bristol.ac.uk.

1 of 26
Please choose your gender.

- ○ Male
- ○ Female
- ○ Other
- ○ Prefer not to say

2 of 26
What is your age?

3 of 26
Please specify your ethnicity.

- ○ White
- ○ Black
- ○ Asian
- ○ Mixed
- ○ Other

4 of 26
Are you attracted to men, women, both or neither?

- ○ Men
- ○ Women
- ○ Both
- ○ Neither

5 of 26
Risks taken during unprotected sex are easy to evaluate.

- ○ Strongly Agree
- ○ Agree
- ○ Neither Agree nor Disagree
- ○ Disagree
- ○ Strongly Disagree

6 of 26
The risk that someone takes if they have unprotected sex also depends on the risk taking behaviour of other people.

- ○ Strongly Agree
- ○ Agree
- ○ Neither Agree nor Disagree
- ○ Disagree
- ○ Strongly Disagree

The following 9 questions will be answered using the following 4 choices:

A. Strongly Agree

B. Agree

C. Disagree

D. Strongly Disagree

If you have not been in the situation described, please respond in the way you think you wil react.

7 of 26
When a sexually attractive stranger accidentally touches me, I easily become aroused.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

8 of 26
If I'm having sex in a secluded, outdoor place and I think that someone is nearby, I am not likely to get very aroused.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

9 of 26
When I talk to someone on the telephone who has a sexy voice, I become sexually aroused.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

10 of 26
I cannot get aroused unless I focus exclusively on sexual stimulation.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

11 of 26
If I'm masturbating on my own and I realize that someone is likely to come into the room at any moment, I will lose my erection/my sexual arousal.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

12 of 26
If I realize there is a risk of catching a sexually transmitted disease, I am unlikely to stay sexually aroused.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

13 of 26
If I can be seen by others while having sex, I am unlikely to stay sexually aroused.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

14 of 26

When I think of a very attractive person, I easily become sexually aroused.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

15 of 26

Once I have an erection, I want to start intercourse right away before I lose my erection

OR

Once I am sexually aroused, I want to start intercourse right away before I lose my arousal.

- ○ Strongly Agree
- ○ Agree
- ○ Disagree
- ○ Strongly Disagree

The following 10 questions will be answered using the following 4 choices:

1. Not at all Like Me
2. Slightly Like Me
3. Mainly Like Me
4. Very Much Like Me

If you have not been in the situation described, please respond in the way you think you wil react.

16 of 26

I like wild "uninhibited" sexual encounters.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

17 of 26

The physical sensations are the most important thing about having sex

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

18 of 26

My sexual partners probably think that I am a "risk taker".

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

19 of 26

When it comes to sex, physical attraction is more important to me than how well I know the person.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

20 of 26

I enjoy the company of sensual people.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

21 of 26

I enjoy watching "X-rated" videos.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

22 of 26

I am interested in trying out new sexual experiences.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

23 of 26

I feel like exploring my sexuality.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

24 of 26

I like to have new and exciting sexual experiences and sensations.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

25 of 26

I enjoy the sensations of intercourse without a condom.

- ○ Not at all Like Me
- ○ Slightly Like Me
- ○ Mainly Like Me
- ○ Very Much Like Me

Term on The Tides

100 men and 100 women will embark on a cruise from Mykonos to Ibiza. The population will be introduced in detail in the next few pages.

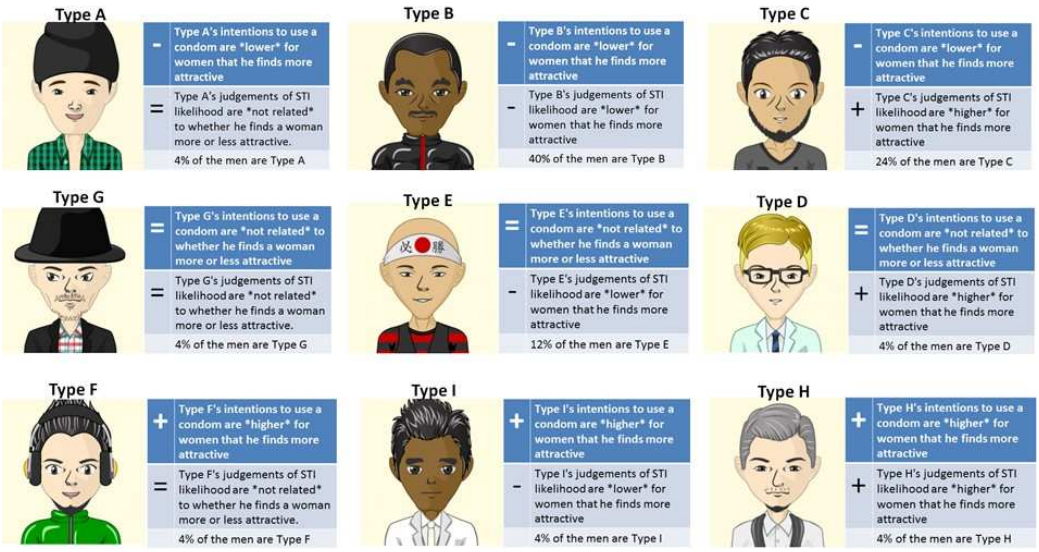
Soon: You will be asked to answer some questions regarding the sexual health of the people on the cruise!

General facts:

- None of the men or women are in a relationship at the start of the cruise.
- The men are equally attractive to each of the women.
- The women have a similar likelihood of using a condom during sex.
- Whether a condom is used or not during sex is a joint decision.
- At the start of the cruise some people may be carrying a sexually transmitted infection without knowing it.

Term on the Tides

- In a previous study: 51 heterosexual men each rated 20 women on their facial attractiveness.
- They also rated the likelihood of the women having a Sexually Transmitted Infection.
- They also reported how likely they were to intend to use a condom should they have sex with each of the women.
- Based on their responses, we identified 9 different types of men shown below.
- We constructed a population of 100 men, each belonging to one of the 9 types.
- Please read about each type below before clicking "Next Question", but don't feel that you have to memorise them as this information will be available to you later on.



Term on the Tides

The 100 women on the cruise can also be considered to belong to 10 equally prevalent types.

The following table indicates how attractive each type of woman is to each type of man.

A "+" indicates "more attractive"

A "=" indicates "average attractiveness"

A "-" indicates "less attractive"

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

Term on the Tides

First, have a look at the practice question, coming next...

26 of 26

Practice Question:

Is a Type A man more likely to contract a sexually transmitted infection from a woman of Type 4 or Type 7?

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type 4
- ○ Type 7

Answer to the Practice Question:

Type 7.

After running 100 simulations of the Term on The Tides population, a Type A man was more likely to contract a sexually transmitted infection from a Type 7 woman than a Type 4 woman.

Are you ready to start the Term On The Tides Quiz?

Click Submit...

University of Southampton

Logged in as : x Block 2 of 3

1 of 10

Who is more likely to infect a Type F man? A Type 3 woman, a Type 4 woman or are they equally likely?

Type F

\+ Type F's intentions to use a condom are *higher* for women that he finds more attractive

= Type F's judgements of STI likelihood are *not related* to whether he finds a woman more or less attractive.

4% of the men are Type F

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type 3
- ○ Type 4
- ○ Equally likely

2 of 10

Is a Type E man more likely to contract a sexually transmitted infection from a Type 1 woman, a Type 6 woman or are they equally likely?

Type E

= Type E's intentions to use a condom are *not related* to whether he finds a woman more or less attractive

\- Type E's judgements of STI likelihood are *lower* for women that he finds more attractive

12% of the men are Type E

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type 1
- ○ Type 6
- ○ Equally likely

3 of 10

Who is more likely to contract a sexually transmitted infection from more women? A Type F man, a Type H man or are they equally likely?

Type F

+	Type F's intentions to use a condom are *higher* for women that he finds more attractive
=	Type F's judgements of STI likelihood are *not related* to whether he finds a woman more or less attractive.
	4% of the men are Type F

Type H

+	Type H's intentions to use a condom are *higher* for women that he finds more attractive
+	Type H's judgements of STI likelihood are *higher* for women that he finds more attractive
	4% of the men are Type H

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type F
- ○ Type H
- ○ Equally likely

4 of 10

Who is more likely to contract a sexually transmitted infection from a woman who is of Type 7? A Type G man, a Type I man or are they equally likely?

Type G

=	Type G's intentions to use a condom are *not related* to whether he finds a woman more or less attractive
=	Type G's judgements of STI likelihood are *not related* to whether he finds a woman more or less attractive.
	4% of the men are Type G

Type I

+	Type I's intentions to use a condom are *higher* for women that he finds more attractive
-	Type I's judgements of STI likelihood are *lower* for women that he finds more attractive
	4% of the men are Type I

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type G
- ○ Type I
- ○ Equally likely

5 of 10

Who is more likely to infect a man of Type A? A Type 4 woman, a Type 8 woman or are they equally likely?

Type A

-	Type A's intentions to use a condom are *lower* for women that he finds more attractive
=	Type A's judgements of STI likelihood are *not related* to whether he finds a woman more or less attractive.

4% of the men are Type A

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type 4
- ○ Type 8
- ○ Equally likely

6 of 10

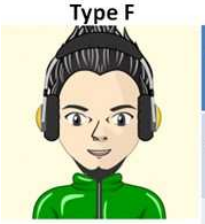
Who is more likely to infect more women? A Type B man, a Type F man or are they equally likely?

Type B

-	Type B's intentions to use a condom are *lower* for women that he finds more attractive
-	Type B's judgements of STI likelihood are *lower* for women that he finds more attractive

40% of the men are Type B

Type F



+	Type F's intentions to use a condom are *higher* for women that he finds more attractive
=	Type F's judgements of STI likelihood are *not related* to whether he finds a woman more or less attractive.

4% of the men are Type F

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Man B
- ○ Man F
- ○ Equally likely

7 of 10

Who is more likely to infect more women? A Type B man, a Type C man or are they equally likely?

Type B

-	Type B's intentions to use a condom are *lower* for women that he finds more attractive
-	Type B's judgements of STI likelihood are *lower* for women that he finds more attractive
	40% of the men are Type B

Type C

-	Type C's intentions to use a condom are *lower* for women that he finds more attractive
+	Type C's judgements of STI likelihood are *higher* for women that he finds more attractive
	24% of the men are Type C

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Man B
- ○ Man C
- ○ Equally likely

8 of 10

Who is more likely to infect more women? A Type C man, a Type E man or are they equally likely?

Type C

-	Type C's intentions to use a condom are *lower* for women that he finds more attractive
+	Type C's judgements of STI likelihood are *higher* for women that he finds more attractive
	24% of the men are Type C

Type E

=	Type E's intentions to use a condom are *not related* to whether he finds a woman more or less attractive
-	Type E's judgements of STI likelihood are *lower* for women that he finds more attractive
	12% of the men are Type E

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type C
- ○ Type E
- ○ Equally likely.

9 of 10

Who is more likely to contract a sexually transmitted infection from more women? A Type E man, a Type G man or are they equally likely?

Type E

= Type E's intentions to use a condom are *not related* to whether he finds a woman more or less attractive

– Type E's judgements of STI likelihood are *lower* for women that he finds more attractive

12% of the men are Type E

Type G

= Type G's intentions to use a condom are *not related* to whether he finds a woman more or less attractive

= Type G's judgements of STI likelihood are *not related* to whether he finds a woman more or less attractive.

4% of the men are Type G

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type E
- ○ Type G
- ○ Equally likely

10 of 10

Who is more likely to infect a woman who is of Type 4? A Type A man, a Type B man or are they equally likely?

Type A

– Type A's intentions to use a condom are *lower* for women that he finds more attractive

= Type A's judgements of STI likelihood are *not related* to whether he finds a woman more or less attractive.

4% of the men are Type A

Type B

– Type B's intentions to use a condom are *lower* for women that he finds more attractive

– Type B's judgements of STI likelihood are *lower* for women that he finds more attractive

40% of the men are Type B

Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

- ○ Type A
- ○ Type B
- ○ Equally likely

Appendix G

Chapter 7 Questionnaire

WSM (Quiz)

PARTICIPANT INFORMATION SHEET (Version no 1, *24/02/2017*)

Study title: Investigating the use of simulation for sex education.

Researcher name: Anastasia Eleftheriou, PhD student, Prof Seth Bullock,

Prof Cynthia Graham, Prof. Roger Ingham (project supervisors)

ERGO Study ID number: 25761

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

Data will be collected using an online quiz to investigate the use of computer simulations for public health issues and, in particular, to explore the use of simulations to access and influence attitudes to sexual behaviour and risk. The study is part of PhD research and the results will form part of the PhD thesis. The results of the study may be published in a scientific journal or presented at scientific conferences, or used for education purposes.

Why have I been chosen?

I am looking for fluent English speakers, between 18 69 years old. You need to fill in a 20 minutes online quiz.

What will happen to me if I take part?

You will attempt a quiz about sexual health. The quiz could be attempted at home and takes approximately 20 minutes. You might be exposed to sexually explicit material.

Are there any benefits in my taking part?

By taking part in this study you will have a chance to contribute to the development of a piece of simulation software which will be used for educational purposes. Your input is invaluable to my research. If you are a Psychology student at the University of Southampton, you will receive 3 credits for your participation. A participant chosen at random will receive an Amazon voucher of £100.

(1).eps (1).eps

Are there any risks involved?

There is a slight chance that taking part in the study may raise your awareness regarding sexual health and some aspects of your sexual behaviour that could put you at risk of contracting sexually transmitted infections. Also, sexually explicit material might be included. You can withdraw from the survey at any ti but cannot withdraw your data after completion of the survey as it is anonymous.

If taking part in this study raises any concerns regarding your personal circumstances you can:

- find more information on NHS choices website http://www.nhs.uk/Livewell/Sexualhealthtopics/Pages/Sexual_health_hub.aspx
- find your local GUM clinic http://www.nhs.uk/chq/Pages/972.aspx?CategoryID=68

or contact your GP for further advice.

Will my participation be confidential?

All study procedures will comply with the Data Protection Act/University policy. All data will be securely stored in line with procedures approved by the University of Southampton. Personal information will not released to or viewed by anyone other than researchers involved in this project. Data stored will be anonymised. Data you provide will be used only for research. They may also be submitted for publication a scientific journal or presentation at a scientific conference, or be disseminated to general public as a part educational activities. No identifiable data (such as your name or date of birth) will be used in any of the listed publications or activities.

What happens if I change my mind?

You can change your mind and withdraw from the study at any time, without giving a reason for your decision (but cannot withdraw your data after completion of the survey as it is anonymous).

What happens if something goes wrong?

If you have any concerns in relation to the study or if you feel that you have been placed at risk, you may contact the Head of Research Governance at the University of Southampton 02380 595058, rgoinfo@soton.ac.uk

Where can I get more information?

If you would like to find out more about the study, or have some questions that you did not find the answe to please contact Anastasia Eleftheriou at ae2n12@soton.ac.uk or Prof Roger Ingham at Roger.Ingham@soton.ac.uk, Prof Cynthia Graham at C.A.Graham@soton.ac.uk, Prof Seth Bullock at seth.bullock@bristol.ac.uk.

Section 1. Demographics

Question 1.1

How old are you?

(2).eps (2).eps

Question 1.2

What is your ethnicity?

a) White
- Welsh/English/Scottish/Northern Irish/British
- Irish
- Gypsy or Irish Traveller
- Any other White background

b) Mixed/Multiple ethnic groups
- White and Black Caribbean
- White and Black African
- White and Asian
- Any other Mixed/Multiple ethnic background

c) Asian/Asian British
- Indian
- Pakistani
- Bangladeshi
- Chinese
- Any other Asian background

d) Black/African/Caribbean/Black British
- African
- Caribbean
- Any other Black/African/Caribbean background

e) Other ethnic group
- Arab
- Any other ethnic group, please describe
- Do not state

Question 1.3

What is your gender?

- Male
- Female
- Other
- Prefer not to say

Question 1.4

Do you prefer having sex with men, women, both or none?

- Men
- Women
- Both
- None

Section 2. SSS, SIS/SES SF

Question 2.1

In the following questions you will find statements about how you might react to various sexual situations, activities, or behaviors. Obviously, how you react will often depend on the circumstances, but we are interested in what would be the most likely reaction for you. Please read each statement carefully and decide how you would be most likely to react.

Then choose the number that corresponds with your answer. Please try to respond to every statement. Sometimes you may feel that none of the responses seems completely accurate. Sometimes you may read a

(3).eps (3).eps

statement that you feel is ‘not applicable’. In these cases, please choose the response you would choose if were applicable to you. In many statements you will find words describing reactions such as ‘sexually aroused’, or sometimes just ‘aroused’. With these words we mean to describe ‘feelings of sexual excitement’, feeling ‘sexually stimulated’, ‘horny’, ‘hot’, or ‘turned on’.

Don’t think too long before answering. Please give your first reaction. Try to not skip any questions. Try t be as honest as possible.

Question 2.2

When a sexually attractive stranger accidentally touches me, I easily become aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.3

If I am having sex in a secluded, outdoor place and I think that someone is nearby, I am not likely to get v aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.4

When I talk to someone on the telephone who has a sexy voice, I become sexually aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.5

I cannot get aroused unless I focus exclusively on sexual stimulation.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.6

If I am masturbating on my own and I realize that someone is likely to come into the room at any momen will lose my sexual arousal.

- Strongly Agree
- Agree
- Disagree

(4).eps (4).eps

- Strongly Disagree

Question 2.7

If I realize there is a risk of catching a sexually transmitted disease, I am unlikely to stay sexually aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.8

If I can be seen by others while having sex, I am unlikely to stay sexually aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.9

When I think of a very attractive person, I easily become sexually aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.10

Once I am sexually aroused, I want to start intercourse right away before I lose my sexual arousal.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.11

When I start fantasizing about sex, I quickly become sexually aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.12

When I see others engaged in sexual activities, I feel like having sex myself.

- Strongly Agree

(5).eps (5).eps

- Agree
- Disagree
- Strongly Disagree

Question 2.13

When I have a distracting thought, I easily lose my arousal.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.14

If I am distracted by hearing music, television, or a conversation, I am unlikely to stay aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.15

When an attractive person flirts with me, I easily become sexually aroused.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Question 2.16

The following 10 questions will be answered using the following 4 choices:

1. Not at all Like Me

2. Slightly Like Me

3. Mainly Like Me

4. Very Much Like Me

Question 2.17

I like wild "uninhibited" sexual encounters.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.18

(6).eps (6).eps

The physical sensations are the most important thing about having sex.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.19

My sexual partners probably think that I am a "risk taker".

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.20

When it comes to sex, physical attraction is more important to me than how well I know the person.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.21

I enjoy the company of sensual people.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.22

I enjoy watching "X rated[1] videos.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.23

I am interested in trying out new sexual experiences.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me

(7).eps (7).eps

Very Much Like Me

Question 2.24

I feel like exploring my sexuality.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.25

I like to have new and exciting sexual experiences and sensations.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Question 2.26

I enjoy the sensations of intercourse without a condom.

- Not at all Like Me
- Slightly Like Me
- Mainly Like Me
- Very Much Like Me

Section 3. CBS

Question 3.1

I won't use a condom unless my partner asks me to do so

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.2

If a partner asked me to use a condom, I would think that he didn't trust me.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree

(8).eps (8).eps

- Strongly agree

Question 3.3

If a partner asked me to use a condom, he would think I was accusing him of cheating.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.4

If I asked a sex partner to use a condom, he might think I was cheating.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.5

I get turned off when my partner suggests that we use a condom.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.6

Condoms rub and make you feel sore.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.7

Condoms don't feel good.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree

(9).eps (9).eps

- Strongly agree

Question 3.8

Condoms feel unnatural.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.9

Condoms reduce the intensity of my orgasm.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.10

Condoms don't fit right.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.11

Condoms spoil the mood.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.12

I would get angry if my partner asked that we use a condom.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree

(10).eps (10).eps

- Strongly agree

Question 3.13

I feel closer to my partner without a condom.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 3.14

It is insulting to me when my partner asks if we can use a condom.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Section 4. Intervention

Question 4.1

This section concerns a population of 6 people (A, B, C, D, E, F) .

Before any sexual encounters between them, there is only ONE HIV+ person (infected by HIV). This person is randomly assigned at the beginning of each simulation scenario.

You need to find out who could be this person, by examining the two fluid exhanges (sexual encounters) shown at time T1 and T2.

Please note that the infected people at the end of the simulation, are more than one and are shown at the bottom of each scenario.

Question 4.2

Scenario 1: The following table shows the encounters in the population. The first phase (T1) finds A having condomless sex with E, B with D and C with F. The second phase (T2) finds A having condomless sex with F, B with E and C with D.

	T1	T2
A:	E	F
B:	D	E
C:	F	D

People with infections at the end of the encounters:

(11).eps (11).eps

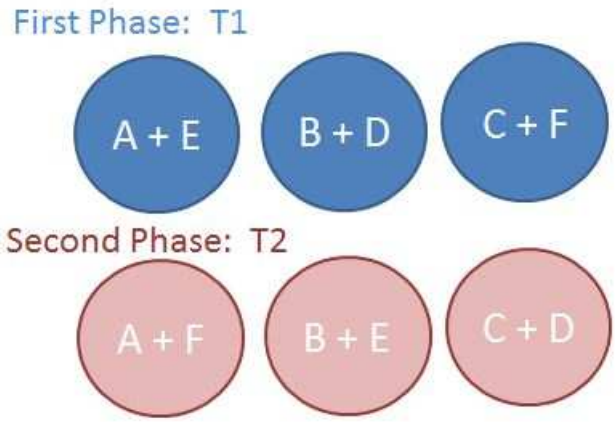
A

C

D

F

Who had HIV initially (before the exchanges at times T1 and T2)?



- A
- C
- D

Question 4.2b

Correct.

Question 4.3

Scenario 2: The following table shows the encounters in the population. The first phase (T1) finds A ha
condomless sex with E, B with F and C with D. The second phase (T2) finds A having condomless sex
D, B with E and C with F.

	T1	T2
A:	E	D
B:	F	E
C:	D	F

Infections at the end of the encounters:

A

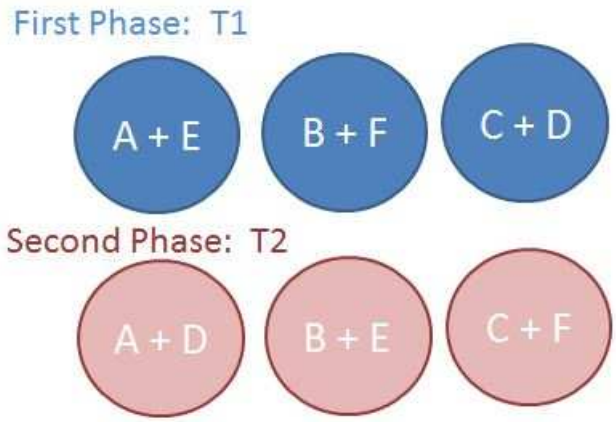
C

D

(12).eps (12).eps

F

Who had HIV initially (before the exchanges at times T1 and T2)?



- A
- C
- F

Question 4.3b

Correct.

Question 4.4

Scenario 3: The following table shows the encounters in the population. The first phase (T1) finds D having condomless sex with B, E with A and F with C. The second phase (T2) finds D having condomless sex with A, E with C and F with B.

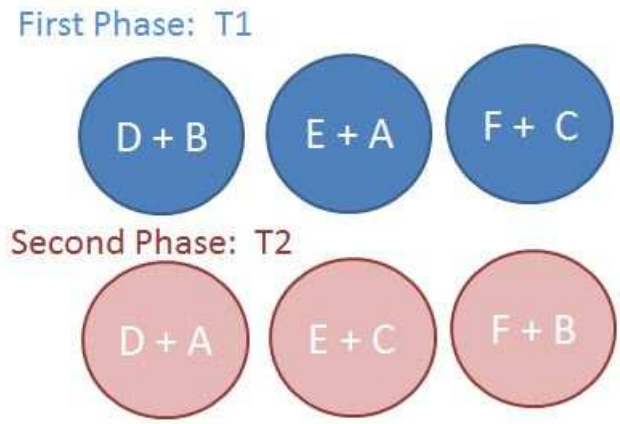
	T1	T2
D:	B	A
E:	A	C
F:	C	B

Infections after encounters:

A
C
D
E

Who had HIV initially (before the exchanges at times T1 and T2)?

(13).eps (13).eps



- C
- D
- E

Question 4.4b

Correct.

Question 4.5

Scenario 4: The following table shows the encounters in the population. The first phase (T1) finds D ha
condomless sex with A, E with B and F with C. The second phase (T2) finds D having condomless sex
C, E with A and F with B.

	T1	T2
D:	A	C
E:	B	A
F:	C	B

Infections afer encounters

A

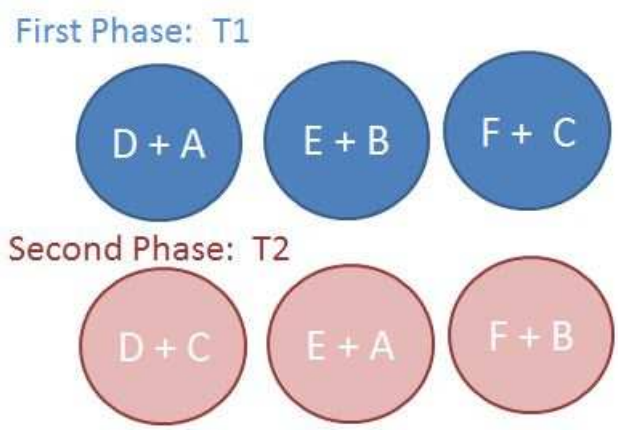
C

D

E

Who had HIV initially (before the exchanges at times T1 and T2)?

(14).eps (14).eps



- C
- D
- E

Question 4.5b

Correct

Question 4.6

Scenario 5: The following table shows the encounters in the population. The first phase (T1) finds D having condomless sex with A, E with B and F with C. The second phase (T2) finds D having condomless sex with C, E with A and F with B.

	T1	T2
D:	A	C
E:	B	A
F:	C	B

Infections after encounters:

B

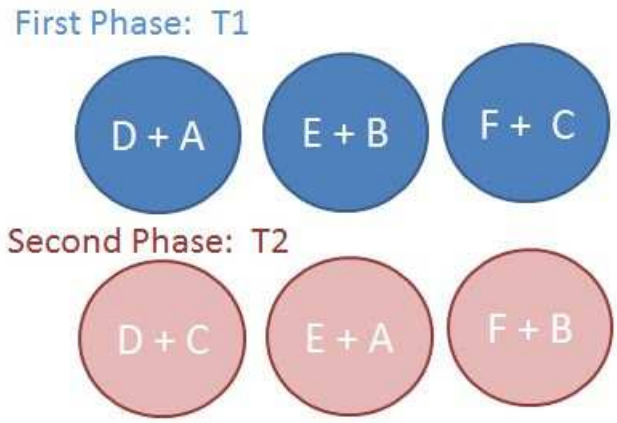
C

D

F

Who had HIV initially (before the exchanges at times T1 and T2)?

(15).eps (15).eps



- B
- D
- F

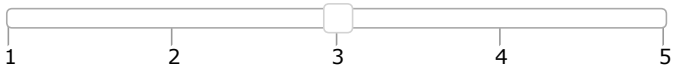
Question 4.6b

Correct

Question 4.7

How thought provoking was the quiz above?

1 means not thought provoking, 5 means very thought provoking.



Section 5. CBS after intervention

Question 5.1

I won't use a condom unless my partner asks me to do so

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

(16).eps (16).eps

Question 5.2

If a partner asked me to use a condom, I would think that he didn't trust me.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.3

If a partner asked me to use a condom, he would think I was accusing him of cheating.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.4

If I asked a sex partner to use a condom, he might think I was cheating.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.5

I get turned off when my partner suggests that we use a condom.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.6

Condoms rub and make you feel sore.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

(17).eps (17).eps

Question 5.7

Condoms don't feel good.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.8

Condoms feel unnatural.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.9

Condoms reduce the intensity of my orgasm.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.10

Condoms don't fit right.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Question 5.11

Condoms spoil the mood.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

(18).eps (18).eps

Question 5.12

I would get angry if my partner asked that we use a condom.

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Question 5.13

I feel closer to my partner without a condom.

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Question 5.14

It is insulting to me when my partner asks if we can use a condom.

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

Debriefing Statement (Version no 1, *24/02/2017*)

Investigating the use of simulation for sex education

The aim of this research was to collect data in order to investigate the use of computer simulations for public health issues. Your data will help our understanding on the topic and it will motivate further research.

The study is part of PhD research and the results will form part of the PhD thesis. The results of the study may be published in a scientific journal or presented at scientific conferences, or used for education purposes.

Once again, the results of this study will not include your name or any other identifying characteristics.

If taking part in this study raised any concerns regarding your personal circumstances you can

- find more information on NHS choices website http://www.nhs.uk/Livewell/Sexualhealthtopics/Pages/Sexual_health_hub.aspx

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- find your local GUM clinic http://www.nhs.uk/chq/Pages/972.aspx?CategoryID=68
- or contact your GP for further advice.

If you have any questions or concerns, please feel free to contact me at ae2n12@soton.ac.uk.

Thank you very much for your participation in this research.

Anastasia Eleftheriou

If you have questions about your rights as a participant in this research, or if you feel that you have bee
placed at risk, you may contact the Research Governance Office at the University of Southampton 0238
595058, rgoinfo@soton.ac.uk

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Appendix H

BMJ Open Paper 1: Does Attractiveness Influence Condom Use Intentions in Heterosexual Men? An Experimental study

Open Access Research

BMJ Open

Does attractiveness influence condom use intentions in heterosexual men? An experimental study

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ABSTRACT

Objectives: Judgements of attractiveness have been shown to influence the character of social interactions. The present study sought to better understand the relationship between perceived attractiveness, perceived sexual health status and condom use intentions in a heterosexual male population.

Setting: The study employed an electronic questionnaire to collect all data, during face-to-face sessions.

Participants: 51 heterosexual, English-speaking men aged between 18 and 69 years.

Outcome measures: Men were asked to rate the attractiveness of 20 women on the basis of facial photographs, to estimate the likelihood that each woman had a sexually transmitted infection (STI) and to indicate their willingness to have sex with or without a condom with each woman.

Results: The more attractive a woman was judged to be on average, the more likely participants would be willing to have sex with her ($p<0.0001$) and the less likely they were to intend to use a condom during sex ($p<0.0001$). Multivariate analysis revealed that higher condom use intentions towards a particular woman were associated with lower ratings of her attractiveness ($p<0.0005$), higher ratings of her STI likelihood ($p<0.0001$), the participant being in an exclusive relationship ($p=0.002$), having a less satisfactory sex life ($p=0.015$), lower age ($p=0.001$), higher number of sexual partners ($p=0.001$), higher age at first intercourse ($p=0.002$), higher rates of condomless sex in the last 12 months ($p<0.043$) and lower confidence in their ability to assess whether or not a woman had an STI ($p=0.001$). The more attractive a participant judged himself to be, the more he believed that other men like him would engage in condomless sex ($p=0.001$) and the less likely he was to intend to use a condom himself ($p=0.02$).

Conclusions: Male perceptions of attractiveness influence their condom use intentions; such risk biases could profitably be discussed during sex education sessions and in condom use promotion interventions.

Strengths and limitations of this study

- First study to explore the relationship between perceived attractiveness and condom use intentions in heterosexual men.
- Findings extend the literature by investigating the association between own perceived attractiveness, sex and condom use intentions.
- Small and relatively homogenous sample.
- Reported condom use intentions may or may not reflect actual condom use behaviour.
- Findings inform interventions for public health.

INTRODUCTION

The impression that a person's appearance makes strongly influences their interactions within their social environment. Facial attractiveness, in particular, has been the subject of extensive research in the human behavioural sciences as it dramatically influences social experience,[1] including decisions about sexual behaviour.[2–4]

Recent evidence by Nedelec and Beaver[5] supported the hypothesis that there is an association between perceived physical attractiveness and health. Specifically, their findings, which were consistent across men and women, showed that the more attractive a person was rated by participants, the less likely they were to be diagnosed with a neuropsychological disorder or a chronic disease. Although some chronic diseases can affect an individual's attractiveness directly (eg, by affecting the skin), other conditions, such as the majority of sexually transmitted infections (STIs), might not necessarily be expected to impact on a person's attractiveness directly. Despite this, it has been shown that people feel that they are able to judge the presence or absence of an STI/HIV on the basis of visual appearance alone.[6]

Lennon and Kenny[7] reported that women's physical attractiveness ratings of men are a strong positive predictor of the women's willingness to have unprotected sex, even when women believed that attractive men were more likely to have an STI. Women in this study indicated that they

preferred their partners to be attractive even though this might put their sexual health at risk. As an alternative to simple ratings of attractiveness and willingness to have sex, Rupp et al[8] used fMRI to measure the brain activity of 12 single heterosexual women, none of whom were using any hormonal contraception, while they viewed photographs of male faces. These stimuli were paired with information regarding the potential health risk posed by each man as a sexual partner, in the form of his number of sexual partners and his frequency of condom use. Participants showed a sexual preference for low-risk men rather than high-risk men. However, in a similar study from the same research group,[9] the same 12 female participants judged men with masculinised faces to be riskier and more attractive than those with feminised faces.

Fishbein et al[10] and Henderson et al[11] focused on the association between romantic attraction and health risks by asking male and female participants to rate attributes that are often used to describe romantic partners, such as 'physical build' or 'emotionality', on their importance for partner selection. These studies reported that the more a participant was attracted to a person with 'risky' features, the less likely they were to consider that the person presented a health risk. Also, high sensation seekers rated potential partners as more attractive and less risky than low sensation seekers did. However, these studies did not address the effect of the participants' own perceived attractiveness on their judgements of risk and attraction and did not consider how these judgements related to condom use intentions in the context of casual sex.

Although there is consistent evidence of links between attractiveness and sexual behaviour, the mechanisms underlying these relationships have not been elucidated. Another unexplored issue is whether the relationships between attractiveness and sexual behaviour differ by gender.

The current study focused on how the perceived facial attractiveness of women by heterosexual men affected their willingness to have condomless sex and perceptions of STI risk. A similar work by Dijkstra et al[12] found that 72 male undergraduates asked to rate pictures of women and consider a brief description of their personality were more motivated to have sex with a physically attractive woman, even though they believed that she was more likely to have an STI. However, condom use intentions were not evaluated. Agocha and Cooper[13] did address this issue directly, finding that physical attractiveness was not a direct predictor of condom use intentions in a sample of psychology undergraduates. However, path analysis revealed that the total indirect effects of physical attractiveness on intentions to use condoms were five to six times larger than those for sexual health information about the target. More recent work by Epstein et al,[14] which involved an internet study displaying a picture and a biography for a randomly assigned target, also supported the hypothesis that a potential partner's physical attractiveness has an impact on intentions to have sex in men and women. However, no significant direct effects of physical attractiveness on intentions to have condomless sex or on perceived STI risk were found.

Although the above studies give some insights into the relationships between facial attractiveness, perceived risk and condom use intentions, their findings were not entirely consistent; in many cases, only one or two pictures of the opposite sex were rated by participants, and not all of the studies considered the context of demographic variables and sexual history. The current study extends research in this area by eliciting men's condom use intentions towards 20 women, and by evaluating these not only with respect to the perceived attractiveness of the women, but also the participants' perceptions of their own attractiveness, their sexual history, including their typical condom use behaviour, and their perceptions of other men's condom use intentions.

It is important to consider participant's self-rated attractiveness when analysing condom use intentions, since self-perceived attractiveness may influence sexual preferences,[15] perceived STI risk[12] and also mating decisions, as individuals tend to choose partners who physically resemble them or appear to have similar facial features.[16] Moreover, eliciting participants' judgements regarding the condom use intentions of other men like themselves may address possible demand characteristics of the study situation, which can encourage participants to provide a 'correct' response to questions directly targeting their own sexual behaviour.[17 18] Finally, in order to consider the possible influence of demographics and sexual experience on condom use intentions, the possible effects of participant age, satisfaction with their sex lives, their number of sexual partners and the age of their first sexual intercourse should be explored. All of the aforementioned variables were addressed in the current study.

The primary purpose of the current study was better to understand the relationship between perceived attractiveness and condom use intentions in heterosexual men and to gain insights into the relationship between perceived attractiveness, demographics, sexual history and perceived sexual health status. The research questions were: (1) does the perceived attractiveness of a potential sexual partner affect sex and/or condom use intentions? (2) does a participant's own perceived attractiveness affect their sex and/or condom use intentions? (3) does heterogeneity in the association between perceived sexual health status and perceived attractiveness influence condom use intentions? (4) Do demographic or sexual experience variables predict condom use intentions?

METHODS

Participants

Data were collected at the University of Southampton between January and May 2015. Men in Southampton and surrounding areas were recruited via social media (Facebook and Twitter), posters at the University and on community advertisement boards, and advertisements on

the University's online participant recruitment site (eFolio). Potential participants were informed that data would be collected using questionnaires in order to investigate the influence of attractiveness on sexual attitudes and intentions and they were screened for eligibility via email. Inclusion criteria were: 18–69 years of age; English-speaking and heterosexual man. Fifty-one men were screened and all met the inclusion criteria. All of them agreed to participate in a face-to-face session in a university location and provided electronic informed consent.

Measures

The study employed an electronic questionnaire to collect all participants' data. A draft questionnaire was initially trialled on five pilot study participants and was then refined on the basis of their feedback during individual think aloud sessions, in which they explained what they could and could not understand and also how participation made them feel. The final questionnaire comprised three sections: (1) participants' demographic information and judgement of their own attractiveness, (2) information regarding the participant's own sex life, (3) 5 judgements on each of 20 women on the basis of a single full frontal facial photograph. The order of the 100 test items in the third section was fully randomised for each participant.

In the rest of the paper, we use a series of single-letter labels to identify key variables associated with six categories of questionnaire items introduced in parentheses on their first mention below.

Demographics and own attractiveness

Participants were asked about their age, ethnicity and occupation, and then asked to rate their own attractiveness (O) on a scale from 0 to 100, with 0 indicating 'very unattractive' and 100 indicating 'very attractive'.

Sexuality variables

Participants' satisfaction with their sex life was assessed by the following item, "Thinking about your sex life in the last year, how much do you agree or disagree with the following statement: 'I feel satisfied with my sex life'". Response options ranged from '1' (strongly agree) to '5' (strongly disagree).

Participants also indicated whether they were attracted to men, women, either or both, their relationship status and how many lifetime sexual intercourse partners they had had. Three further yes/no questions were asked: "As far as you know, have you ever had an STI?", "As far as you know, do you currently have an STI?" and "As far as you know, are you allergic or sensitive to latex, non-latex condom and/or lubricants?" Finally, participants were asked: "Which one of the following percentages describes better the proportion of occasions of intercourse you have not used a condom in your lifetime?", "Which one of the following percentages describes better the proportion of occasions of intercourse you have not used a condom in the past twelve months?" and "How easy would it be for you to identify whether a woman has an STI, without asking?" Answers ranged from 0% to 100%, in six intervals with boundaries at 10%, 30%, 50%, 70%, 90% and 100%.

Ratings of facial photographs

Participants were asked to provide 5 ratings for each of 20 women on the basis of a single black and white photograph of the woman's face taken from the Extended Cohn-Kanade (CK+) database:[19] "Please rate the attractiveness of the following woman" (A); "If you were single, how likely would you be to have sex with this woman should the opportunity arise?" (S); "If you were single and you were to have sex with this woman, how likely is it that you would use a condom?" (C); "Out of 100 men like you, how many would have condomless sex with this woman should the opportunity arise?" (M) and "How likely is this woman to have an STI?" (I). Participants indicated their answer to each question by moving a slider between 0 and 100. These 100 items were presented in fully randomised order, that is, the 5 questions regarding a particular woman were not presented together or in a particular order and, similarly, the 20 questions regarding a particular rating (eg, attractiveness) were not presented together or in a particular order. Prior to commencing the task, a simultaneous presentation of all 20 faces was shown to enable the participants to anchor their judgements.

Stimuli selection and procedures

The Extended Cohn-Kanade (CK+) database[19] includes facial image data from 210 men and women aged 18–50 years. The data set includes 81% Euro-American, 13% Afro-American and 6% 'other' participants. For this study, 20 female faces with neutral expression were chosen at random and were displayed in black and white.

Procedure

After providing electronic informed consent, each participant completed the self-administered electronic questionnaire on a university computer (taking between 25 and 30 min). A researcher was present during the session in case the participant needed clarification of any questions, but they were not able to see participants' responses. Each participant received £4 (~6US$) at the end of the session. The Ethics Committee of the University of Southampton approved the protocol (ERGO ref: 13607).

Data analysis

To identify factors influencing condom use and interactions among them, a series of bivariate associations (Pearson's correlation coefficients[i]) were calculated, followed by a multivariate test of associations (a repeated-measures linear mixed model).

[i]Spearman's ρ was also calculated and provided similar values unless explicitly noted.

Table 1 The percentage of sexual intercourse episodes in which condoms were not used reported by 47 participants (ie, excluding four participants who had never had sexual intercourse) during their lifetime and during the last 12 months

% Condomless sex	<10%	<30%	<50%	<70%	<90%	≤100%
Lifetime	14	6	7	11	5	4
Past 12 months	20	2	6	4	4	11

RESULTS

Demographics

Fifty-one heterosexual men, mean age 26.41 years (SD=7.91, minimum=19, maximum=61), completed the session. Twenty participants were white British, 17 were white 'other' (eg, Italian) and the remaining were identified as Indian, Chinese, any other Asian background, Caribbean, Hispanic and other mixed background.

Sexual experience variables

In response to the statement: "I feel satisfied with my sex life", 5 (9.8%) participants agreed strongly, 25 (49%) agreed, 10 (19.6%) neither agreed nor disagreed, 8 (15.6%) disagreed, 2 (4%) disagreed strongly and 1 (2%) preferred not to say. All of the participants reported that they were exclusively attracted to women except one who reported that he was attracted to men and women. Twenty-three (45.1%) participants were single, 21 (41.2%) were in an exclusive relationship, 4 (7.8%) were in an open relationship and 3 (5.9%) were married. None reported having an STI at the time of the session, and 5 (9.8%) participants reported having an STI in the past. The average number of lifetime sexual partners was 9.65 (SD=10.95, minimum=0, maximum=60) and the mean age at first sexual intercourse was 18.3 years (SD=3.4, minimum=14, maximum=30). None of the participants reported suffering from an allergy to latex, non-latex condoms and/or lubricants. Reported rates of condomless sexual intercourse are presented in table 1.

Participants' ratings

In analysing participants' ratings, we distinguished between considering the data associated with each of the women being rated, aggregating over the participants' ratings and considering the data associated with each participant, aggregating over the women that he rated. For example, were some women judged to be more attractive than others on average, considering the participants as a group? This set of values will be denoted as A_w (see table 2 for ratings). Alternatively, did some participants find the set of 20 women in the study more attractive than other participants did, considering the women as a group? This set of values will be denoted as A_p.

Table 2 The mean participant ratings for each female photograph (scale 0–100)

Woman	Attractiveness (A_w)	Condom use intentions (C_w)	Sexually transmitted infection likelihood (I_w)	Other men: sex without a condom (M_w)	Willingness to have sex (S_w)
1	30.5	87.3	44.9	27.2	31.9
2	18.7	89.0	32.2	19.8	16.5
3	38.3	86.7	36.9	27.8	33.1
4	40.7	83.4	26.1	29.9	42.3
5	40.9	85.2	33.3	31.3	41.2
6	46.3	85.9	28.5	34.4	45.6
7	69.5	82.1	35.7	46.4	71.3
8	69.1	78.0	24.8	46.0	66.2
9	45.7	84.9	31.8	34.6	46.0
10	53.8	77.3	27.2	34.6	54.4
11	55.5	81.3	24.8	39.1	58.5
12	52.7	82.9	37.4	34.3	56.0
13	47.4	87.2	32.7	31.8	45.4
14	45.2	83.7	27.2	33.1	46.4
15	40.9	86.2	29.7	30.9	39.9
16	35.7	89.5	37.0	29.1	32.1
17	30.5	85.3	30.6	26.3	29.3
18	47.6	83.9	33.8	30.7	49.5
19	46.5	83.0	33.8	33.5	42.7
20	56.2	81.7	28.1	37.4	58.2

Table 3 Bivariate associations between mean ratings for 20 women (df=18) of their attractiveness, A_w, condom use intentions towards them, C_w, their sexually transmitted infection likelihood, I_w, the extent to which men like the participants would be willing to engage in condomless sex with them, M_w and the willingness of the participants to have sex with them, S_w

ρ/r	Attractiveness (A_w)	Condom use intentions (C_w)	Sexually transmitted infection likelihood (I_w)	Other men: sex without a condom (M_w)	Willingness to have sex (S_w)
Attractiveness (A_w)	–	−0.785***	−0.358	0.970***	0.985***
Condom use intentions (C_w)	−0.818***	–	0.553*	−0.730***	−0.795***
Sexually transmitted infection likelihood (I_w)	−0.299	0.517*	–	−0.348	−0.353
Other men: sex without a condom (M_w)	0.910***	−0.779***	−0.395	–	0.952***
Willingness to have sex (S_w)	0.963***	−0.844***	−0.362	0.917***	–

Pearson's r values are shown in the upper right half of the table, Spearman's ρ in the lower left: *p<0.05, **p<0.01, ***p<0.001, grey cells=NS.

Associations between participants' ratings of the 20 women

First, we constructed average ratings for each woman and considered relationships among these. The more attractive a woman was judged to be on average, A_w, the more likely participants would be willing to have sex with her, S_w (r=0.985, df=18, p<0.0001). Furthermore, the more attractive a woman was judged to be, A_w, the less likely men were to intend to use a condom during sex, C_w (r=−0.785, df=18, p<0.0001). Consequently, average condom use intentions, C_w, tended to be lower for women that participants were, on average, more willing to have sex with, S_w (r=−0.795, df=18, p<0.0001).

On average, participants judged that more men like themselves would have sex without a condom, M_w, to a greater extent with women that the participants judged, on average, to be more attractive, A_w (r=0.970, df=18, p<0.0001), and with whom the participants were, on average, more willing to have sex, S_w (r=0.952, df=18, p<0.0001). Consequently, where the average judgement of the number of men willing to have condomless sex with a woman, M_w, was high, participants' average condom use intentions towards the woman, C_w, were lower (r=−0.730, df=18, p<0.0001).

Although the average perceived STI likelihood for a woman, I_w, was positively correlated with average condom use intentions towards her, C_w (r=0.553, df=18, p<0.05), it had no significant association with her average perceived attractiveness, A_w, or with participants' average willingness to have sex with her, S_w. These bivariate associations are summarised in table 3.

Overall ratings of women

Next, for each participant, we averaged over their ratings of the 20 women and considered relationships among these 'overall' ratings. Participants who tended, overall, to rate the 20 women as more attractive, A_p, tended to be more willing to have sex, overall, S_p (r=0.855, df=49, p<0.0001). Participants who judged that men like themselves were more willing, overall, to have condomless sex with the 20 women, M_p, also tended to believe that, overall, the 20 women had a higher likelihood of having an STI, I_p (r=0.544, df=49, p<0.001) and themselves had higher overall condom use intentions, C_p (r=0.313, df=49, p<0.05). However, overall judgement of STI likelihood was not related to overall condom use intentions. These relationships are summarised in table 4.

Table 4 Bivariate associations (Pearson's r) between 51 (df=49) participants' overall ratings

ρ/r	Attractiveness (A_P)	Condom use intentions (C_P)	Sexually transmitted infection likelihood (I_P)	Other men: sex without a condom (M_P)	Willingness to have sex (S_P)
Attractiveness (A_P)	–	−0.126	0.094	0.067	0.855***
Condom use intentions (C_P)	−0.018	–	−0.041	−0.313*	−0.14
Sexually transmitted infection likelihood (I_P)	0.068	−0.003	–	−0.544***	0.154
Other men: sex without a condom (M_P)	0.009	−0.300	0.494**	–	0.102
Willingness to have sex (S_P)	0.837***	−0.089	0.178	0.057	–

Significance levels are indicated: *p<0.05, **p<0.01, ***p<0.001, grey cells=NS.

Influence of perceived own attractiveness and ability to detect STIs

The more attractive a participant judged himself to be, O_p, the more he believed that, overall, other men like him would not use a condom during sex, M_p (r=0.491, df=40, p=0.001) and the less likely he was, overall, to intend to use a condom himself, C_p (r=–0.355, df=40, p=0.02).

Participants' confidence in their ability to detect whether a potential sexual partner had an STI without asking was significantly negatively correlated with their overall tendency to rate women as more attractive, A_p (r=–0.295, df=49, p=0.036), and more likely to have an STI, I_p (r=0.323, df=49, p=0.02), and was also associated with overall lower condom use intentions in themselves, C_p (r=–0.403, df=49, p=0.003), and men like themselves, M_p (r=0.292, df=49, p=0.038). Participants who were more confident in their ability to detect STIs without asking also tended to rate themselves as more attractive (r=0.612, df=40, p<0.0001).

Influence of age and sexual experience variables

Participants more satisfied with their sex life tended to provide lower overall attractiveness ratings, A_p (r=0.373, df=49, p=0.006). Neither a participant's age, number of lifetime sexual partners, nor their relationship status, had an association with their overall ratings. Of the 47 participants who had indicated that they had experienced sexual intercourse, those who reported having had an STI gave higher overall ratings of attractiveness, A_p (r=0.346, df=45, p=0.017), willingness to have sex, S_p (r=0.308, df=45, p=0.035) and rates of condomless sex in men like themselves, M_p (r=0.312, df=45, p=0.016). Age at first sexual intercourse and rate of condomless sex over the last 12 months were not significantly related to the participants' overall ratings, but participants' lifetime rate of condomless sex was negatively associated with overall condom use intentions towards the women that they rated in the study, C_p (r=–0.301, df=45, p=0.04). These relationships are summarised in table 5.

Linear mixed model

A linear mixed model with repeated measures was constructed in order to carry out a multivariate analysis addressing the question: what linear combination of factors best explains the variation in participants' condom use intentions across the 20 women rated. The main benefit of a linear mixed model is that it enables repeated measures to be handled (in this case the 20 women rated), and deals with the possibility that participants may vary in the overall level and variability of their condom use intentions.

The set of participant condom use intention ratings (C_p) was the outcome variable, with the repeated measures being the individual women rated. Four participants who had indicated that they had not had sexual intercourse were excluded in order to include sexual experience variables related to sexual activity (eg, age at first sexual intercourse). All demographic and sexual experience variables and rating variables were included as main effects, except those for which there was no variation in the participant sample (ie, allergy to latex and current STI)[ii]. Willingness to have sex ratings was excluded from the model due to their very strong collinearity with attractiveness ratings (r=0.8). The model thus attempted to identify a single set of relationships that could account for all participants' patterns of condom use intentions.

Variables significantly associated with higher condom use intentions towards a woman were lower ratings of her attractiveness, A_p (p<0.0005), higher ratings of her STI likelihood, I_p (p<0.0005) and lower estimates of the number of men who would have condomless sex with her, M_p (p<0.0005). Demographic and sex experience variables that were significantly associated with participant's reporting higher condom use intentions were being either married or in an exclusive relationship (p=0.002), being less satisfied with sex life (p=0.016), lower age (p=0.001), higher number of sexual partners (p=0.001), higher age of first intercourse (p=0.003), lower lifetime rates of condomless sex (p<0.0005) but higher rates of condomless sex in the last 12 months (p<0.041) and lower confidence in their ability to determine, without asking, whether a woman had an STI (p=0.001). The participant's STI history was not significant.

Participant heterogeneity analysis

Note that while the above analyses have revealed relationships between average ratings, they are quite insensitive to between-participant heterogeneity. This means that they are not suited to answering questions such as: do the condom use intentions of participants who are more attracted to women that they regard as at higher risk of an STI differ from those of participants who are attracted to 'safe' women? The following analyses address this deficiency by considering within-participant correlations between ratings (eg, the correlation between condom use intentions and STI risk for each participant).

Some within-participant correlations were very consistent, for example, the average correlation between participant's attractiveness ratings and their willingness to have sex ratings was r_{AS} ¼ 0:76, with 45 participants exhibiting a correlation >0.8. However, in other respects, participants were more heterogeneous. In particular, while

[ii]Twelve variables were included in the mixed linear model: participants' ratings of women's attractiveness, STI likelihood and the extent to which other men like themselves would be willing to have condomless sex with the women, as well as participant age, satisfaction with their sex life, relationship status, STI history, number of sexual partners, age at first intercourse, lifetime condom use, condom use in the past year and their confidence in their ability to predict a woman's STI status on the basis of her appearance. The "participant's own attractiveness" variable was not included due to missing data for the first nine participants who did not receive this questionnaire item.

Table 5 Bivariate associations (Pearson's r) between 51 (df=49) participant demographic and sex experience variables (left column) and their mean ratings of 20 women

R	Attractiveness (A_P)	Condom use intentions (C_P)	Sexually transmitted infection likelihood (I_P)	Other men: sex without a condom (M_P)	Willingness to have sex (S_P)
Age	0.212	−0.249	0.156	0.270	0.276†
Satisfaction with sex life	−0.373**	0.086	−0.193	−0.154	−0.178
No. of sex partners	−0.193	−0.084	0.274	0.197	−0.044
Relationship status	0.163	−0.056	−0.075	0.152	0.207
Past sexually transmitted infection	0.346*	−0.256	−0.080	0.312*	0.308*
Age at first intercourse	0.211	0.183	−0.125	−0.142	0.180
Condomless sex in lifetime	−0.038	−0.301*	−0.228	−0.047	−0.201
Condomless sex in last 12 months	0.05	−0.201	−0.099	0.150	−0.094

Four participants indicating that they had not had sexual intercourse were excluded from the bottom four analyses (ie, df=45).
Significance levels are indicated: *p<0.05, **p<0.01, grey cells=NS.
†Although r is significant (at p<0.05) for Age by S_P, Spearman's ρ (0.04) is not significant (p=0.78), suggesting that outlier participants have had a disproportionate influence on the association.

the average correlation between participant's attractiveness ratings and their STI likelihood ratings was close to zero, 21 participants had strong preferences for either 'safe' or 'risky' women, with r_{AI} correlations either greater than 0.4 or less than −0.4.

The extent to which a participant was attracted to more risky sexual partners (ie, the correlation between participant's attractiveness ratings and their STI likelihood ratings) had no influence on the correlation between their condom use intentions ratings and their willingness to have sex ratings. Men who were attracted to high-risk women and men who were attracted to low-risk women both had lower condom use intentions towards the women that they were attracted to (cf. the flat distribution of points in the lower half of figure 1A). Consequently, participants more willing to have sex with safer women had lower condom use intentions towards safer women, whereas participants more willing to have sex with riskier women tended to have lower condom use intentions towards those high-risk women (cf. the diagonal distribution of points in figure 1B, with risk seekers in the bottom right quadrant).

DISCUSSION

This study suggests that there is a strong correlation between perceived attractiveness and condom use intentions in heterosexual men. Participants were more willing to have sex with attractive women, but were less inclined to use condoms when they do so. Agocha and Cooper[13] found that male participants perceived women of high attractiveness as less risky and reported that they were less likely to discuss risk-relevant topics with them. Conceivably, such men might believe that attractive women take care of themselves more than less attractive women do, and therefore that they are healthier and pose less of a health risk, legitimising their reduced condom use intentions. However, this hypothesis is undermined by Dijkstra et al's finding[12] that participants perceived highly attractive women to be more promiscuous and more likely to have an STI than less attractive women. Conversely, Epstein et al[14] did not find a significant effect of perceived attractiveness on condomless sex intentions or perceived STI likelihood.

It seems possible that these diverse findings stem from genuine diversity in the male population. The current study found no overall relationship between judgements of STI likelihood and judgements of attractiveness. On average, men are not more attracted to women they judge to be at lower risk of STI. Instead, participants varied significantly in this respect, with some men significantly more attracted to women that they judged to be free of STIs and some men significantly more attracted to women that they judged to be more likely to have an STI. If condom use intentions in men reflect their judgements of STI risk, then we might expect these intentions to differ along this risk-seeking/safe-seeking dimension. This is, however, not the case. Men who are more attracted to 'riskier' women are just as disinclined to wear a condom when they have sex with these women as men who are more attracted to 'safer' women. This leads to behaviour that appears irrational from the perspective of avoiding infection: men attracted to riskier women are more inclined to use condoms with the safer women who they are less attracted to, rather than the risky women with whom

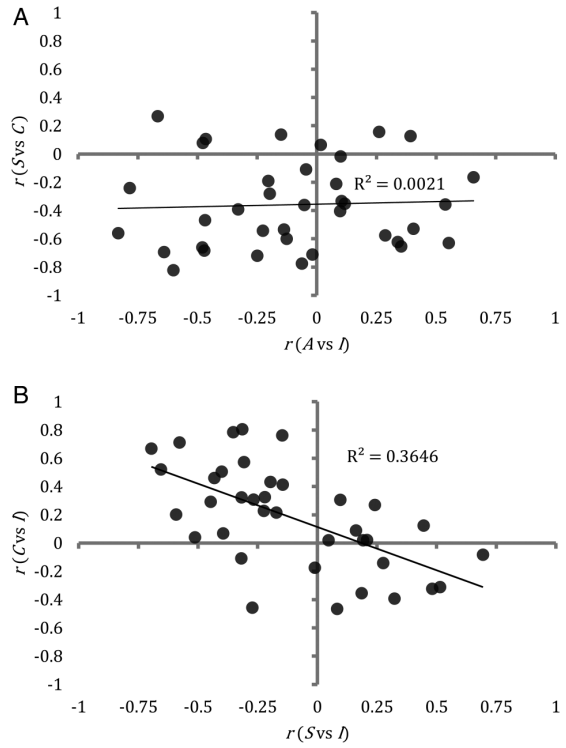

Figure 1 Scatterplots showing trends in the ratings of individual participants. Each point represents data from one participant: (A) the extent to which a participant tended to be attracted to women whom he judged to be likely to have a sexually transmitted infection (horizontal axis) had no influence on the extent to which he intended to use condoms with women he was willing to have sex with. (B) The extent to which a participant tended to be more willing to have sex with women whom he judged to be more likely to have asexually transmitted infection (horizontal axis) was significantly associated with his tendency to have lower condom use intentions towards those high-risk women (R^2=0.3646, df=49, p<0.0001).

they are more willing to have sex with. This underlines the fact that people are often fully aware of the 'rational' responses (in a health promotion sense), but their actual behaviour does not necessarily follow suit.[20]

The tendency of participants to have reduced condom use intentions towards women with whom they are willing to have sex is surprising in the light of their judgement that a greater number of men like themselves would be willing to have condomless sex with these women, which implies that these women are at high risk of STIs. This observation did not translate into higher perceived risk, either in terms of increased overall condom use intentions towards more 'attractive' women or increased overall expectations of infection in 'attractive' women. This finding agrees with Fishbein et al,[10] who found that risk information about a partner is sometimes ignored when the partner is attractive.

This study also sheds some light on the sexual risk taking of men based on their own perceived attractiveness. Men who judged themselves to be more attractive were less likely to intend to use a condom and also estimated higher rates of condomless sex in men like themselves. This is unlikely to be due to these men having had more sexual experiences than men who are less confident of their attractiveness, since reporting a high number of sexual partners was associated with higher condom use intentions. Alternatively, attractive men may feel that they can influence their partner not to use a condom to a greater extent than less attractive men, who might be more worried that if their partner does not agree to condom use, they might not have a high chance of success with them or other women.

Studies have demonstrated that people form beliefs about STI risk during first encounters,[21] that these judgements can be made within milliseconds[22] and that they are based on a wide variety of factors.[23] However, prior to this study, the influence on condom use intentions of participants' confidence in their judgements had not been thoroughly investigated. Participants' confidence in their ability to judge whether a potential sexual partner had an STI on the basis of appearance was found to be significantly positively correlated with participants' tendency to rate women as less attractive and as more likely to have an STI, and with lower condom use intentions in themselves and men like themselves, and higher self-perceived attractiveness.

Condom use intentions were positively correlated with reported lifetime condom use, which suggests that participants responded to the hypothetical survey scenarios in a manner that reflected to some extent their real sexual behaviour.

Although we might have expected to find little variability in participants' ratings in a study with strong normative demand characteristics (eg, participants might feel that they are expected to use condoms when they have sex with women), the data revealed a wide variety of behaviour and intentions, organised around strong trends and patterns despite the relatively small sample. Moreover, men varied considerably in their attitudes to sexual behaviour, condom use and risk. This suggests that tailored sex education interventions, to target particular groups of people, might be useful; for example, a message that is appropriate for men who report that they are attracted to women who are likely to be free from infection may not be effective for men who are attracted to women that they believe are more likely to have an STI (figure 1). More generally, it may be profitable to explore interventions that target the tensions between some of the beliefs exhibited by the participants here; for instance, the fact that participants believed that many men like themselves would most like to have unprotected sex with the kind of women that the participants themselves find attractive. This intervention could take the form of a computer game, which adapts its content based on the target group or

individual. As younger people are very familiar with computer and video game playing, they may find it easier to engage with this kind of sex education intervention and, therefore, they could better understand the risks and their misconceptions.[24] Education through games can be effective as it is predominantly the player who directs activity and therefore the learners are involved in the learning process, in contrast with traditional education, which suggests a teacher-centred approach where learners are relatively passive.

Future research could also investigate whether individual differences in variables known to influence risk taking, such as sexual sensation seeking[25] and sexual excitation/inhibition,[26] might mediate the relationship between attractiveness and condom use intentions.

Limitations

Participants completed the study in the presence of a female researcher who may have influenced their responses, as has been shown in previous studies.[27] Future studies should control for this possible confounding effect. Also, the degree to which participants were sexually aroused was not recorded during the study. Sexual arousal could dramatically influence their condom use intentions.[28] Another limitation was the small and relatively homogeneous sample; however, 51 men and 20 stimulus women provided over 1000 data points for each measure. Finally, participants' reported condom use intentions in this study may or may not resemble their actual usual condom use behaviour since condom use behaviour may not correlate highly with condom use intentions[29] due to the influence of contextual factors such as alcohol and sexual arousal.

Notwithstanding these limitations, this study is the first to explore the relationship between perceived attractiveness and condom use intentions in heterosexual men, including their self-ratings of attractiveness and previous sexual experiences.

CONCLUSIONS

In summary, this study extends the literature by investigating the association between own perceived attractiveness, sex and condom use intentions. Additionally, the associations between age, sex life satisfaction, STI history, reported condom use with sex and condom use intentions were explored. Male perceptions of attractiveness influence their condom use intentions; such risk biases could profitably be discussed during sex and relationships education sessions in educational settings.

Contributors AE led the study design, conducted the research and prepared early drafts of the article. SB, CAG and RI helped with the design of the study. SB and NS helped with the statistical analyses. All authors read and commented on drafts of the article and approved the final version.

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Does attractiveness influence condom use intentions in heterosexual men? An experimental study

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Appendix I

JMIR Serious Games Paper: Using Computer Simulations for Investigating a Sex Education Intervention: An Exploratory Study

JMIR SERIOUS GAMES Eleftheriou et al

Original Paper

Using Computer Simulations for Investigating a Sex Education Intervention: An Exploratory Study

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Abstract

Background: Sexually transmitted infections (STIs) are ongoing concerns. The best method for preventing the transmission of these infections is the correct and consistent use of condoms. Few studies have explored the use of games in interventions for increasing condom use by challenging the false sense of security associated with judging the presence of an STI based on attractiveness.

Objectives: The primary purpose of this study was to explore the potential use of computer simulation as a serious game for sex education. Specific aims were to (1) study the influence of a newly designed serious game on self-rated confidence for assessing STI risk and (2) examine whether this varied by gender, age, and scores on sexuality-related personality trait measures.

Methods: This paper undertook a Web-based questionnaire study employing between and within subject analyses. A Web-based platform hosted in the United Kingdom was used to deliver male and female stimuli (facial photographs) and collect data. A convenience sample group of 66 participants (64%, 42/66) male, mean age 22.5 years) completed the *Term on the Tides,* a computer simulation developed for this study. Participants also completed questionnaires on demographics, sexual preferences, sexual risk evaluations, the Sexual Sensation Seeking Scale (SSS), and the Sexual Inhibition Subscale 2 (SIS2) of the *Sexual Inhibition/Sexual Excitation Scales-Short Form (SIS/SES - SF)*.

Results: The overall confidence of participants to evaluate sexual risks reduced after playing the game (P<.005). Age and personality trait measures did not predict the change in confidence of evaluating risk. Women demonstrated larger shifts in confidence than did men (P=.03).

Conclusions: This study extends the literature by investigating the potential of computer simulations as a serious game for sex education. Engaging in the *Term on the Tides* game had an impact on participants' confidence in evaluating sexual risks.

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KEYWORDS

sex education; personality; STI; gender; computer simulation

Introduction

Background

Sexually transmitted infections (STI), including human immunodeficiency virus (HIV) are ongoing concerns. Rates of new STI diagnoses are increasing in most countries of the world, particularly among young people [1]. The best method for preventing the spread of these infections is the correct and consistent use of condoms [2,3]. However, people continue to engage in risky sexual behaviors, such as having condomless

sex [4] and using condoms incorrectly [5,6]. Given these threats to individual and public health, many strategies and intervention programs have been developed to encourage consistent and correct condom use; these interventions have met with varied levels of success [7].

There are several reasons for variation in the impact of interventions. First, a "one-size-fits-all" approach is unlikely to be effective with all the intended recipients, given that they will vary in age, sexual preferences, sexual experience, and sexual attitudes [8-10]. Kirby and Laris [9] noted that it is important for a sex education program to meet the needs of the audience, taking into account different backgrounds and community values. Recent research has shown that personality traits, as well as perceived attractiveness, can significantly affect the perception of sexual risk [11]. Henderson et al [12] demonstrated how individuals high in Sensation Seeking (SS), compared with those lower in SS, rate potential partners as more attractive and are more willing to have sex with those partners, but they feel that they are less likely to contract an STI. Results of a similar study showed that participants who were engaged in a wider range of potentially risky sexual behaviors were characterized by higher Sexual Sensation Seeking Scale (SSS) [13]. These results support the idea that sex education programs may benefit from the inclusion of components aimed at teaching young people to satisfy their preferences for SSS through sexual behaviors involving minimum risk.

In addition to SSS, another measure that might be relevant is Sexual Inhibition (SI), particularly a subscale from the *Sexual Inhibition/Sexual Excitation Scales (SIS/SES*), which assesses sexual inhibition due to performance consequences (Sexual Inhibition Subscale 2, SIS2). In a sample of gay men, Bancroft et al [14] showed that condomless anal sex was more likely among those who scored lower on sexual inhibition due to the "threat of performance consequences" (eg, threat of an STI). In samples of both heterosexual men and women, research has supported the association between scores on SIS2 and sexual risk taking behavior [15,16].

Second, some people feel less vulnerable to STIs based on their belief that they can ascertain whether a potential partner is likely to be infected or not on the basis of the way that they look or some other superficial characteristic. It has been shown that men feel that they would be able to make judgments about other people's sexual health status based on perceived attractiveness [8,17]. In one study, participants believed that judgments of sexual unfaithfulness could be made of the face alone, without consideration of behavioral cues [18]. Hence, one main aim of sex education programs, but one that has been seldom addressed in interventions to date, should be to challenge this false sense of security.

Third, many sex education programs have been described, particularly by young people, as being "boring" or "irrelevant" to their needs [19]. Carswell et al [20] emphasized the importance of Web-based sex education interventions, pointing out how attractive they are for young people, as they offer a confidential and convenient medium for accessing health information, avoiding the embarrassment of discussions with teachers and health providers, and overcoming potential boredom by using an interesting game format. DeSmet et al [21] and D'Cruz et al [22] highlighted the importance of certain game design features that should be considered when developing a game for sex education, such as individual tailoring, goal-setting, narrative or story, audiovisual effects, interactivity, challenge on different levels, rewards, and immediate feedback.

Bearing in mind these three issues, one direction in which sexual health interventions could profitably develop involves the use of serious games. As young people are very familiar with computer and video game playing [23,24], they may find it easier and more motivating to engage with this format of sex education intervention [25,26]. Serious games could focus on increasing understanding of the risks and addressing misconceptions [27] in the complex area of STI transmission. This could happen if people are given the potential to engage with a simulated world of people and their sexual interactions, in order to see how easy it is for diseases to spread. In serious games, it is predominantly the players who direct events and are therefore actively involved in the learning process [28,29], in contrast to traditional sex education interventions, where learners are generally relatively passive [30,31].

There has been some previous research exploring the use of games for sex education. *The Source* [19] is an alternative reality game that was delivered over 5 weeks to young people aged between 13 and 18 years. Each week focused on a different topic (including sexual health) that was taught using various methods, such as puzzles, board games, digital media tasks, and scavenger hunts. No behavioral outcome data were reported. However, participants enjoyed the tasks and some of them reported that *The Source* reinforced their decisions to engage in safer sex, although many of them commented that they found the board games boring and not as interactive as the computerized tasks.

Verran et al [32] explored the idea of using a computer simulation called *SimZombie* for educational activities about the epidemiology of an infectious disease (albeit not a sexually transmitted one) carried out at the Manchester Science Festival 2011. *SimZombie* makes use of the fact that many young people show interest in zombies and therefore it helps them engage more than they would do with a "one-way" mode of communication, such as a leaflet explaining the epidemiology of diseases. In the activities designed by Verran and colleagues, 10 teams of 4-6 participants (predominantly families or teenagers) had to answer 3 rounds of questions about monsters, microbiology, and general scientific knowledge. After each round, their answers were marked by being inserted into the simulation. Enthusiastic feedback given by participants evidenced learning through these activities.

Shegog et al [33] developed a stand-alone Web-based game of 13 lessons, called *It's Your Game (IYG)*. IYG lessons, which target early adolescents, include activities like interactive 2D exercises, quizzes, animations, and peer video. An evaluation of this game [34] showed no significant difference in the delay of sexual activity between intervention and control students; however, there was a significant positive between-group difference on psychological variables related to STI and condom

knowledge, perceived norms about sex and condom use self-efficacy.

Although previous studies have suggested potential positive benefits of serious games in health education, very little research has been carried out to investigate the influence of computer simulations for sex education specifically. As it is possible that the benefits of such games will vary according to age [35], gender [19], and sexual attitudes [8], it would be useful to investigate the possible impact of these variables.

Aim of This Study

The primary purpose of this study was to explore the potential of computer simulation as a serious game for sex education and how the effects of a serious game might be moderated by personality traits, age, and gender. The research questions were (1) Do gender, age, and personality traits influence levels of confidence in evaluating sexual risk? (2) Does a simulation in the form of a serious game influence participants' confidence regarding the assessment of sexual risk? and (3) Do gender, age, and personality traits influence the impact of the serious game in altering participants' confidence in evaluating sexual risks?

Methods

Sample and Recruitment

Men and women in Southampton and surrounding areas were recruited via social media (Facebook, Twitter), posters at the University, and community advertisement boards. Potential participants were informed that data would be collected using an electronic quiz in order to investigate the use of a serious game in the form of a computer simulation for sex education. The posters contained the following information: "I would like to see how you will perform in a game we have developed for sex education." Inclusion criteria were 18-30 years of age and English speaking. A total of 42 men, 22 women, and 2 participants who chose "other" for the question on gender were screened and all met the inclusion criteria.

Data were collected in May 2016. In total, 22 participants completed the experiment online at home, with a further 44 doing so in the lab. All participants were provided with a study information sheet and indicated electronic informed consent. The study took approximately 25 min.

Study Design

This was a Web-based questionnaire study (that used between and within subject analyses). The study employed a quiz to collect data. A draft quiz was initially trialed on 6 pilot study participants and was then refined on the basis of their feedback during individual "think aloud" sessions. "Think aloud" is a commonly used protocol for usability testing of an intervention [36].

Measures

The final questionnaire comprised four sections: (1) demographic information, (2) the participant's sexual risk evaluations, (3 personality trait questionnaires (SSS [37] and SIS2 of the *SIS/SES – Short Form* [38]), and (4) the *Term on the Tides* quiz. The order of the 10 test questions in the quiz was fully randomized for each participant.

Demographics and Sexual Behavior

Participants were asked about their age, ethnicity, gender, and sexual orientation. Ethnicity options included white, black, Asian, mixed, and other. Gender options were "male," "female," "other," and "prefer not to say," and for sexual orientation (preference), "men," "women," "both," or "none."

Personality Traits Questionnaires

The SSS [37] assesses the tendency to seek out varied, novel, and complex sexual experiences and the desire to take personal, physical, and social risks in order to enhance sexual sensations. A sample item is "I am interested in trying out new sexual experiences." The SSS can be used with both men and women, and shows good construct validity and internal consistency (Cronbach alpha=.83 for men and Cronbach alpha=.81 for women) [37]. Questions were answered on a 4-point scale, ranging from 1 (*not at all like me*) to 4 (*very much like me*). The sums of the scores are calculated to produce a total score on SSS, with a higher score indicating higher levels of the trait.

The SIS2 assesses individual propensity to inhibit arousal because of threat of performance consequences (such as contracting an STI) [38]. This scale is one of three subscales of the *SIS/SES – SF*. A sample item is "If I realize there is a risk of catching a sexually transmitted disease, I am unlikely to stay sexually aroused." SIS/SES-SF can be used with both men and women, shows good construct validity and test-retest reliability [38]. Response options range from 1 (*strongly disagree*) to 4 (*strongly agree*); after suitable recoding, scores are summed to produce a total score, with a higher score indicating higher levels of inhibition.

Evaluation of Sexual Risk

Participants were asked to respond to the following statement: "Risks taken during unprotected sex are easy to evaluate." Response options ranged from 1 (*strongly agree*) to 5 (*strongly disagree*). This item was used as a measure of the participants' confidence in evaluating sexual risk.

Participants also rated their level of agreement with this statement: "The risk that someone takes when they have unprotected sex depends on the risk taking behavior of the other people in the sexual population." Response options ranged from 1 (*strongly agree*) to 5 (*strongly disagree*). This item was included to assess the extent to which participants felt that they were in control of potential risky situations.

Both items were completed before (t_1), and immediately after (t_2), completion of the *Term on the Tides* quiz.

Game Description: Term on the Tides

The quiz concerns a cruise called *Term on the Tides*, developed for this study, where the user of the game is asked to answer some questions about the sexual health status of people on the cruise, at different stages of the simulation (developed in Java).

The storyboard was introduced with the following: "You embarked on a singles love cruise sailing from Mykonos down

to Ibiza. The ship is full of heterosexual single men and women who are looking for easy, no-strings attached sexual encounters with each other. Passengers have not been medically examined and therefore are unaware of whether are carrying a sexually transmitted disease or not. The journey time to your destination is 1 week. The ship is fully prepared for any lengthy journey and it is well-stocked with food and supplies including an inexhaustive supply of condoms. Due to the nature of the cruise, everyone is unconcerned with forming a relationship. So whether they will choose to have sex with someone, with or without a condom, is purely based on physical appearance." The main task of the participants was to give the right answer to 10 questions or scenarios regarding the sexual health status of certain people on the cruise.

The scenarios presented in the questions were based on the responses of male participants in a previous study [8], regarding their reported condom use intentions according to their perceptions of women's attractiveness. These responses were used in order to produce the profiles of the people in the simulation (Figure 1). Each person's profile had two characteristics: (1) how their condom use intentions and their judgments of STI likelihood varied with the attractiveness of a potential sexual partner, and (2) how the STI likelihood judgments of the person varied with the attractiveness of a potential sexual partner. For example, the Type A man shown in Figure 1 tends to use condoms less with women he finds more attractive (therefore he gets a "−" sign in the first box of his profile) and also believes that STI status is not associated with perceived attractiveness (therefore he gets a "=" in the second box of his profile). As nine different profiles could be created using combinations of the three symbols ("+," "−," "="), nine different types of men were created and several copies (clones, ie, people with similar behavior) of those were included in the simulation. The number of clones of each type used was proportional to the number of participants in the first study [8] who fitted those types, based on their responses. In total, there were 100 men in the simulation.

A summary of attractiveness ratings given by each man in the previous study to each woman was shown to the users throughout the game (Figure 2). The profiles of the women were chosen in a similar way to that described above for men, with the difference being that we constructed the female profiles based on how men rated female pictures in the first study [8]. Ten types of women were chosen and we tried to include as much variability in attractiveness and STI ratings as possible. Ten clones of each one of those profiles was included in the simulation, leading to a total of 100 simulated women.

Figure 1. Male profiles in the computer simulation. Each type has two symbols to describe his personality. For the top one, a "+" indicates that a person uses condoms more with women that they find attractive, a "−" indicates that a person uses condoms less with women that they find attractive, and an "=" indicates that condom use is not affected by attractiveness. The bottom symbol represents the belief of a person with regards to the relationship between sexually transmitted infection (STI) risk and attractiveness: "+" means the person believes that attractive women are more likely to have an STI, "−" means that they believe attractive women are less likely to have an STI, and "=" means that the person believes that attractiveness is not related to STI.

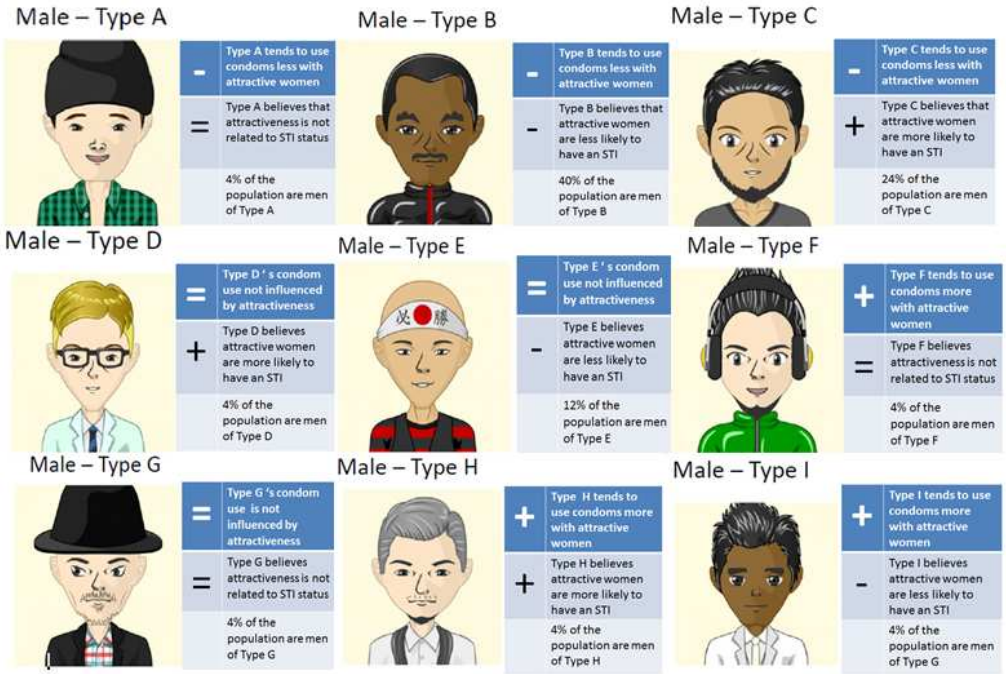


Figure 2. Attractiveness table. A "+" indicates that the specified man is attracted to the specified woman, a "−" indicates that the man specified is not attracted to the specified woman, and an "=" means that the man does not find the woman either attractive or unattractive.

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

There were various different framings used and each one of them clearly specified the precise situation of the people in the simulation. For example, in one, the user is asked to predict the outcome of an encounter between a man of Type A and a Type 4 woman versus an encounter between a man of Type A and a Type 7 woman (see Figure 3). When participants were able to correctly judge which sexual interaction was most risky, they were awarded 1 point. Ten scenarios were presented; therefore, the score for someone who did not make any correct estimates would be 0 and for someone who accurately answered all scenarios would be 10.

The final stage of the game was the feedback provided to the users. Users watched a series of encounters between men and women in the simulated population, and they received information on how well they managed to estimate risk in each scenario, by receiving an overall score for the quiz and appropriate feedback to each question (see Figure 4).

In order to determine the correct answers to the questions, the computer simulation makes use of the attractiveness and condom use intentions of each person on the cruise. At the beginning of each simulation, infections are allocated to the population at random. People have the chance to meet each other and decide (1) whether to have sex or not, and, if they decide to have sex, (2) whether to have sex with or without a condom, based on the variables of attractiveness and condom use intentions specified for their type. There is a very high chance of an STI transmission when someone has condomless sex with another person who carries an infection. An average over 100 simulations was used for this quiz.

In order to account for possible biases stemming from the appearance of the images used for each type of person in the game, a random selection of pictures was allocated at the beginning of the game, from a selection of three different versions (white, black, and Asian faces).

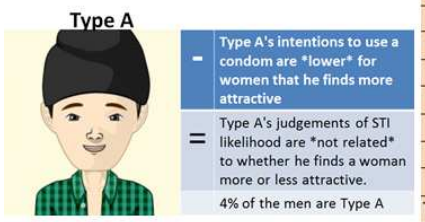
Procedure

After providing informed consent, each participant completed the self-administered questionnaires followed by the quiz. A £100 Amazon voucher was offered as an incentive to the person with the highest score on the quiz. The Ethics Committee of the University of Southampton approved the study.

Data Analysis

To identify factors influencing the confidence ratings and the levels of change of confidence of evaluating sexual risk, a series of bivariate associations (Pearson correlation coefficients) and independent *t* test were conducted between the main variables examined (age, gender, personality traits, quiz score, and confidence of evaluating sexual risk before and after the game). Matched pairs *t* test was used to test whether participants' confidence in evaluating STI risk changed from t_1 to t_2, that is, before and after the simulation.

Figure 3. Example question: Is a type A man more likely to get an infection from a Type 4 woman or a Type 7 woman?



Attractiveness Table

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
	Number of men	4	40	24	4	12	4	4	4	4
Women Types	Number of women									
Type 1	10	-	-	-	-	-	-	-	-	=
Type 2	10	=	-	-	-	=	-	-	=	-
Type 3	10	-	+	+	+	+	=	-	=	+
Type 4	10	=	+	=	=	+	-	-	+	+
Type 5	10	+	=	=	+	+	+	-	-	+
Type 6	10	+	=	=	=	+	-	-	-	=
Type 7	10	+	-	=	+	=	+	-	=	+
Type 8	10	+	=	=	-	=	+	-	-	=
Type 9	10	=	-	=	=	=	-	-	=	-
Type 10	10	+	-	=	-	=	=	-	+	=

Figure 4. Feedback given to the participants.

	Men Types	Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I	Female Infections
	Number of men	4	40	24	4	12	4	4	4	4	○ means woman infected by man
Women Types	Number of women										
Type 1	10	-	-	-	-	-	-	-	-	=	1
Type 2	10	=	-	-	-	=	-	-	=	-	1
Type 3	10	-	+	+	+	+	=	-	=	+	
Type 4	10	=	+	=	=	+	-	-	+	+	1
Type 5	10	+	=	=	+	+	+	-	-	+	1
Type 6	10	+	=	=	=	+	-	-	-	=	
Type 7	10	+	-	=	+	=	+	-	=	+	1
Type 8	10	+	=	=	-	=	+	-	-	=	
Type 9	10	=	-	=	=	=	-	-	=	-	1
Type 10	10	+	-	=	-	=	=	-	+	=	1
Male Infections Summary ○ means man infected by woman		2			1	1	1		2	1	

Results

Descriptive Statistics

Demographics

A total of 66 participants (42 men, 22 women, and 2 "other") had a mean age of 22.5 years (SD 3.3, min 18, max 29). The majority of participants were identified as white (80%, 53/66) and as heterosexual (approximately 88% [58/66]; see Table 1).

Personality Variables

On the SSS, the mean score for men was 23.1 and for women was 22.5. Higher scores indicated greater sexual sensation seeking. There was no significant gender difference in this measure (t_{62}=0.42, not significant [ns]).

Table 1. Sample demographics.

Variable		n
Ethnicity		
	White	53
	Black	3
	Asian	7
	Mixed	1
	Other	2
Gender		
	Men	42
	Women	22
	Prefer not to say	2
Age (in years)		
	18-24	46
	25-30	20

On the SIS2, the higher a participant scored, the higher the propensity for sexual arousal to be reduced in the face of threats of performance consequences. The mean SIS2 score for women (12.9) was significantly higher than that for men (11.2) (t_{62}=3.05, P<.005).

Research Question 1: Do Gender, Age, and Personality Traits Influence Levels of Confidence in Evaluating Sexual Risk?

At t_1, women believed that risk was easier to assess than did men, with the mean ratings 3.82 and 3.25, respectively (t_{62}=1.99, P=.05); however, the belief that risk depends on the other people did not differ between men and women (t_{62}=0.19, ns).

Age showed no significant correlations with participants' confidence in evaluating risk (r=.11, n=66, ns) or their belief that risk depends on others in the population (r=−.05, n=66, ns).

At t_1, no significant correlations between SSS or SIS2 and participants' confidence in evaluating sexual risk (r=.15 and r=.10, respectively, n=66, ns) or in believing that the sexual risk depends on others in the population (r=.15 and r=.13, respectively, n=66, ns) were found.

Research Question 2: Does a Simulation in the Form of a Serious Game Influence Participants' Confidence Regarding the Assessment of Sexual Risk?

In response to the statement "Risks taken during unprotected sex are easy to evaluate," the mean score before the game was 3.47, and after the game it was 2.98. A matched pairs t test showed that the change in confidence was significant (t_{63}=5.81, P<.001). Before the intervention, 56% agreed that it was easy to evaluate risk, whereas only 44% did so after the intervention. Similarly, 24% disagreed before the game compared with 38% after the game.

In response to the statement "The risk that someone takes when they have unprotected sex depends on the risk taking behavior of the other people in the sexual population," the mean score before the game was 3.74, and after the game it was 3.77. A matched pairs t test revealed that the difference between these mean scores was not significant (t_{65}=0.27, ns).

Research Question 3: Do Gender, Age, and Personality Traits Influence the Impact of the Serious Game in Altering Participants' Confidence in Evaluating Sexual Risks?

There was a significant gender difference in the impact of the game on confidence ratings; women had a greater reduction in confidence regarding their perceived ability to evaluate sexual risk than did men (mean change scores for men 0.30 and 0.82 for women; t_{60}=3.11, P<.005). There were no gender differences in change scores for believing that risk depends on other people (mean change scores for men 0.05 and −0.18 for women; t_{62}=0.92, ns). Age did not correlate with either of the risk measures (for easy, r=.12, n=64, ns, and for risk depends on others, r=−.18, n=60, ns).

Similarly, there was no correlation between the changes in confidence ratings concerning assessment of sexual risk before and after the game, and scores on SSS or SIS2 (r=−.06, n=64, ns and r=.11, n=64, ns, respectively). Finally, there was also no correlation between the changes in confidence ratings concerning sexual risk depending on others before and after the game, and scores on SSS or SIS2 (r=.20, n=66, ns, and r=−.03, n=66, ns, respectively).

Additional Results on Quiz Scores

The average score on the quiz across the 66 participants was 5 out of 10 (min=2, max=8; the mean for men was 5.1, and 4.8 for women; t_{62}=0.79, ns). There were no differences in scores according to age (r=−.13, n=66, ns) or whether participants completed the study at home or in the laboratory (r=.20, n=66, ns). Anecdotal reports after the study indicated that many participants found the game very interesting and thought provoking, but also quite challenging.

No significant correlation was found between scores on the quiz and confidence in evaluating sexual risk at t_1 (r=−.06, n=66, ns and r=−.07, n=66, ns, for risk for self and risk for others, respectively), or the change in confidence regarding risk-assessment between t_1 and t_2 (r=−.01, n=64, ns and r=−.06, n=66, ns, respectively).

Discussion

Principal Findings

This study sheds some light on the use of computer simulations as a serious game for sex education. There was a significant change in participants' confidence in evaluating sexual risk in the *Term on the Tides* game. Before they played the game, the majority of the participants believed that it was easy to evaluate the risks of unprotected sex. The serious game challenged individuals' confidence to evaluate risks and, as a result of this, approximately 40% of participants reported lower confidence after playing the game than they did at the t_1 baseline. The fact that overall confidence in evaluating risks reduced after the participants had engaged with the game illustrates a potentially positive public health outcome. It would be expected that lower confidence in evaluating sexual risks would lead to greater caution in sexual encounters.

Age and the personality trait variables—SSS and SIS2—were not correlated with the confidence of evaluating risk or with the level of change in confidence before and after the game. Gender, however, did have an effect, as women demonstrated a bigger shift in confidence of evaluating sexual risk than men. This finding agrees with a previous study on *The Source*, an alternative reality game [19], which suggested that women were influenced more by engaging in the game than men. Brüll et al [39] argued that males prefer the use of more explicit terminology to describe sexual activity in a game than females.

Previous studies have shown that the difficulty of a game is a major determinant of the influence that it has on users, mainly because users get discouraged if the game is very difficult or they get bored if it is too easy [40,41]. Although in this case participants were not asked directly to comment on the difficulty of the game, we observed that many reflected on the experience and discussed with the researcher what they had learned from the game. Most of them found it "challenging," and may have been motivated to continue because the person with the highest score would win an Amazon voucher.

Future research should investigate the effect of age on the influence of a sex education game using a bigger sample, as there were not enough older participants in this study to report findings regarding this variable with confidence. Additionally, the relationship status and relationship power of the participants should be investigated, as this might significantly change the way they associate with the characters of the game and therefore their evaluation of sexual risk [42]. Moreover, different ways to enhance immersion in the game should be examined, in order to keep the interest of the users high and keep them engaged with the educational activity for as long as possible; for example, by using a virtual reality (360) simulation, which will challenge the users' sexual health knowledge and attitudes on various difficulty levels using a somewhat less artificial and sterile environment or characters [43]. Sexual arousal during the sex education game could also be investigated as it is a factor that influences condom use in real-life contexts [44].

This study is a step toward the design of tailored and relevant sex education interventions, as called for by DeSmet [21] and D'Cruz [22]. Although this study includes several features recommended by these authors, for example, goal-setting, narrative, and so on, it might be profitable to explore greater interactivity and the use of audiovisual stimuli.

Strengths and Limitations

Some limitations of the study need to be acknowledged. Participants were not asked systematically about the difficulty of the game and therefore we only have anecdotal information about this variable. Also, we used a relatively small convenience sample and no behavioral outcomes or behavioral theory were assessed. Notwithstanding these limitations, this study is the first to explore the influence of computer simulations in the form of a serious game for sex education in relation to risk perception, and to investigate the impact that individual difference variables (age, gender, and personality) may have on the outcome. The results would be particularly useful for serious games designers for sex education as they provide some limited but promising insight into which aspects of games-tailoring could be beneficial and worth investigating further.

Conclusions

Computer simulations, presented in the form of a serious game, had an impact on participants' confidence in evaluating sexual risk, especially for women. This suggests that serious games developed for use in this setting should be further investigated and perhaps gender-tailored. Working toward these goals might contribute to a reduction in STI rates. Personality traits and age were not related to the change in participants' confidence in evaluating sexual risks before and after engaging in the game.

Acknowledgments

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Authors' Contributions

AE led the study design, game development, conducted the research, and prepared early drafts of the article. SB, CG, and RI helped with the design of the study and the game development. RI and AE carried out the analyses. All authors read and commented on drafts of the article, and approved the final version.

Conflicts of Interest

None declared.

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Abbreviations

HIV: human immunodeficiency virus
IYG: It's Your Game
SES: Sexual Excitation Scale
SI: Sexual Inhibition

SIS2: Sexual Inhibition Subscale 2
SS: Sensation Seeking
SSS: Sexual Sensation Seeking Scale
STI: sexually transmitted infection

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