The Effect of Masculinity on Risk Behavior and Risk Homeostasis

A Gaming Experiment

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Content

Abstract

This thesis examines risk behavior and risk compensation behavior, and explores the effect that masculinity has on these behaviors. Theoretical aspects of risk behavior for the workplace and in general are discussed, in addition to why masculinity can influence this, and why Risk Homeostasis Theory as proposed by Wilde can affect risk behavior. A self-made spaceship game was used for this experiment to objectively assess both risk behavior and risk homeostasis, where participants had to avoid meteors while accumulating points for staying alive, dependent on how fast they were going. This was done for several rounds, with varying protective conditions that were randomized. Results include evidence for a connection between masculinity and risk behavior, with a stronger connection for males. Inconsistent evidence for risk compensation behavior has been found. These results are discussed in light of the existing literature, in addition to potential flaws in the experiment, implications of this study, and recommendations for future research.

1 Introduction

1.1 Overview of risk behavior

Risk behavior has long been a topic of research among psychologists and scientists from other fields of study. It can be defined as engaging in behaviors that can lead to perceived negative consequences (Byrnes, Miller, & Schafer, 1999). This implies that these negative consequences are subjective in nature, and thus differ from person to person. One individual might perceive the same negative consequence to be irrelevant, while the other might feel that this consequence should definitively be avoided. This also implies that risk is related to chance. A behavior might or might not lead to negative consequences. If an individual judges that a behavior has no chance to lead to a negative consequence, he or she will not perceive this to be risk behavior.

The reasoning behind engaging in these behaviors is often looked at in terms of possible reward versus perceived danger or harm (Kahneman, 2003). This effect is not linear; harm or losses seem to weigh heavier than rewards gained. This is called loss aversion, and this entails that losses weigh an estimated amount of 2 to 2.5 times heavier than profits when it comes to judging gains versus losses. This effect is also dependent on reference; €100 loss weighs more for someone who only has €100 in comparison to someone who has €1000. A difference in the probability that people take risks can be found in the nature of the risk itself: if the risk is unknown or new, people are more likely to avoid it, but if the risk is familiar, seemingly controllable, or self-chosen, the chances of taking the risk increase (Slovic, 1987). This indicates that risk behavior can be influenced by either changing the nature of the risk, or the perception of the risk factor.

There are several reasons why risk behavior is relevant to psychological research. Risk behavior has effects on health (DiClemente, Hansen, & Ponton, 1995), e.g., not wearing condoms during intercourse can lead to sexually transmitted diseases, taking drugs or alcohol can lead on dependency and health issues. In addition, researching risk behavior can provide insight into the adaptiveness of human behavior (Byrnes, 1998). This can help understand effective decision making, and how individual differences affect this process. Also, the underlying reasons for high risk professions can be researched (e.g., firefighters, soldiers). What processes promote putting one's self at risk in favor of people beside themselves? Another reason is that the interplay between genes and the environment can be studied to help discriminate between the causes of certain risk behavior (Byrnes, Miller, & Schafer, 1999). Finally, human beings do not always make rational decisions, and insight into risk behavior can help provide insight into the nature of this form of decision making. This study mainly focuses on this last reason.

1.2 Gender, masculinity and risk

When zooming in on individuals who perform risk taking behavior, several notable differences can be found. One of these differences can be found in gender: men take more risk than women generally (Byrnes et al., 1999). The strength of these differences is dependent on the kind of risk taking behavior, e.g., when looking at self-reported risk behavior, there is a big gender difference found in driving, and less so in drinking, drug use, and sexual activities, and even less in smoking. Studies that observe risk behavior also show significant differences between genders when it comes to physical activity, driving, informed guessing, gambling, a risky experiment, physical skills, and intellectual risk taking (sharing tentative ideas, asking questions, trying-out new procedures and strategies, and subjecting ideas and conceptions to disconfirming evidence). These findings are confirmed by Turner and McClure (2003), where participants reported their risk-taking behavior with regards to driving and in general. Males scored higher in driver aggression, thrill seeking, and in general risk acceptance. In addition, males had a greatly increased chance to have reported at least one crash as a driver and even greater chance to have reported two or more crashes.

The reasoning behind these gender differences remains unclear. Byrnes (1998) suggests that these differences could reflect differences in raising boys versus girls, in self-correcting strategies, and overconfidence in males. Another explanation can be found in differences between levels of masculinity. Masculinity can be defined as "a configuration of practices that are organized in relation to the structures of gender identities and relations" (Stergiou-Kita et al., 2015, " Theoretical conceptualizations of masculinity", para. 1). Stergiou-Kita and colleagues (2015) argue that dominant masculine norms can affect perceptions, acceptance and normalization of risks in the workplace. One of these norms is the acceptance and normalization of risk. This is evident in several areas of work, such as amongst firefighters (Desmond, 2006), amongst electricians (Nielson, 2012), amongst fishermen (Knudsen & Gron, 2010), and within the mining industry (Wicks, 2002). Risk for men in these areas of work is seen as a normal part of the job, and consequences of risk (e.g., pain, injury) generally do not lead to complaints in these contexts. This effect is strengthened by masculine socialization through apprenticeship programs, where these programs have historically encouraged macho workplace cultures, that are characterized by competition, danger tolerance, overstrain, and disobeying safety regulations (Johnston & McIvor, 2004). Another masculine norm that goes hand in hand with accepting risk is accepting injury and pain. Working through pain and playing through pain (in the case of sports) can be considered normal for athletes, or in male dominated areas of work (Stergiou-Kita et al., 2015). Exceptions are only made when injury or pain impacts performance, which leads to an increased prevalence of musculoskeletal problems in those occupations.

Another masculine norm is independence, likely caused by the cultural expectation of men to be the breadwinner of the family (Johnston & McIvor, 2004). This expectation leads to a demonstration of masculinity in the form of self-reliance, reduced help-seeking behavior, and a resistance to authority. This effect is not only visible during work, but also with regards to health and safety, caused by the desire not to appear weak or waste the time of other people. Finally, masculinity can enforce productivity over safety and health. This is especially evident in high risk occupations, and can be increased by the competitive nature of some occupations, such as amongst construction workers that wish to gain favor with employers (Stergiou-Kita et al., 2015). This leads to increased risk taking behavior.

Currently, little is understood about the effects of masculine traits amongst women (Stergiou-Kita et al., 2015). When consulting available research on masculinity and women, a connection can be found between feminism and masculinity. An ideal man and an ideal women are both described as possessing masculine characteristics by feminist men and women and non-feminist men and women (Suter & Toller, 2006). In addition, masculine women more often than feminine women saw themselves as a feminist.

What causes individual differences in masculinity? Regardless of gender, these differences can occur through both genetic pathways and environmental effects (Lippa & Hershberger, 1999). It has been found that genetic factors indeed significantly contribute to differences in masculinity, with decent heritability, and that the effects of both genetic and environmental effects on masculinity are generally the same for both males and females. Personality traits have been shown to have decent heritability already (Loehlin, 1992), and Lippa & Hershberger (1999) show that masculinity is no exception to this. Verweij, Mosing, Ullén, & Madison (2016) also attempt to explain individual differences found in masculinity, where they used a questionnaire in order to create a masculinity versus femininity (bipolar) scale. They only used twins for this study. Besides the fact that males scored higher on masculinity, they found that genetic factors explained one third of the variation in masculinity versus femininity score, and that family shared environmental factors did not explain any variation. The strongest influence on masculinity came from 'residual influences', which explained about two third of the variation. This means that unique experiences and social interactions may play a factor in establishing masculinity. They also found that the influence of genes and the environment on masculinity versus femininity does not differ between the sexes. Opposite sex twins scored higher on masculinity, for male-female versus female-female twins explained by the possible hormonal transfer during pregnancy from the male to the female twin.

1.3 Risk behavior at the workplace

The occurrence of risk behavior in occupational contexts can be seen as a problem that is larger than the choices of individuals. Risk behavior at the workplace can be considered to be behavior that violates safety regulations or unsafe acts in general. Reason (2000) argues that in as much as 90% of quality lapses in aviation management individuals were judged to be free of blame, and that the focus of error management should not be on unsafe acts of individuals, but on creating countermeasures to errors; putting system defenses in place, and to expect errors to happen. These system defenses can be anything from a technical system, such as alarms or shutdowns, to people and procedures. System defenses and their function can be better understood by the Swiss cheese model (figure 1) by Reason (1990), where holes like in Swiss cheese function as failed or absent defenses. If all safeguards fail to prevent a hazard from happening, losses occur. This model provides insight in why an individual can sometimes be considered to be blameless for committing an error.

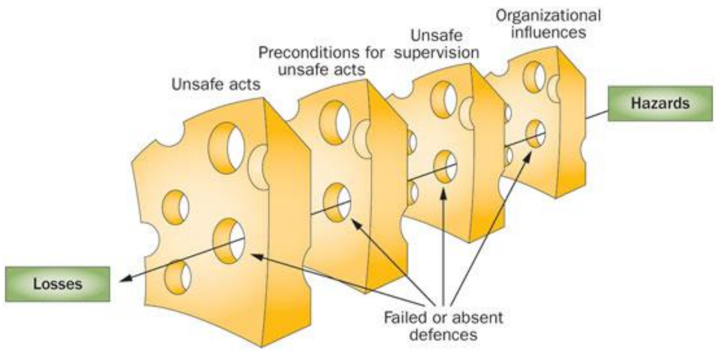


Figure 1. The Swiss cheese model of safeguards and error by Reason (1990).

This means that errors and their damaging consequences can be reduced by effective error management, accompanied by creating a safety culture. The process of creating such a culture is greatly enhanced by creating a reporting culture, where analyses are made whenever error occurs, or almost occurs. A pre-requisite for this kind of culture is a just culture, where it is agreed on which errors are to blame on the individual, and which are not. Safety success in high-reliability organizations has been shown to rely on timely human adjustments, where control shifts to experts on the spot in an emergency situation. This has several implications for the causes of error: (1) errors happen partly because there are not enough, or not the right system defenses in place, (2) errors are made partly because the company has not (yet) made thorough analyses of errors, mishaps, or nearerrors in the past and implemented changes based on these analyses, and (3) organizational safety culture plays a big role in how employees deal with error.

Another reason for the occurrence of occupational error can be found in safety and withdrawal behavior of employees, caused by job insecurity, and mediated by work related attitudes and psychological well-being (Emberland & Rundmo, 2010). Figure 2 shows this connection. The effects of job insecurity on work related attitudes and on health and well-being have been well established (Sverke, Hellgren, & Näswall, 2002). In the short-term, the changes in rational perceptions, attitudinal responses, and behavioral responses caused by job insecurity decreases job satisfaction, job involvement, organizational commitment, and trust. In the long-term, it decreases physical and mental health, work related performance, and turnover intention. This creates a pathway through which the evaluative response to job insecurity predicts risk behavior. This risk behavior is expressed in the form of non-compliance with safety regulations. This connection is largely dependent on how motivated the employee is to adhere to safety regulations and to show general safety behavior.

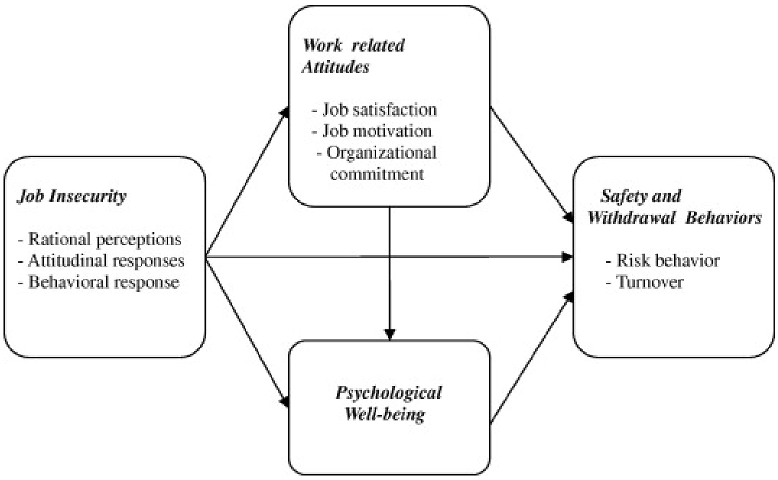


Figure 2. Model of the effect of job insecurity on safety and withdrawal behaviors by Emberland and Rundmo (2010).

1.4 Risk homeostasis

Several theories attempt to explain why people take risks, and how risk behavior can be influenced (e.g., Janz & Becker, 1984; Fisher & Fisher, 1992). The Health Belief Model (Janz & Becker, 1984) attempts to explain this through four dimensions, aimed at the consequences of risk: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. These dimensions, aided by internal (symptoms) or external (media) stimuli can trigger a cue-to-action, causing an individual to exert health-related behavior (disease prevention, visit a doctor). A general model was made by Fisher & Fisher (1992) to promote safety behavior regarding AIDS. The model is based on three dimensions: information (about AIDS transmission, prevention), motivation (reducing risk), and behavioral skills (the skills for the behavior that is needed to reduce the risk). The model explains about 35% of variance when tested among a gay male sample.

Another one of these theories is the Risk Homeostasis Theory (RHT) (Wilde, 1982). RHT presumes that people attempt to maintain an optimum level of risk. Therefore if people's perceived risk is lowered, e.g. by implementing safety measures, they increase their risk behavior to compensate, e.g. by keeping less distance between vehicles by car. In essence, people maintain this form of homeostasis by matching their optimum level of risk with the experienced amount of risk. Wilde (1982) assumes that therefore safety measures can only be successful when the targeted people are not aware of their increased safety. The only way to counter this, is by lowering the willingness to take risks instead (thus reducing the optimum level of risk). This theory was first used as a framework to explain causes for traffic accidents, and later was used in a more broadly sense to explain risk behavior. Wilde (1982) argues that the amount of risk people are willing to take depends on four factors: (1) expected benefits of risk behavior, (2) expected costs of risk behavior, (3) expected benefit of safe behavior, and (4) expected cost of safe behavior.

This homeostatic effect can be explained by comparing it to how a thermostat works. A change in safety behavior leads to a change in injury rate, and a change in injury rate leads to a change in safety behavior, much like a change in the temperature leads to a change in a thermostat, and a change in the thermostat leads to a change in temperature. On the left side perceived costs and benefits lead to the targeted level of risk (a), and perceptual skills lead to perceived level of risk (b), much like targeted temperature and perceived temperature. Any difference between these two leads to a desired adjustment (c) and consequently an adjustment action (d). This results in a change in outcomes (e), which after a period of time (f) leads to a new evaluation of the level of risk (b). An adjustment action by a thermostat leads to a change in room temperature, which in turn leads to a new perceived temperature.

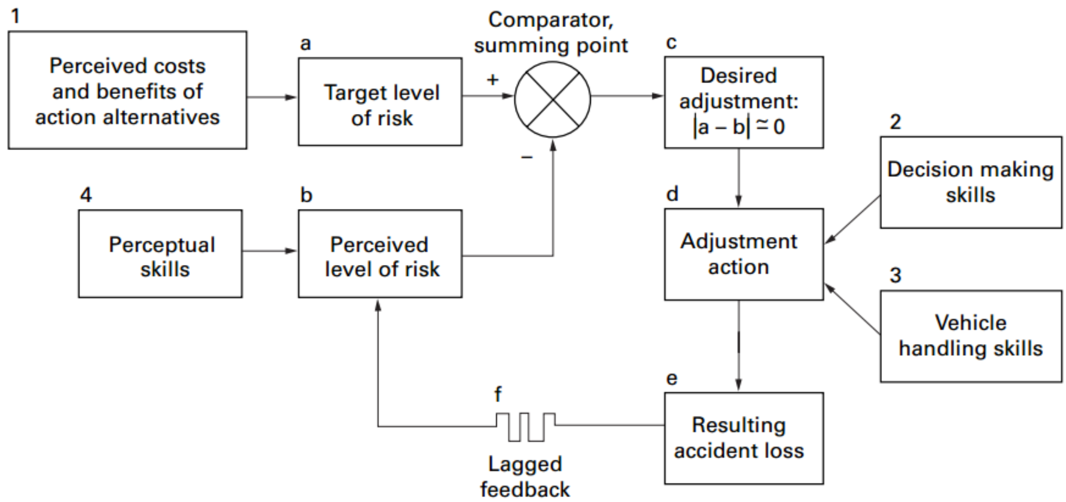


Figure 3. Homeostatic model on driving behavior and accidents by Wilde (1998).

Wilde (1998) points to multiple studies to support his theory. Drivers move faster on roads where there is a low accident rate. Seatbelts reduce the likelihood of mortality after an accident, but do not reduce the death rate per capita. Drivers with cars that are equipped with air bags, or with better breaks drive more aggressively (Peterson, Hoffer, & Millner, 1995; Posser, Sageber, Sætermo, 1996). More and better lightning on a road goes hand in hand with faster driving (Björnskau, Fosser, 1996). Children that underwent traffic safety education showed a higher traffic injury rate in a Swedish study, and finally, accidental poisoning for children became more frequent after introduction of childproof vials for medicine (Wilde, 1998).

The theory itself is highly controversial. Evans (1986) advocated to refute RHT, because the data supporting RHT was methodologically unsound, and no homeostatic effect was found when looking at the introduction of safety laws, such as wearing helmets for motorcyclists, in comparison with states that did not introduce those laws. In addition, several researchers have made critical remarks about the practical falsifiability of the proposed homeostatic effect, based on the difference in compensation measures based on time and setting (Trimpop, 1996), on the lack of a clear definition of the measure of compensation (Haight, 1986; Glendon et al., 1996), or on the difficulty of obtaining evidence for a change in the target level of risk (Hoyes & Glendon, 1993).

1.5 Current study's hypotheses

The current research attempts to further explore the differences in risk behavior between men and women, and examine this through the influence of masculinity on risk taking behavior by means of a gaming experiment with different protective conditions, and with the availability of increasing or decreasing risk behavior. In addition, the current research aims to investigate if a homeostatic effect indeed occurs in different protective conditions, and if this effect is different based on masculinity. Based on the review of Stergiou-Kita and colleagues (2015), masculinity is expected to have a linear connection with risk behavior (1), and an increase in masculinity is expected to lead to an increase in risk behavior (2). This effect is expected to be the same for both men and women (3), based on the way that masculinity and feminism seem linked, and on the fact that masculinity in general seems to go hand in hand with acceptance of risk (Suter & Toller, 2006). Compensatory effects are expected during levels with different amounts of protection in general (4), and after shield loss (5), based on RHT by Wilde (1982). Finally, no study so far has explored a possible interaction effect of masculinity on the compensatory effect of RHT. Based on the generalisability of RHT no difference is expected to be found in compensatory effects for highly masculine people (6).

2 Method

2.1 Participants

The amount of people that participated in this study was 69 (11 men and 58 women), ranging in age from 18 to 36 years old (*M* = 22.4, *SD* = 3.22). Most of them had either VWO or a WO bachelor as highest completed education (33 and 23 respectively). They voluntarily participated in this experiment, and were able to receive either university credits or a small sum of money (€6.50). The people who scored the highest on a self-made spaceship game experiment were able to receive €50, €30, and €10 respectively. There were no different groups; all participants followed the same procedure. Informed consent was obtained from all participants. Only people above the age of 18 were allowed in this study.

2.2 The spaceship game

The spaceship game was a game that was developed last year by another group of students who studied the same topic, risk homeostasis, at Leiden University. In the game you control a small spaceship and you have to avoid being hit by meteors that fly in a horizontal line. The spaceship meanwhile continuously flies forward. The only controls you have is flying up, flying down, increasing your speed (to a certain maximum), and decreasing your speed (to a certain minimum). Points are accumulated over time. The longer you are alive in a level, the more points you make, and increasing your speed greatly increases your points earned per second. Figure 4 shows a screenshot of the game.

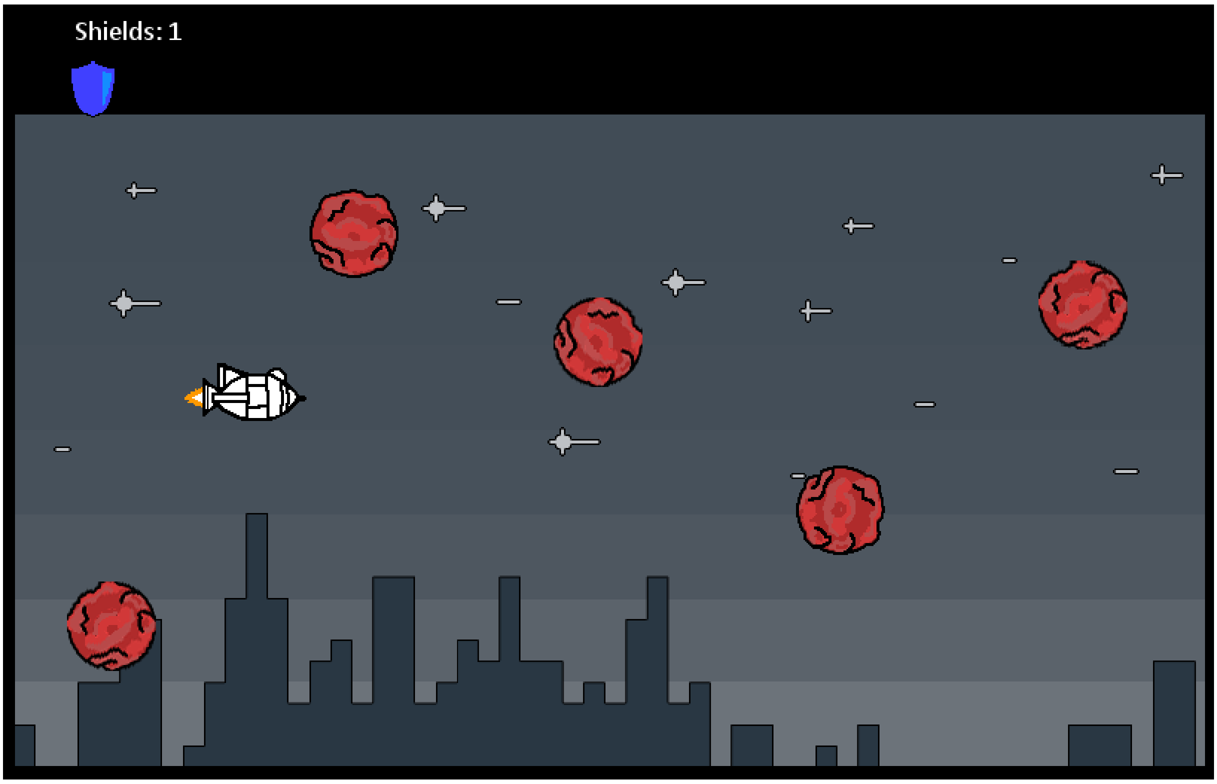


Figure 4. Screenshot of the spaceship game.

Each level started with a certain amount of shields. These levels were assigned randomly, but without having the same level twice, and contained either 5, 4, 3, 1, or 0 shields. Being hit with a meteor results in the loss of a shield. A practice round, from which the data was not used in this study, helps to practice the game before the start of the measured levels, and participants had either 1 or 3 shields in this practice round, assigned randomly. Each round lasted for up to a maximum of 4 minutes. After that, the spaceship flies away and the level ends, regardless of how many shields are remaining.

During every game, a information was being accumulated into two separate log files, which were created automatically in the folder named after the participant number. In the first log file, the event log, the information was sorted per shield condition. Each time a shield was lost, or a level ended due to being hit by a meteor, the information from that round was stored. Information in this log gave information about what meteor hit the spaceship, how fast the ship was generally going and average distance to meteors, but also general information such as participant number, and remaining shields. The second log, the step log, contained the same variables, but kept track of them each one tenth of a second (so it created 10 logs per second). Data from this log was used in creating the risk parameters by using formulas in Microsoft Excel.

The formula to calculate average speed was as follows:

$$speed_p = \big(2.7 + (difficulty * 0.5)\big) * 100$$

This formula was translated into a Microsoft Excel value, and averages were calculated per shield. Difficulty could be any discreet value between 1 (minimum speed in the game) and 13 (maximum speed in the game). Calculated in pixels, this was a value between 320 and 920 pixels per second. The value of 2.7 in this formula is the base speed.

The original formula to calculate TTC was as follows:

$$TTC = \frac{meteor\ in\ path\ location\ x - 109}{speed_p}$$

This formula was slightly adapted in order not to let values of -109 weigh in on the average if no meteor was in the path. The Microsoft Excel formula was made so that this formula gave no number unless there was an actual meteor on the horizontal path of the spaceship. The condition was added that meteor in path location x had to be greater than 0. The -109 in the formula stands for the amount of pixels that the spaceship is distanced from the left screen. This means that once a meteor is in the path of the spaceship, the distance in pixels is only accurate once 109 has been subtracted from that number, and would otherwise give the amount of pixels between the meteor and the left screen side. This change to the formula was necessary in order to preserve the validity of the construct, since there should be no time to collision if there is no meteor.

The formula to calculate DCM was as follows:

$$distance = \sqrt{(closest\ meteor\ location\ x)^2 + (closest\ meteor\ location\ y - ship\ location\ y)^2}$$

This formula makes use of the Pythagorean Theorem. It calculated the distance between any closest meteor in the form of a triangle. It yields the distance in pixels between the ship and the closest meteor. This is also measured ten times per second, but averages were calculated per shield.

The game itself was programmed using GameMaker 8.1, which is freely available software. The game automatically runs in full screen with a resolution of 800 x 600 pixels. There was no option added to change this resolution, and if a screen's resolution exceeded the game's resolution, a black border filled in the difference between the sizes.

2.3 Design

The current study followed a mixed experimental and cross-sectional within-subjects design. The same group was exposed to 5 different levels of protective conditions in the spaceship game experiment, and 18 different protective conditions based on the amount of shields left, followed by a cross-sectional survey. To reduce carry-over effects, the 5 levels of protective conditions were randomized. There was no control group. Dependant variables were mean speed of the spaceship, mean time to collision (TTC) of the spaceship with a meteor, and the mean distance to the closest meteor (DCM). The independent variable of the survey was the masculinity score, which was a total score of all the subscales of the Perceived Masculinity Questionnaire combined.

2.4 Procedure

Participants were tested on 4 consecutive days, during which they could walk into the designated computer room at a time of their choosing. The instructors were making sure the room was quiet, in order not to cause any distractions. Their names were recorded, after which they were handed instructions about the procedure and the game itself, and an informed consent letter. The instructions contained general information, e.g. confidentiality of results, and voluntary participation, but also the importance of the participant number. Subjects were assigned a participant number, based on order of coming in (first subject gets number 1, second number 2, etc.). This participant number was used to combine the data from the game with the data from the survey. The information letter set the scene for the game, and gave specific instructions on what procedure to follow behind the computer. The full letter can be found in appendix 1, and the informed consent letter can be found in appendix 2.

After taking place behind one of the many computers present, an instructor asked for their signed informed consent letter, and asked if they had fully read the information letter, after which the instructor started the game. Most of them could log onto their university account, others were allowed to follow the procedure on one of the instructors' accounts. Participants completed the game roughly in between 10 to 25 minutes.

After completing the game, an instructor turned the game off, and went to the website for the survey, where the participants filled in some demographic characteristics and answer questions about eating behavior, sports behavior and position, music preferences, and questions related to masculinity (only the results from the demographic questions and the questions related to masculinity will be used in this report of the study).

Once the survey was completed, an instructor checked if the participant had indeed arrived at the last page of the survey, and informed the participant that he or she was done, that he or she could log out from the computer if they used an account of their own, and that he or she could go to the instructor's desk to round everything up. Here their names were marked on a form to make sure everything was filled in properly, and they signed their name on a document that was used to keep track of participants and their rewards, to show that they received either their credits or money. Participants could choose a small snack, and then left the room.

2.5 Instruments, materials, and apparatus

Participant numbers and participant information were written down using pen and paper. Computers with Windows 7 were used for both the spaceship game and the online survey. All computers that were used had the same screen size, and the same keyboards.

The Perceived Masculinity Questionnaire 47 was used as a basis in this study to obtain multidimensional data about the masculinity of the participants. This questionnaire was developed by J. W. Chesebro and K. Fuse (2001). The questionnaire originally consisted of 10 scales; (1) physiological energy, (2) physical characteristics, (3) gender-related sociocultural roles, (4) idealized gender, (5) gender preferences, (6) subjective gender-identity, (7) gender-related age identity, (8) gender-related racial and national identities, (9) lust, and (10) masculine eroticism. Several questions related to sex and sexual fantasies, and one scale (gender-related sociocultural roles) were dropped for this study on an ethical and cultural basis. This adapted version contained 31 questions and 9 dimensions.

2.6 Data management

IBM SPSS Statistics 20 was used for conducting the analyses. None of the files that were used had missing or incomplete data. Only the step logs were used for analyses. Every time a participant played the game, a file was made on a single network folder. This means that even though participants played the game on different computers, the files were all stored in a single folder, with one subfolder for each participant. Data from the surveys was collected using Qualtrics. After all participants completed the survey, data was exported from their website and integrated into the SPSS data file.

3 Results

3.1 Masculinity and Risk Behavior

3.1.1 Masculinity scale construction

3.1.1.1 Reliability analysis

The masculinity scale consists of eight subscales. In order to determine if the items of these subscales are sufficiently correlated, 8 reliability analyses were conducted on each of the subscales of masculinity. The resulting Cronbach's alpha (α) of these subscales can be seen in table 1. If $\alpha > .7$ the subscale is considered to be acceptable. If $\alpha < .5$ the subscale is considered to be inconsistent. As can be seen in table 1, subjective gender identity is the only subscale with a high internal consistency (α = .91). The subscales physical characteristics (α = .369) and lust (α = .115) have a low internal consistency. Tables 10 through 17 in the appendices show the inter-item correlations per scale. Only 2 scales show consistent decent inter-item correlations (all correlations > .6): subjective gender identity, and gender-related racial and national identities.

Table 1. *Cronbach's alpha of the masculinity subscales*

Subscale	α
Physiological energy - arousal, tension, & aggressive tendencies	.58
Physical characteristics - bodily shape & size	.369
Idealized gender	.576
Subjective gender identity	.907
Gender-related age identity	.573
Gender-related racial and national identities	.91
Lust	.115
Masculine eroticism	.663

3.1.1.2 Factor analysis

A factor analysis was conducted on 31 items from the masculinity scale using the principal component method to provide insight into the underlying structure of the items. First, the factorability of the items was examined. 24 items out of the 31 items correlated at least .3 with at least one other item. This suggests decent factorability. The Kaiser-Meyer-Olkin measure of sampling adequacy was .57, which is > .5, and Bartlett's test of sphericity was significant ($\chi2$ (465) = 1136.56, $p < .001$) which suggests decent factorability. 2 out of 31 items had anti-image correlation matrix diagonals of < .35, which suggests decent factorability. The communalities were all above .3 (see table 2), implying that each item shared some common variance with other items. However, the sample size is rather low (N = 69). A sample size of 310 would be optimal (31 questions, an increase in N of 10 per question). Because all other tests provided decent factorability, based on these findings factor analysis was deemed suitable.

An Oblimin rotation was applied to so that each factor loads as high as possible on a few variables, and as low as possible on all other variables. The factors are allowed to correlate with each other on theoretical grounds of masculinity. Because this version of the Perceived Masculinity Scale uses 8 subscales, an 8 factor solution has been chosen, which explained 67% of the variance.

The first 3 factors explained 19%, 30%, and 39% of the variance respectively. The following 4 factors explained 46%, 53%, 58%, and 63% of the total variance respectively. Ideally, the items of each subscale would score high on 1 factor together, and low on all the others. This is not the case, as can be seen in table 2, but the factor loadings seem acceptable, with moderate consistency.

Because the 8 factor solution shows different scales than the original scales, the results are difficult to interpret. The main result is that masculinity has different aspects, and that 8 of these aspects explain an acceptable amount of variance (67%). This amount is reasonable enough to interpret masculinity scores with analyses.

Table 2. *Factor loadings and communalities of based on a principal components analysis with Oblimin rotation for 31 items from the adapted version of the Perceived Masculinity Scale*

Item	Factor loadings								Communalities
	1	2	3	4	5	6	7	8	
Desirability for aggression	-.18	.21	.04	-.51	.45	.12	-.01	.1	.57
Desirability for assertiveness	-.17	.15	.39	-.1	-.01	-.09	.37	-.51	.61
Desirability for competitiveness	-.13	.19	.49	-.17	-.06	.02	.46	.01	.54
Desirability for dominance	-.06	.01	.55	-.49	.07	.21	.38	-.11	.75
Physically muscular perception	.6	.08	.12	-.01	-.08	.19	-.13	.13	.46
Body shape perception	.12	-.03	-.13	-.07	-.09	.6	-.11	.22	.47
Voice perception	.15	.11	.27	-.07	-.11	.55	.33	-.13	.55
Masculine man perception media	-.27	.32	-.07	.06	-.52	.27	.2	.16	.59
Masculine man perception local	-.08	.15	-.21	.15	-.73	.17	.09	.13	.68
Sexual image masculinity self	.69	.48	-.08	.17	-.08	-.13	.08	-.1	.76
Sexual image masculinity others	.68	.43	-.16	.09	-.16	-.12	.17	-.14	.76
Sexual role masculinity self	.72	.41	.02	-.13	.03	-.06	-.2	-.01	.74
Sexual role masculinity friends	.82	.34	.01	-.13	.01	-.16	-.12	.0	.84
Sexual role masculinity parents	.75	.38	-.1	-.12	.08	-.05	.09	.16	.77
Sexual role masculinity strangers	.71	.48	-.04	.21	.04	-.22	.13	-.04	.84
Sexual maturity self	.24	-.56	.12	-.21	.11	-.45	.17	.11	.68
Sexual maturity others	.22	-.47	.01	-.08	.25	-.09	.17	.42	.55
Too old for sexuality self	.17	-.39	.46	.43	-.23	-.2	-.11	-.27	.75
Too old for sexuality others	.17	-.31	.43	.37	-.2	-.18	-.08	-.17	.55
Sexuality restriction self	.72	-.43	.11	-.03	.0	.3	-.05	-.19	.84
Sexuality restriction others	.72	-.43	.05	-.05	-.03	.33	-.07	-.08	.84
Sexuality restriction society	.66	-.46	.01	.19	.18	.18	.06	-.05	.77
Sexuality restriction local	.65	-.49	-.1	.05	.13	.19	.17	.04	.62
Sex frequency desire	.23	-.25	.17	-.45	-.3	-.23	.17	.34	.33
Romance	.21	-.11	-.18	-.19	-.17	-.29	.27	.13	.74
Body stimulation	-.14	.09	-.4	.33	.48	-.02	.46	-.07	.64
Foreplay	-.06	.02	-.54	.33	.37	.23	.17	-.17	.65
Masculinity appearance society	-.14	.2	.67	.1	.16	.1	-.32	.08	.64
Masculinity appearance self	.02	.02	.35	.66	-.06	-.01	.2	.42	.77
Grooming society	.05	.44	.51	-.02	.36	.08	-.31	.1	.7
Grooming self	.04	.24	.4	.53	.3	.05	.24	.33	.76

Note. Items are grouped by scale, shown by a different color, respectively: Physiological energy, Physical characteristics, Idealized gender, Subjective gender identity, Gender-related age identity, Gender-related racial and national identities, Lust, and Masculine eroticism.

3.1.2 Masculinity and speed

A simple linear regression analysis was conducted to predict average speed based on masculinity score. No significant regression equation was found (F (1, 64) = 3.53, p = .065), with an R^2 of .052. The average speed showed an unstandardized coefficient of B = .031 and a standardized coefficient of β = .229 (t = 1.88, p = .065). This means that there is no strong linear connection between masculinity and average speed. Figure 5 shows the relationship between the two variables in a scatterplot.

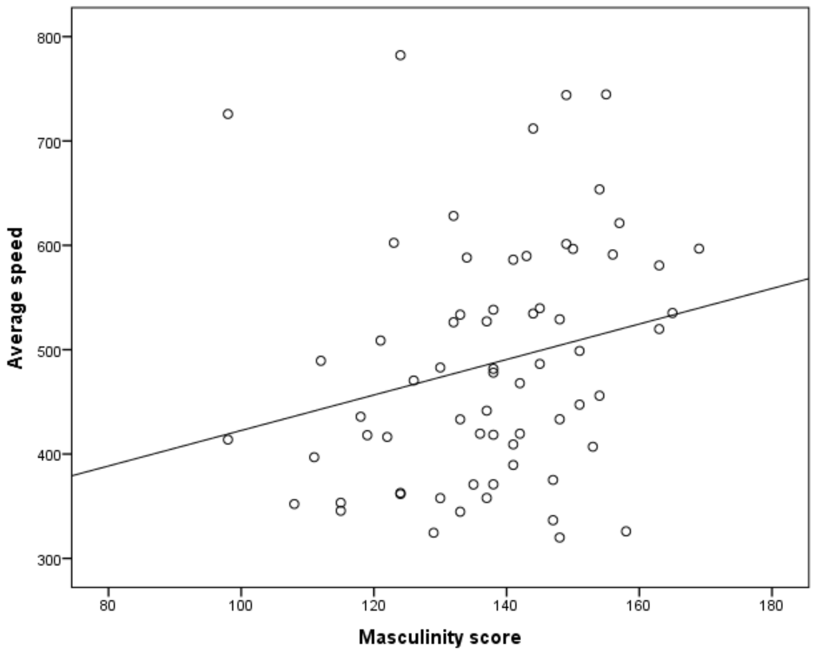
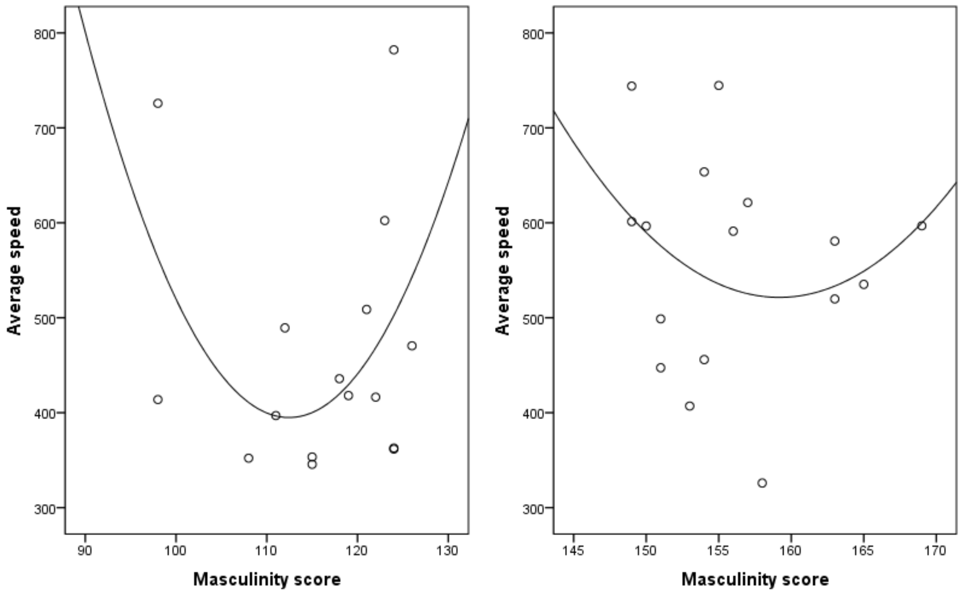


Figure 5. Scatterplot of masculinity score and average speed.

To further investigate the effect of masculinity on average speed, two scatterplots were made, one for masculinity and average speed for the top 25% scores on masculinity, and one for the lowest 25% scores on masculinity. Figures 6 and 7 show the results. The top 25% masculinity scores show a weak quadratic trend, with an R^2 of .069 (linear trend had an R^2 of .008). The lowest 25% masculinity scores on the other hand show a moderate quadratic trend with an R^2 of .206 (linear trend had an R^2 of .002). This means that high masculinity may have a quadratic connection with average speed, and that separating the high and low masculinity groups leads to a less strong linear connection between the two variables.



Figures 6 & 7. Scatterplots of masculinity score and average TTC for lowest 25% of scores on masculinity (left), and highest 25% of scores on masculinity (right).

A mixed-model repeated measures ANOVA was conducted to compare the average speed of two groups, the top 25% scores on masculinity with the lowest 75% scores on masculinity, at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. For this hypothesis, only the between-subjects analysis is relevant; the within-subjects effect of speed will be shown in the risk homeostasis segment. A significant difference was found between the top 25% of masculinity group and the lowest 75% of masculinity group (F (1, 64) = 9.84, p = .003). The mean speed of the starting shield conditions for both groups are shown in figure 8, and presented in table 18 in the appendices. As shown in the figure and in the table, the high masculinity group goes faster with the spaceship than the lower masculinity group in all 5 conditions.

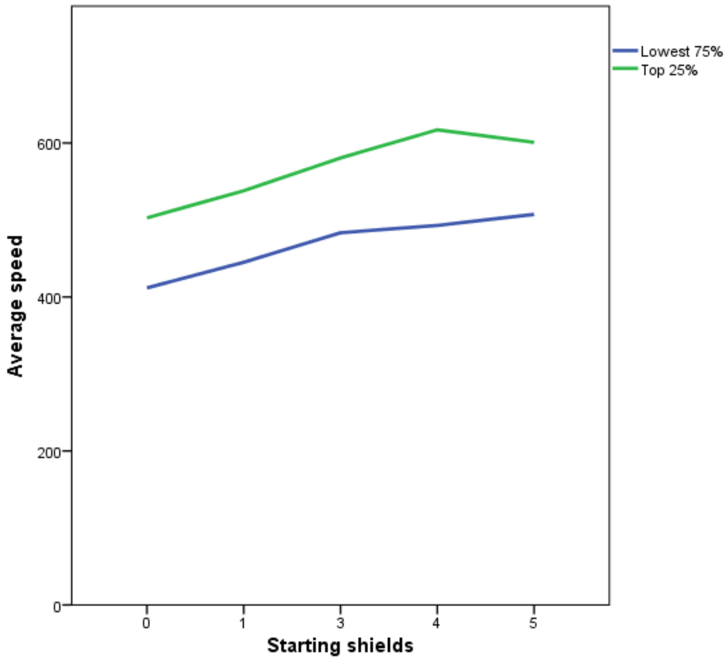


Figure 8. Line plot of amount of starting shields and average speed for lowest 75% of masculinity and top 25% of masculinity.

3.1.3 Masculinity and TTC

A simple linear regression analysis was conducted to predict average TTC based on masculinity score. A significant regression equation was found (F (1, 64) = 4.36, p = .041), with an R^2 of .064. The average TTC showed an unstandardized coefficient of B = -.003, and a standardized coefficient of β = -.253 (t = -2.09, p = .041). This means that an increase in masculinity leads to a generally small decrease in TTC, which is in line with the hypothesis. Figure 9 shows the relationship between the two variables in a scatterplot.

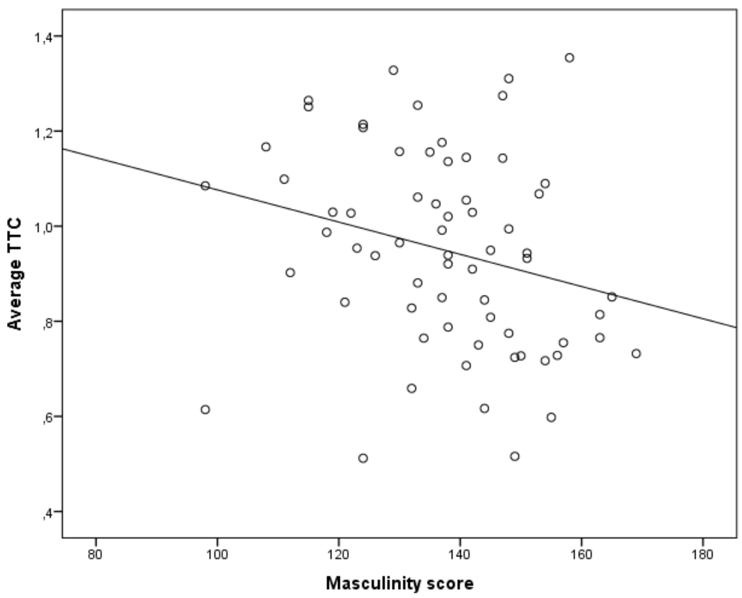
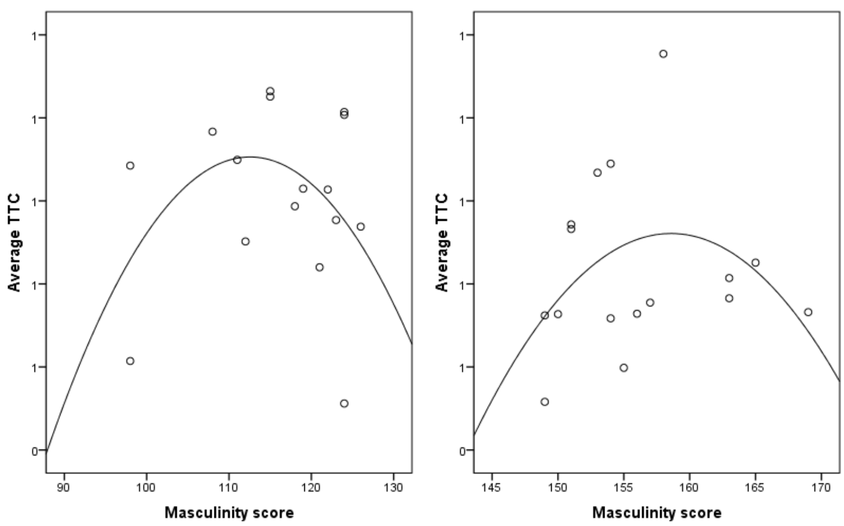


Figure 9. Scatterplot of masculinity score and average TTC.

To further investigate the effect of masculinity on average TTC, two scatterplots were made, one for masculinity and average speed for the top 25% scores on masculinity, and one for the lowest 25% scores on masculinity. Figures 10 and 11 show the results. The top 25% masculinity scores show a moderate quadratic trend, with an R^2 of .135 (linear trend had an R^2 of .003). The lowest 25% masculinity scores also show a moderate quadratic trend with an R^2 of .164 (linear trend had an R^2 of .002). This means that the linear connection that was found earlier is not visible when separating the high and low masculinity groups.



Figures 10 & 11. Scatterplots of masculinity score and average TTC for lowest 25% of scores on masculinity (left), and highest 25% of scores on masculinity (right).

A mixed-model repeated measures ANOVA was conducted to compare the average TTC of two groups, the top 25% scores on masculinity with the lowest 75% scores on masculinity, at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. For this hypothesis, only the between-subjects analysis is relevant; the within-subjects effect of TTC will be shown in the risk homeostasis segment. A significant difference was found between the top 25% of masculinity group and the lowest 75% of masculinity group (F (1, 63) = 7.74, p = .007). The mean TTC of the starting shield conditions for both groups are shown in figure 12, and presented in table 19 in the appendices. As shown in the figure and in the table, the high masculinity group takes less distance from the meteors with the spaceship than the lower masculinity group.

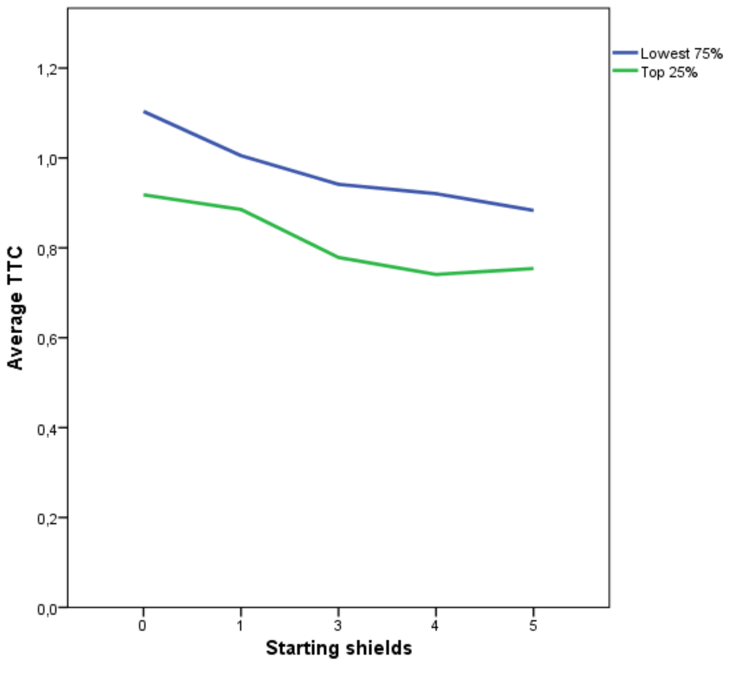


Figure 12. Line plot of amount of starting shields and average TTC for lowest 75% of masculinity and top 25% of masculinity.

3.1.4 Masculinity and DCM

A simple linear regression analysis was conducted to predict average DCM based on masculinity score. No significant regression equation was found (*F* (1, 64) = 0.01, *p* = .932), with an R^2 of .0. The average DCM showed an unstandardized coefficient of *B* = -.009 and a standardized coefficient of *β* = -.011 (*t* = -.09, *p* = .932). This means that there is no linear connection between masculinity and average DCM. Figure 13 shows the relationship between the two variables in a scatterplot.

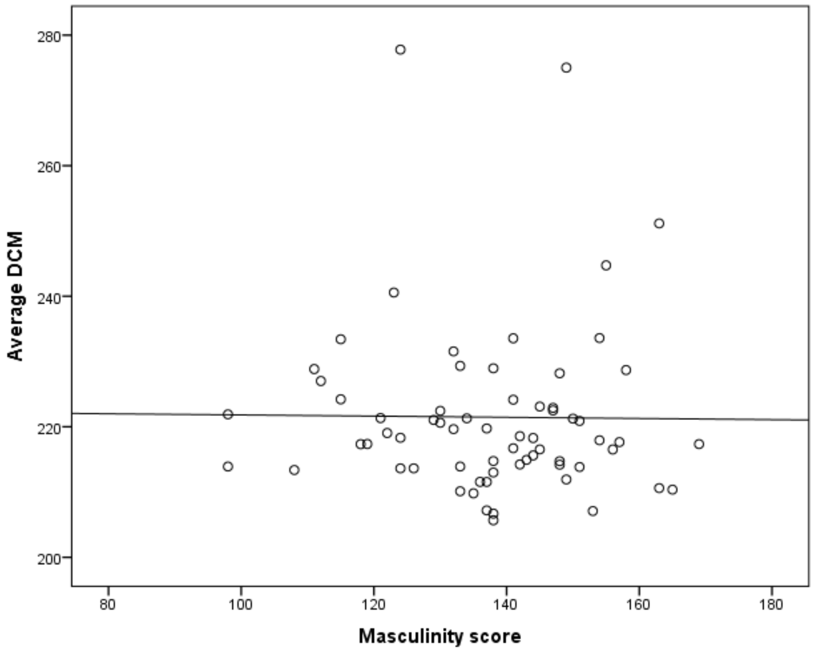
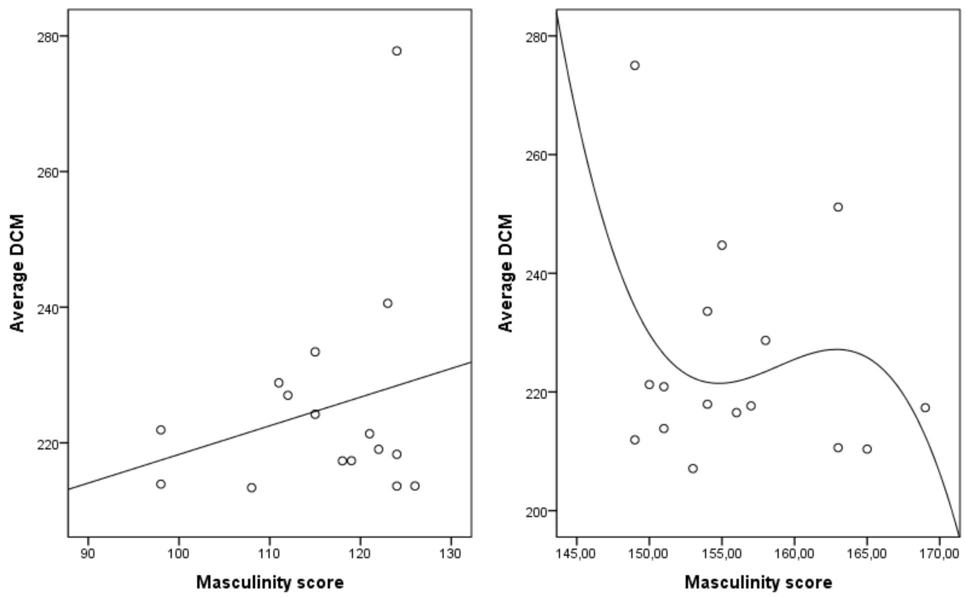


Figure 13. Scatterplot of masculinity score and average DCM.

To further investigate the effect of masculinity on average DCM, two scatterplots were made, one for masculinity and average speed for the top 25% scores on masculinity, and one for the lowest 25% scores on masculinity. Figures 14 and 15 show the results. The top 25% masculinity scores show a small cubic trend, with an R^2 of .086 (linear trend had an R^2 of .028, quadratic trend had an R^2 of .031). The lowest 25% masculinity scores show a very small linear trend with an R^2 of .054 (quadratic trend also had an R^2 of .054). This means that there is no clear connection between high or low masculinity and average DCM.



Figures 14 & 15. Scatterplots of masculinity score and average DCM for lowest 25% of scores on masculinity (left), and highest 25% of scores on masculinity (right).

A mixed-model repeated measures ANOVA was conducted to compare the average DCM of two groups, the top 25% scores on masculinity with the lowest 75% scores on masculinity, at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. For this hypothesis, only the between-subjects analysis is relevant; the within-subjects effect of DCM will be shown in the risk homeostasis segment. No significant difference was found between the top 25% of masculinity group and the lowest 75% of masculinity group (F (1, 64) = 1.58, p = .213). This means that high masculinity does not cause a difference in DCM in different starting shield conditions. The mean DCM of the starting shield conditions for both groups are shown in figure 16, and presented in table 20 in the appendices.

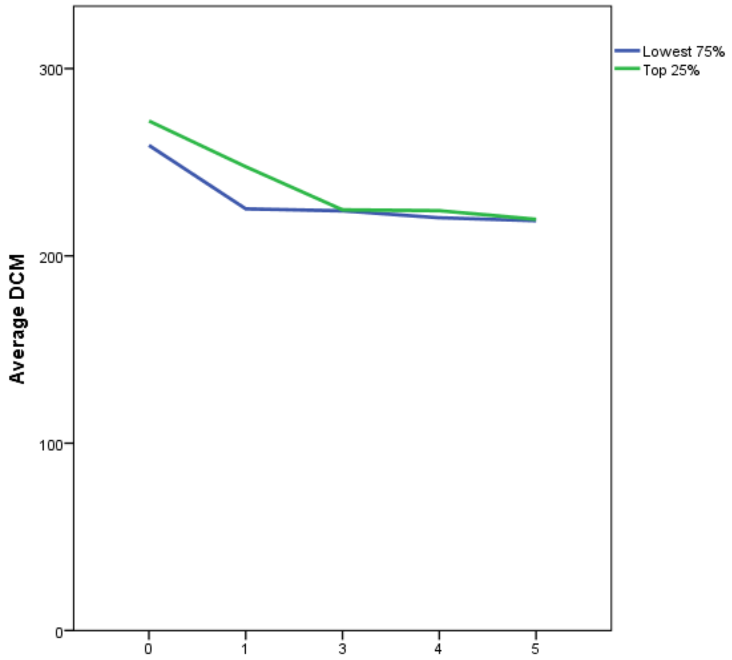


Figure 16. Line plot of amount of starting shields and average TTC for lowest 75% of masculinity and top 25% of masculinity.

3.1.5 Gender effects of masculinity on risk behavior

3.1.5.1 General gender differences

An independent samples T-test was conducted to compare means of speed, TTC, and DCM across all shield conditions and levels, in addition to total masculinity score, between males (N = 11) and females (N = 58). The results are displayed in table 3. Significant differences have been found for average DCM (t = -2.68; p = .012) and for total masculinity score (t = 5.39; p = < .001). As can be seen in table 3, this means males keep less distance between the ship and the meteors, and they perceive themselves to be more masculine.

Table 3. *Gender differences between parameters of risk behavior and total masculinity score*

	Males	Females	*t*	*p*
Average speed	496.66	483.48	.35	.733
Average TTC	.931	.953	-.31	.76
Average DCM	215.45	222.55	-2.68	.012
Total masculinity score	153.27	134.42	5.39	< .001

3.1.5.1 Gender effects of masculinity on speed

Two simple linear regression analyses were conducted to predict average speed based on masculinity score, one for females (N = 58) and one for males (N = 11). A significant regression equation was found for males (F (1, 9) = 6.94, p = .027), with an R^2 of .435. The average speed showed an unstandardized coefficient of B = 7.93 and a standardized coefficient of β = .66 (t = 2.64, p = .027). No significant regression equation was found for females (F (1, 53) = 1.94, p = .17), with an R^2 of .035. The average speed showed an unstandardized coefficient of B = 1.5 and a standardized coefficient of β = .188 (t = 1.39, p = .17). This means that there is a strong linear connection between masculinity and average speed for males, but contrary to the hypothesis not for females. Figure 17 shows the relationship between the two variables in a scatterplot for both males and females.

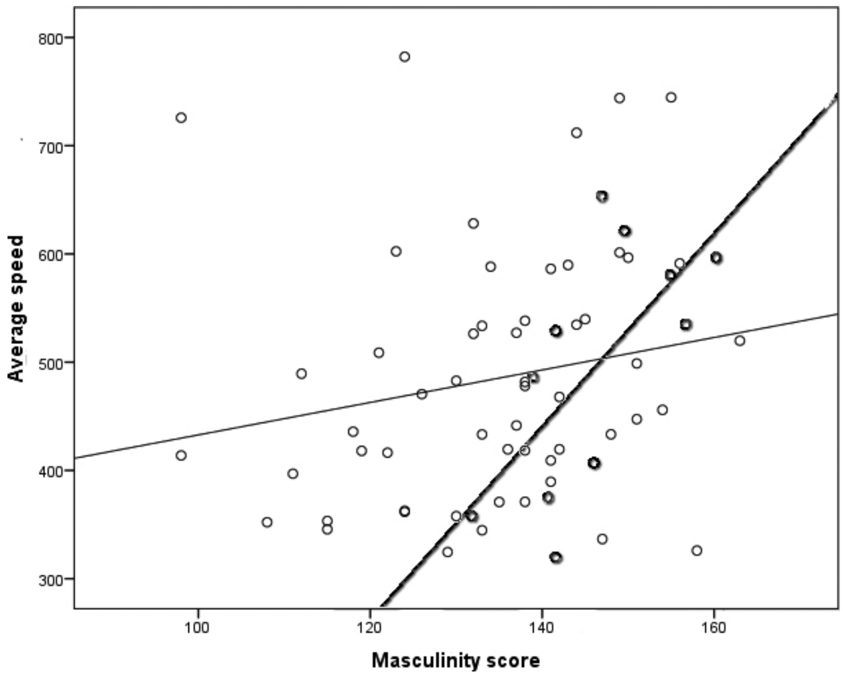


Figure 17. Scatterplot of masculinity score and average speed. Female scatters are shown with normal circles, while male scatters are shown with thick black circles.

3.1.5.2 Gender effects of masculinity on TTC

Two simple linear regression analyses were conducted to predict average TTC based on masculinity score, one for females (N = 58) and one for males (N = 11). A significant regression equation was found for males (F (1, 9) = 6.65, p = .03), with an R^2 of .425. The average TTC showed an unstandardized coefficient of B = -.014 and a standardized coefficient of β = -.652 (t = -2.58, p = .03). No significant regression equation was found for females (F (1, 53) = 2.68, p = .108), with an R^2 of .048. The average TTC showed an unstandardized coefficient of B = -.003 and a standardized coefficient of β = -.219 (t = -1.64, p = .108). This means that there is a strong linear connection between masculinity and average TTC for males, but contrary to the hypothesis not for females. Figure 18 shows the relationship between the two variables in a scatterplot for both males and females.

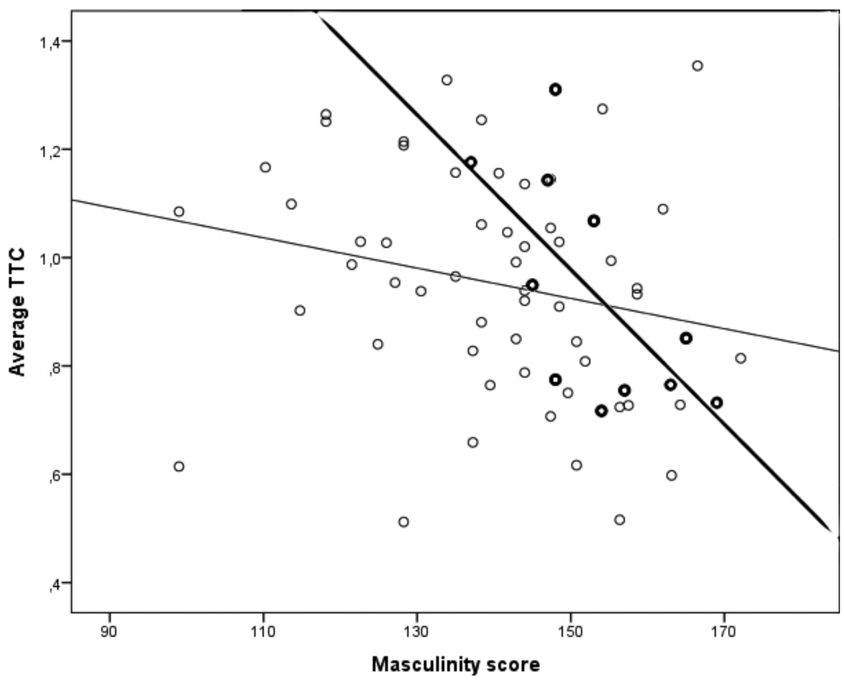


Figure 18. Scatterplot of masculinity score and average speed. Female scatters are shown with normal circles, while male scatters are shown with thick black circles.

3.1.5.3 Gender effects of masculinity on DCM

Two simple linear regression analyses were conducted to predict average DCM based on masculinity score, one for females (N = 58) and one for males (N = 11). No significant regression equation was found for males (F (1, 9) = .05, p = .828), with an R^2 of .006. The average DCM showed an unstandardized coefficient of B = -.05 and a standardized coefficient of β = -.074 (t = -.223, p = .828). No significant regression equation was found for females (F (1, 53) = .6, p = .443), with an R^2 of .011. The average DCM showed an unstandardized coefficient of B = .1 and a standardized coefficient of β = .106 (t = .773, p = .443). This means that there is no linear connection between masculinity and average DCM for both males and females.

3.2 Risk Homeostasis

3.2.1 Effects of total shields on risk behavior

3.2.1.1 Effects of total shields on speed

A one-way repeated measures ANOVA was conducted to compare scores on speed at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. Testing the degree of sphericity shows that εGG > .75 (εGG = .93), therefore εHF for F correction will be used. The univariate results showed a significant effect for the amount of shields people started with on average speed (F (3.94, 267.75) = 17.44, p < .001). The multivariate approach also showed a significant effect for the amount of shields people started with on average speed (Wilks' Lambda = .56, F (4, 65) = 13.05, p < .001). Post-hoc Bonferroni tests were conducted to see which conditions differ from each other in average speed. The results show a difference between the 0 starting shield condition and the 3 starting shield condition (p < .001), the 0 starting shield condition and the 4 starting shield condition (p < .001), the 0 starting shield condition and the 5 starting shield condition (p < .001), the 1 starting shield condition and the 4 starting shield condition (p = .005), and the 1 starting shield condition and the 5 starting shield condition ($p < .001$). The mean speed of the starting shield conditions are shown in figure 19, and presented in table 21 in the appendices.

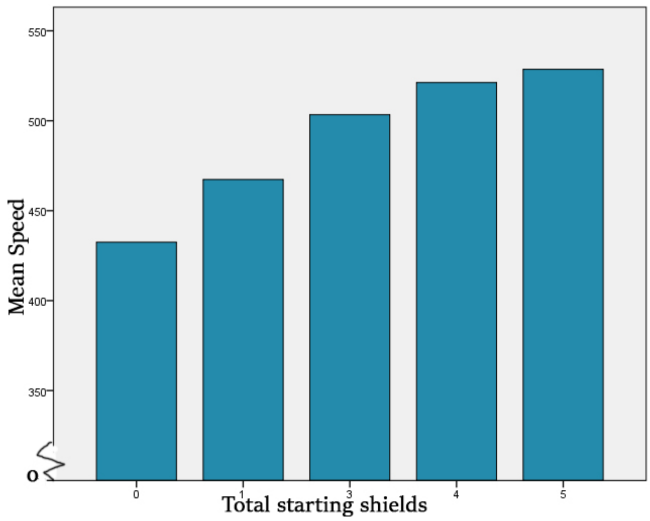


Figure 19. Mean speed for total starting shields.

3.2.1.2 Effects of total shields on TTC

A one-way repeated measures ANOVA was conducted to compare scores on TTC at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. Testing the degree of sphericity shows that $\varepsilon GG > .75$ ($\varepsilon GG = .89$), therefore εHF for F correction will be used. The univariate results showed a significant effect for the amount of shields people started with on average TTC (F (3.77, 252.35) = 17.42, $p < .001$). The multivariate approach also showed a significant effect for the amount of shields people started with on average TTC (Wilks' Lambda = .56, F (4, 64) = 12.47, $p < .001$). Post-hoc Bonferroni tests were conducted to see which conditions differ from each other in average TTC. The results show a difference between the 0 starting shield condition and the 1 starting shield condition ($p = .026$), the 0 starting shield condition and the 3 starting shield condition ($p < .001$), the 0 starting shield condition and the 4 starting shield condition ($p < .001$), the 0 starting shield condition and the 5 starting shield condition ($p < .001$), the 1 starting shield condition and the 4 starting shield condition ($p < .001$), and the 1 starting shield condition and the 5 starting shield condition ($p < .001$).

The mean TTC of the starting shield conditions are shown in figure 20, and presented in table 22 in the appendices.

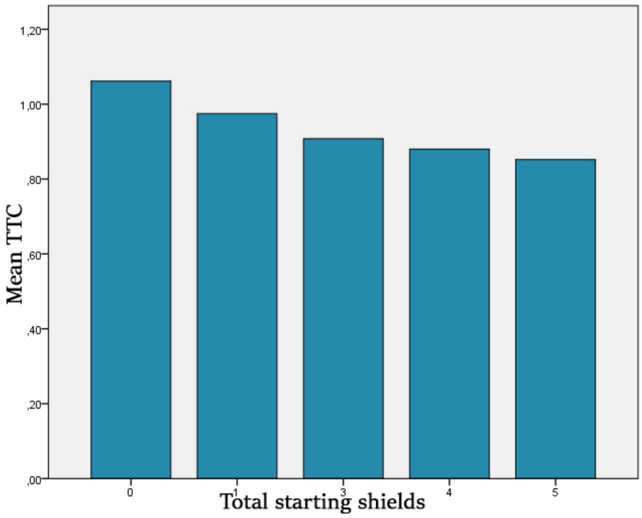


Figure 20. Mean TTC for total starting shields.

3.2.1.3 Effects of total shields on DCM

A one-way repeated measures ANOVA was conducted to compare scores on DCM at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. Testing the degree of sphericity shows that $\varepsilon GG < .75$ ($\varepsilon GG = .37$), therefore εGG will be used. The univariate results showed a significant effect for the amount of shields people started with on average DCM (F (1.35, 91.46) = 21.66, $p < .001$). The multivariate approach also showed a significant effect for the amount of shields people started with on average DCM (Wilks' Lambda = .62, F (4, 65) = 10, $p < .001$). Post-hoc Bonferroni tests were conducted to see which conditions differ from each other in average DCM. The results show a difference between the 0 starting shield condition and the 1 starting shield condition ($p = .002$), the 0 starting shield condition and the 3 starting shield condition ($p < .001$), the 0 starting shield condition and the 4 starting shield condition ($p < .001$), the 0 starting shield condition and the 5 starting shield condition ($p < .001$), the 1 starting shield condition and the 4 starting shield condition ($p = .011$), the

1 starting shield condition and the 5 starting shield condition (p = .001), and the 3 starting shield condition and the 5 starting shield condition (p = .023). The mean DCM of the starting shield conditions are shown in figure 21, and presented in table 23 in the appendices.

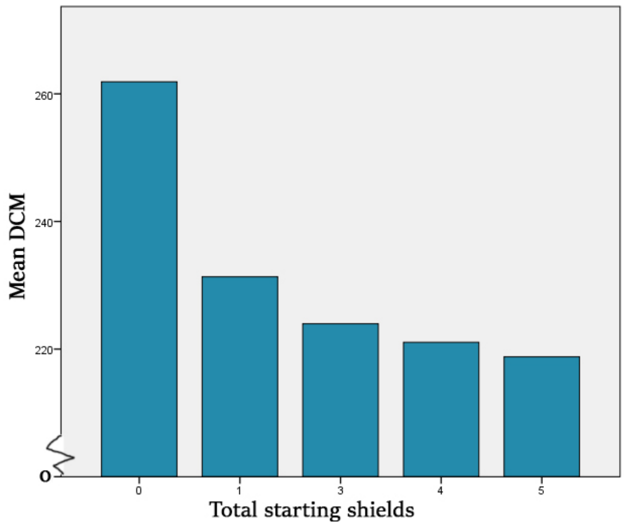


Figure 21. Mean DCM for total starting shields.

3.2.2 Effects of shield loss on speed

3.2.2.1 Effect on speed in condition with 5 shields

A one-way repeated measures ANOVA was conducted to compare means of speed on the 5 shield starting condition between 5 shields through 0 shields remaining. Testing the degree of sphericity shows that εGG < .75 (εGG = .5), therefore εGG will be used. The univariate results showed a significant effect for the amount of remaining shields on average speed (F (2.51, 155.29) = 36.09, p < .001). The multivariate approach also showed a significant effect for the amount of remaining shields on average speed (Wilks' Lambda = .44, F (5, 58) = 14.5, p < .001). Post-hoc Bonferroni tests were conducted to see which conditions differ from each other in average speed. The results show a significant difference between having 5 shields and all other amounts of remaining shields (p < .001). Another significant difference has been found with having 4 shields and having 2 shields (p = .001).

However, the direction of this effect is the opposite of the hypothesized effect; speed increases when shields become less. An overview of the relevant means are presented in table 4.

Table 4. *Means of speed in the condition with 5 starting shields*

Remaining shields	Mean speed
5	456.74
4	555.47
3	576.11
2	585.34
1	590.94
0	592.98

3.2.2.2 Effect on speed in condition with 4 shields

A one-way repeated measures ANOVA was conducted to compare means of speed on the 4 shield starting condition between 4 shields through 0 shields remaining. Testing the degree of sphericity shows that $\varepsilon GG < .75$ ($\varepsilon GG = .52$), therefore εGG will be used. The univariate results showed a significant effect for the amount of remaining shields on average speed (F (2.06, 115.31) = 36.82, $p < .001$). The multivariate approach also showed a significant effect for the amount of remaining shields on average speed (Wilks' Lambda = .43, F (4, 53) = 17.28, $p < .001$). Post-hoc Bonferroni tests were conducted to see which conditions differ from each other in average speed. The results show a significant difference between having 4 shields and all other amounts of remaining shields ($p < .001$). However, the direction of this effect is the opposite of the hypothesized effect; speed increases when shields become less. An overview of the relevant means are presented in table 5.

Table 5. *Means of speed in the condition with 4 starting shields*

Remaining shields	Mean speed
4	473.8
3	578.08
2	586.18
1	594.91
0	595.49

3.2.2.3 Effect on speed in condition with 3 shields

A one-way repeated measures ANOVA was conducted to compare means of speed on the 3 shield starting condition between 3 shields through 0 shields remaining. Testing the degree of sphericity shows that $\varepsilon GG < .75$ ($\varepsilon GG = .61$), therefore *εGG* will be used. The univariate results showed a significant effect for the amount of remaining shields on average speed (F (1.83, 104.46) = 49.58, $p < .001$). The multivariate approach also showed a significant effect for the amount of remaining shields on average speed (Wilks' Lambda = .41, F (3, 55) = 26.45, $p < .001$). Post-hoc Bonferroni tests were conducted to see which conditions differ from each other in average speed. The results show a significant difference between having 3 shields and all other amounts of remaining shields ($p < .001$). Significant differences have also been found between having 2 shields and having 1 shield ($p = .001$), and between having 2 shields and having 0 shields ($p = .001$). However, the direction of this effect is the opposite of the hypothesized effect; speed increases when shields become less. An overview of the relevant means are presented in table 6.

Table 6. *Means of speed in the condition with 3 starting shields*

Remaining shields	Mean speed
3	458.06
2	556.83
1	596.79
0	608.2

3.2.2.4 Effect on speed in condition with 1 shield

A one-way repeated measures ANOVA was conducted to compare means of speed on the 1 shield starting condition between having 1 shield and having 0 shields remaining. The univariate results showed a significant effect for the amount of remaining shields on average speed (F (1, 68) = 52, p < .001). The multivariate approach also showed a significant effect for the amount of remaining shields on average speed (Wilks' Lambda = .56, F (1, 68) = 52, p < .001). However, the direction of this effect is the opposite of the hypothesized effect; speed increases when shields drop from 1 (M = 440.2) to 0 (M = 524.69).

3.2.3 Effects of shield loss on TTC

3.2.3.1 Effect on TTC in condition with 5 shields

A one-way repeated measures ANOVA was conducted to compare means of TTC on the 5 shield starting condition between 4 shields through 0 shields remaining. Testing the degree of sphericity shows that εGG > .75 (εGG = .78), therefore εHF will be used. The univariate results showed a significant effect for the amount of remaining shields on average TTC (F (3.32, 205.67) = 4.23, p = .005). The multivariate approach also showed a significant effect for the amount of remaining shields on average TTC (Wilks' Lambda = .79, F (4, 59) = 4.03, p = .006). Post-hoc Bonferroni tests were conducted to see which conditions differ from each other in average TTC. The results show a significant difference between having 4 shields and having 2 shields (p = .011), between having 4 shields and having 1 shield (p = .038), and between having 4 shields and having 0 shields remaining (p = .02). However, the direction of this effect is the opposite of the hypothesized effect; TTC decreases when shields become less. An overview of the relevant means are presented in table 7.

Table 7. *Means of TTC in the condition with 5 starting shields*

Remaining shields	Mean TTC
4	.795
3	.744
2	.731
1	.714
0	.709

3.2.3.2 Effect on TTC in condition with 4 shields

A one-way repeated measures ANOVA was conducted to compare means of TTC on the 4 shield starting condition between 3 shields through 0 shields remaining. Testing the degree of sphericity shows that $\varepsilon GG > .75$ ($\varepsilon GG = .84$), therefore εHF will be used. The univariate results showed no significant effect for the amount of remaining shields on average TTC (F (2.64, 148) = .23, $p = .852$). The multivariate approach also showed no significant effect for the amount of remaining shields on average TTC (Wilks' Lambda = .98, F (3, 54) = .31, $p = .816$). This means that there are no differences in TTC when shields are lost during the 4 shield starting condition. An overview of the relevant means are presented in table 8.

Table 8. *Means of TTC in the condition with 4 starting shields*

Remaining shields	Mean TTC
3	.737
2	.735
1	.718
0	.728

3.2.3.3 Effect on TTC in condition with 3 shields

A one-way repeated measures ANOVA was conducted to compare means of TTC on the 3 shield starting condition between 2 shields through 0 shields remaining. Testing the degree of sphericity shows that *εGG* > .75 (*εGG* = 1), therefore *εHF* will be used. The univariate results showed no significant effect for the amount of remaining shields on average TTC (F (2, 114) = 2.24, p = .111). The multivariate approach also showed no significant effect for the amount of remaining shields on average TTC (Wilks' Lambda = .93, F (2, 56) = 2.15, p = .216). This means that there are no differences in TTC when shields are lost during the 3 shield starting condition. An overview of the relevant means are presented in table 9.

Table 9. *Means of TTC in the condition with 3 starting shields*

Remaining shields	Mean TTC
2	.753
1	.688
0	.695

3.2.3.4 Effect on TTC in condition with 1 shield

A one-way repeated measures ANOVA was conducted to compare means of TTC on the 3 shield starting condition between 3 shields through 0 shields remaining. The univariate results showed a significant effect for the amount of remaining shields on average TTC (F (1, 68) = 72.21, p < .001). The multivariate approach also showed a significant effect for the amount of remaining shields on average TTC (Wilks' Lambda = .48, F (1, 68) = 72.21, p < .001). The direction of this effect is the opposite of the hypothesized effect; TTC decreases when shields drop from 1 (M = 1.051) to 0 (M = .810).

3.2.4 Effects of shield loss on DCM

3.2.4.1 Effect on DCM in condition with 5 shields

A one-way repeated measures ANOVA was conducted to compare means of DCM on the 5 shield starting condition between 4 shields through 0 shields remaining. Testing the degree of sphericity shows that *εGG* > .75 (*εGG* = .88), therefore *εHF* will be used. The univariate results showed no significant effect for the amount of remaining shields on average DCM (F (3.77, 233.94) = .46, p = .757). The multivariate approach also did not show a significant effect for the amount of remaining shields on average DCM (Wilks' Lambda = .97, F (4, 59) = .39, p = .812).

3.2.4.2 Effect on DCM in condition with 4 shields

A one-way repeated measures ANOVA was conducted to compare means of DCM on the 4 shield starting condition between 3 shields through 0 shields remaining. Testing the degree of sphericity shows that εGG > .75 (εGG = .95), therefore εHF will be used. The univariate results showed no significant effect for the amount of remaining shields on average DCM (F (3, 171) = .26, p = .852). The multivariate approach also did not show a significant effect for the amount of remaining shields on average DCM (Wilks' Lambda = .98, F (2, 56) = .3, p = .83).

3.2.4.3 Effect on DCM in condition with 3 shields

A one-way repeated measures ANOVA was conducted to compare means of DCM on the 3 shield starting condition between 2 shields through 0 shields remaining. Testing the degree of sphericity shows that εGG > .75 (εGG = .95), therefore εHF will be used. The univariate results showed no significant effect for the amount of remaining shields on average DCM (F (1.97, 112.22) = .36, p = .694). The multivariate approach also did not show a significant effect for the amount of remaining shields on average DCM (Wilks' Lambda = .98, F (2, 56) = .45, p = .64).

3.2.5 Effect of masculinity on risk homeostasis

3.2.5.1 Effect of masculinity on speed for different starting shield conditions

A one-way repeated measures ANOVA with masculinity score as covariate was conducted to compare scores on speed at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. Testing the degree of sphericity shows that εGG > .75 (εGG = .9), therefore εHF for F correction will be used. The univariate results showed no significant effect for the amount of shields people started with on average speed (F (3.91, 250.45) = .76, p = .549). The multivariate approach also showed no significant effect for the amount of shields people started with on average speed (Wilks' Lambda = .93, F (4, 61) = 1.13, p = .35). This means that after controlling for masculinity, there is no difference in average speed across the different starting shield conditions. The covariate of masculinity score was significant (F (1, 64) = 4.12, p = .047).

3.2.5.2 Effect of masculinity on TTC for different starting shield conditions

A one-way repeated measures ANOVA with masculinity score as covariate was conducted to compare scores on TTC at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. Testing the degree of sphericity shows that εGG > .75 (εGG = .86), therefore εHF for F correction will be used. The univariate results showed no significant effect for the amount of shields people started with on average TTC (F (3.73, 235.2) = .8, p = .517). The multivariate approach also showed no significant effect for the amount of shields people started with on average TTC (Wilks' Lambda = .91, F (4, 60) = 1.43, p = .24). This means that after controlling for masculinity, there is no difference in average TTC across the different starting shield conditions. The covariate of masculinity score was not significant (F (1, 63) = 3.62, p = .062).

3.2.5.3 Effect of masculinity on DCM for different starting shield conditions

A one-way repeated measures ANOVA with masculinity score as covariate was conducted to compare scores on DCM at the 5 shields starting condition, 4 shields starting condition, 3 shields starting condition, 1 shields starting condition, and 0 shields starting condition. Testing the degree of sphericity shows that εGG < .75 (εGG = .33), therefore εGG will be used. The univariate results showed no significant effect for the amount of shields people started with on average DCM (F (1.31, 83.81) = .45, p = .56). The multivariate approach also showed no significant effect for the amount of shields people started with on average DCM (Wilks' Lambda = .93, F (4, 61) = 1.24, p = .302). This means that after controlling for masculinity, there is no difference in average DCM across the different starting shield conditions. The covariate of masculinity score was not significant (F (1, 64) = .27, p = .603).

4 Discussion

The aim of this study was to further explore the difference in risk behavior found between men and women (Byrnes et al., 1999), by looking at the influence of masculinity for both men and women on several markers of risk behavior by using a gaming experiment, in which participants controlled a spaceship and had to dodge incoming meteors while gaining points. In addition, based on the assumptions of risk homeostasis by Wilde (1982), the current study looked at compensatory effects between different protective conditions and levels, to see whether indeed risk behavior increases when the spaceship has more protection, and decreases when the spaceship has less protection. Finally, the current study looked at possible interaction effects of perceived masculinity on these compensatory effects. The results generally support the influence of masculinity on risk behavior, but results are unclear for how this manifests in women, with only a clear effect on males. Results showed results that both support and refute the homeostatic effect on risk behavior as proposed by Wilde (1982), and showed compensatory behavior between levels, but a reversed effect within levels, where risk behavior increased as safety decreased. After correcting for masculinity, no compensatory effects were found.

4.1 Masculinity, gender and risk behavior

The current study in general found some support for the connection between masculinity and risk behavior, which is somewhat in line with the existing literature (e.g. Stergiou-Kita et. al, 2015). Men showed higher masculinity scores than females. In addition, they took more risk by having a reduced amount of space between the ship and meteors (lower DCM). There was no significant difference found between males and females on the remaining risk parameters, likely due to the small amount of males that participated.

The hypothesized linear connection did not occur among all three variables of risk behavior. A linear trend was observable in average speed, but this trend was not significant. A linear trend was significant, however, between TTC and masculinity, meaning that higher masculinity lead to keeping less horizontal distance between the ship and a meteor. No connection or trend could be found between DCM and masculinity. It is possible that the reason for an observable but not significant trend between speed and masculinity is because the research suggests that not masculinity itself but masculine norms lead to risk behavior (Stergiou-Kita et. al, 2015). These masculine norms are likely to be present in highly masculine people, and are also present in the masculinity questionnaire itself, which can explain the connection.

When computing a separate regression analysis for men and women, the linear connection between speed and masculinity became significant for men, but a connection became less likely for women. A similar effect occurred with TTC: a significant connection was found for men, but the connection was no longer significant for women. These results imply that masculinity manifests itself differently for men and women. Women with high masculinity generally show less risk behavior than men with high masculinity. An explanation for this could be that, because of the multiple subscales of the masculinity questionnaire, women with a high masculinity score might on average have lower scores on the subscale with dominance, assertiveness, aggressiveness and competitiveness, which is the subscale that is theoretically the most likely to predict risk behavior.

When splitting the highest and lowest 25% of masculinity, the aforementioned linear effects disappeared, and became quadratic trends. This could imply that low and high masculinity are different traits by themselves. No evidence has been found in the literature to further explain this occurrence. If the connection between masculinity and risk behavior was indeed a linear connection, no difference should have been found between the highest and lowest masculinity group with regards to their connection with risk behavior.

Lastly, after dividing the sample in a group with the highest 25% of masculinity scores and the rest, significant differences were found between the two groups on both speed and TTC, with the highest 25% of masculinity group showing more average speed and less average TTC (so more risk behavior) during all levels. These results are exactly in line with the literature, because participants with high masculinity showed more risk behavior across all levels (Stergiou-Kita et al., 2015). The literature explains this through both the acceptance of risk and the drive to compete as two masculine norms. Because higher speed provided more and faster points in the game, and the people with the highest scores were rewarded with prize money, this could have triggered these drives.

4.2 Compensatory effects

To investigate whether risk behavior increased as safety increased, and whether risk behavior decreased as safety decreased, as proposed by RHT (Wilde, 1982), risk behavior was observed as an average across levels, and as an average during each level between different shields. Between different levels, a compensatory effect was found. Risk behavior on average was lower during levels with a lower amount of protection. This was seen in all three measures of risk behavior (speed, TTC, and DCM). This is in line with RHT, that states that risk behavior decreases as safety decreases.

A different trend occurred in most cases whenever shields were lost during each level; people showed more risk in terms of speed and TTC generally, as safety decreased. DCM showed no significant effects between different shield conditions each level. This is contradictory with what RHT theorizes (Wilde, 1998). According to RHT, risk behavior should decrease as shields drop, because people would experience a discrepancy between the experienced level of risk and targeted level of risk, followed by the compensatory action of decreasing risk behavior when being exposed to increased risk. An explanation for this, is that people could possibly care more about the influence of safety behavior on their points when they have more shields. As their shields drop, they could think that they cannot influence their score in a significant way anymore. This effect looks similar to learned helplessness as proposed by Seligman (1972), where organism feel like they have no control (anymore) on aversive stimuli (in this case hitting a meteor).

The difference between the two found effects is interesting. Risk behavior is on average lower in levels with lower protection, but higher in the lower protective conditions within a level.

The average risk behavior per level mostly showed big differences between the zero remaining shield condition and higher shield conditions, but rarely between the higher shield conditions within a level. This could imply that there was some sort of 'first life effect', where the first life influenced the results of the data too much. This effect has larger influence in a zero and one shield level compared to levels with a larger amount of shields.

4.3 Masculinity and compensatory effects

To investigate the influence of masculinity on compensatory effects, the average risk behavior was observed per level, after controlling for masculinity. The covariate of masculinity score was significant for speed, but not for the other two. Still, because of the big difference in multivariate significance, I decided to include the results with the covariate. Interestingly, the effect that was found earlier, namely the decrease in risk behavior as safety decreased, was no longer found. This means that after controlling for masculinity, no difference can be observed in average risk behavior across different levels of the game for any of the risk parameters (speed, TTC, and DCM). This means that the difference between levels that was found earlier could have been caused by a difference in masculinity. This effect is unexpected, because the results showed earlier that compensatory effects were found between levels, and it was hypothesized based on available literature that masculinity should not affect this compensatory behavior.

4.4 Limitations of the current study

There are several limitations to be found with regards to the current study. There were some issues with the data management in the game itself. The first shield condition of every level showed very different data than the remaining shield conditions from this level. This happened because during the first condition, the meteors were still flying in, so distance from meteors was higher. After that, even if a shield was lost, the game would continue providing immunity for a few seconds, meaning meteors were around during every shield condition except for the first one each level. We attempted to correct for this in the data by not using any data from the first five seconds of each level, but analysis of the data showed that the first shield condition of each level still showed major differences that were likely to be caused by this 'first life effect'. This means that in analyses were we considered the first life effect to be too influential, we removed this first life from the analysis, e.g., for comparing averages from TTC and DCM within a level. However, because speed could be increased during this time, some exceptions were made for speed. This first life effect is stronger for participants who had relatively short rounds, because this effect is only influential in the first seconds of every level.

Another point of criticism can be made for the transferability of the game scenario to a workplace, or other 'realistic' scenario. Losing shields and not finishing a level, or in essence not scoring many points, only had an influence on the total game score, and thus on the chances of earning the top 3 prize money. Participants received the same amount of money or credits, regardless of their scores, and no scores were publically compared to each other. This might have lead to participants not showing the same care or the same risk behavior they would show in a more realistic scenario. This can also affect the way masculinity manifests itself in behavior. Highly masculine people might show more restraint at the workplace, where behavior has a larger consequential impact, and while playing a game they might have less restrictions to actually do what they want to do, so the impact of masculinity might be increased by this effect. There are arguments to be made in favor of transferability as well. Risk behavior was rewarded with faster points, but of course, participants would have greater chance of losing a shield. Speeding on the road can lead to being home or at work faster, skipping safety regulations might lead to an employee reaching his targets faster, or not wearing a helmet on a scooter might be more relaxing on a warm day. In addition, there is overlap between the literature and behavior shown in this experiment, e.g. higher masculinity leads to higher risk behavior (Stergiou-Kita et al., 2015), which means that there is in fact transferability of certain traits to behavior in the game.

Lastly, the Perceived Masculinity Questionnaire 47 was adapted for this experiment. Several questions related to sex and sexual fantasies were dropped, on an ethical basis. These questions seemed incredibly personal, and it did not seem ethical to ask this of young students in this voluntary context. In addition, one scale (gender-related sociocultural roles) was dropped entirely for this study on a cultural basis. This scale had several questions regarding supporting of a sports team in several scenarios (e.g., wearing sports merchandise, friends seeing you as a fan of sports). Sports in general are a very strong cultural aspect in the USA (Powell, 1991). To avoid contamination on the score of masculinity, I chose not to include this scale in the questionnaire, because it is reasonable to assume that the influence of sports on masculinity is either different or reduced in other countries than the USA. The remaining scales had a poor internal consistency, indicating that the questionnaire itself could perhaps be made more effective by adding several questions per scale and assessing whether certain questions do indeed measure the same construct.

4.5 Implications of the current study

This study has several implications for the research on psychology, masculinity, and RHT, and on safety culture at the workplace. It has shown that risk and masculinity are connected, and that this effect is stronger for males. This means that high masculinity females, but especially high masculinity males could commit more unsafe acts at the workplace. Possible ways to counter this are provided by Reason (1990), and his Swiss cheese model. System defenses can be put in place to prevent risk behavior from leading to certain losses, such as alarms, fail-safes, or even added control by people. Further evidence against RHT has been provided by this study. There was inconsistent evidence for compensatory behavior, and some of the found effects were reversed; decreased safety within levels went together with increased risk behavior. This could be an additional counterargument towards RHT's notion that safety measures should not be consciously implemented, but that instead the willingness to take risks should be lowered (Wilde, 1982).

4.6 Recommendations for future studies

Based on the method and findings of this study, the research on masculinity, risk behavior, and RHT can be expanded in several ways. In a similar gaming experiment, it would be interesting to see what happens to the risk behavior of participants when they are protected with an unknown amount of shields, which could be similar to a real life situation; the consequences of an error are sometimes hard to predict. In addition, the current study found a difference in high masculinity males and high masculinity females. Additional research is needed to provide an answer to why this is different, and what overlap there is between the two. An additional femininity scale could be added, providing more analyses to compare masculinity, femininity, and the influence of gender. Lastly, right now there is little research done on interventions that focus on counteracting the risk behavior of high masculinity males in general, and instead, many interventions focus on reducing risk behavior in general. Several interventions could be tested, with the spaceship game being played before and after the intervention to analyze if an intervention had an effect in reducing risk behavior amongst high masculinity people.

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Appendix

Appendix 1 - Information letter

Information letter - Risk homeostasis in gaming

Welcome and thank you for coming! You are going to play a computer game and fill in a questionnaire. Before you start, please read this information letter and sign the informed consent. Your participation is completely anonymous and voluntarily. Your records are coded by means of a participant number (see the post-it). You will need to enter this number when starting the game and the questionnaire. Please double check when entering your number, this is important. If you would like to stop the experiment you may do so at any moment. The results of this study will be used in SPSS to conduct statistical analyses for our master thesis about the risk homeostasis theory.

The game

The game is about a little spaceship in a galaxy not so far away on its way to deliver very valuable cargo. The spaceship is in a hurry and has to reach its destination as soon as possible. Unfortunately, the ship runs into a thick cloud of meteors. You are the ship's captain and you have to stay on your toes to dodge the danger and get through. The goal is to go as fast as you can (a faster speed will result in more points) but also try to avoid the meteors (a collision with a meteor will cost you a life).
You will receive specific instructions about the game (e.g. which buttons to use etcetera) when starting the game.

Instructions

Please pay attention only to your own computer screen. Also, please do not make noise. When you have a question raise your hand and one of us will come to you.

After you have read and completed the informed consent, please login with your UL account (Some of the computers are already logged in, if so, do not log in with your own UL account). When your desktop is completely loaded raise your hand. We will start the game for you After you have finished the game please raise your hand and we will start the questionnaire for you. *Please do not forget to enter your (correct) post-it number both in the game and questionnaire*! When you completed the questionnaire you can collect your money or credits for participating.

Any questions?

Remarks or complaints afterwards can be directed towards the senior researcher:

Jop Groeneweg
Groeneweg@fsw.leidenuniv.nl

Appendix 2 - Informed consent letter

Informed Consent - Risk homeostasis in gaming

In this experiment we will test the risk homeostasis theory by means of a computer game. The experiment will take about 45 minutes. You will be compensated for your time by receiving 2 credits or €6,50. By signing the form you agree with the following statements.

- I have read the information letter. I could ask additional questions. Questions that I had have been answered adequately. I have had sufficient time to decide whether or not I participate.

- I am aware that participation is completely voluntary. I know that I can decide at any moment not to participate or to stop. I do not need to provide a reason for that.

- My responses are processed anonymously or in a coded way.

- I give consent to use my data for the purposes that are mentioned in the information letter.

I consent to participating in this study.

Name of participant: ____

Signature: ____

Date: _____/_____/______

Appendix 3 - Tables

Table 10. *Inter-item correlations for Physiological energy scale*

Item	1	2	3	4
1 Desirability for aggression	-			
2 Desirability for assertiveness	.137	-		
3 Desirability for competitiveness	.104	.229	-	
4 Desirability for dominance	.243	.385	.452	-

Table 11. *Inter-item correlations for Physical characteristics scale*

Item	1	2	3
5 Physically muscular perception	-		
6 Body shape perception	.15	-	
7 Voice perception	.193	.165	-

Table 12. *Inter-item correlations for Idealized gender scale*

Item	1	2	3	4
8 Masculine man perception media	-			
9 Masculine man perception local	.598	-		
10 Sexual image masculinity self	-.125	.04	-	
11 Sexual image masculinity others	-.01	.142	.833	-

Table 13. *Inter-item correlations for Subjective gender identity scale*

Item	1	2	3	4
12 Sexual role masculinity self	-			
13 Sexual role masculinity friends	.788	-		
14 Sexual role masculinity parents	.651	.747	-	
15 Sexual role masculinity strangers	.646	.715	.709	-

Table 14. *Inter-item correlations for Gender-related age identity scale*

Item	1	2	3	4
16 Sexual maturity self	-			
17 Sexual maturity others	.573	-		
18 Too old for sexuality self	.212	-.017	-	
19 Too old for sexuality others	.125	.067	.662	-

Table 15. *Inter-item correlations for Gender-related racial and national identities scale*

Item	1	2	3	4
20 Sexuality restriction self	-			
21 Sexuality restriction others	.891	-		
22 Sexuality restriction society	.659	.671	-	
23 Sexuality restriction local	.686	.677	.752	-

Table 16. *Inter-item correlations for Lust scale*

Item	1	2	3	4
24 Sex frequency desire	-			
25 Romance	.24	-		
26 Body stimulation	-.248	.074	-	
27 Foreplay	-.343	-.044	.557	-

Table 17. *Inter-item correlations for Masculine eroticism scale*

Item	1	2	3	4
28 Masculinity appearance society	-			
29 Masculinity appearance self	.248	-		
30 Grooming society	.574	.023	-	
31 Grooming self	.235	.561	.351	-

Table 18. *Means of speed for total starting shields for top 25% of masculinity score and lowest 75% masculinity score*

	0	1	3	4	5
			Mean speed		
Top 25% masc.	503	538	581	617	601
Lowest 75% masc.	412	538	581	493	507

Table 19. *Means of TTC for total starting shields for top 25% of masculinity score and lowest 75% masculinity score*

	0	1	3	4	5
			Mean speed		
Top 25% masc.	.92	.89	.78	.74	.75
Lowest 75% masc.	1.1	1.01	.95	.92	.89

Table 20. *Means of DCM for total starting shields for top 25% of masculinity score and lowest 75% masculinity score*

	0	1	3	4	5
			Mean speed		
Top 25% masc.	272	248	225	224	219
Lowest 75% masc.	259	225	224	220	218

Table 21. *Means of speed for total starting shields*

Starting shields	Mean speed
0	432
1	467
3	503
4	521
5	529

Table 22. *Means of TTC for total starting shields*

Starting shields	Mean TTC
0	1.06
1	.98
3	.91
4	.88
5	.86

Table 23. *Means of DCM for total starting shields*

Starting shields	Mean DCM
0	262
1	231
3	224
4	221
5	219