Does Environmental Harshness Influence our Decision to Deceive?

Bachelor thesis

Wiebke Nothhelfer

S1943294

BSc Psychology

University of Twente

24 - 07 - 2020

Supervisor: Jeanette Hadaschik (MSc)

2nd Supervisor: Dr. Mariëlle Stel

Contents

Abstract

This study investigated the influence of cues of a harsh environment on deception and perceived safety, relaxation, and stress. The theoretical approach of Frankenhuis et al. (2016) on cognition in harsh and unpredictable environments was chosen, to look for an external factor, which influences an individual's deceptive behaviour. The approach is based on evolutionary Life History Theory and suggests that humans adapt according to the cues they receive from their environment, to survive and reproduce. Past research supported the theoretical approach but has not yet investigated the effect on deception. It was hypothesised that cues of harshness influence perceived safety and perceived relaxation negatively and the decision to deceive and perceived stress positively. Two videos of a neighbourhood, one displaying cues of harshness and one not, were introduced as a new manipulation. Previous research influenced participants with newspaper articles or by sending them into actual neighbourhoods, which displayed cues of harshness. The new manipulation ensured better immersion and a true experiment, which is comparable and replicable. Participants (N = 106) were randomly assigned to a condition with or without cues of harshness. After watching the assigned video, participants got a chance to deceive, which was measured with a dice roll. The outcome of a Kruskal-Wallis Test showed a significant influence of cues of harshness on perceived safety ($H(2) = 43.672$, $p = .000$), relaxation ($H(2) = 19.335$, $p = .000$), and stress ($H(2) = 15.787$, $p = .000$). There was no influence found on the decision to deceive ($H(2) = 5.472$, $p = .065$). Due to a small sample size and a possibly not representative sample because of convenience sampling, further research was suggested, with bigger samples and even more immersive manipulations like Virtual Reality.

Does Environmental Harshness Influence our Decision to Deceive?

Deception

Why do people deceive? This question is of high importance for psychologists. Deception seems risky and could entail serious consequences, but nonetheless everyone tells a lie occasionally. Deception is among other things a characteristic of fraud and can be prosecuted by law. Since this is not unknown one wonders why a person would risk the negative consequence of being detected.

Deception is "to intentionally cause to have a false belief that is known or believed to be false" (Mahon & Zalta, 2008, p. 1). It can be conceptualised as a form of risk-taking. Risk is defined as the "inherent possibility of loss" (Yates & Stone, 1992, p. 4). There are all kinds of potential losses that deception entails if it is detected. If one deceives in front of their social group and gets detected, one may lose their social status. Another kind of loss is financial loss, by being detected committing smaller frauds and then having to pay a fine. If the crime is bigger the consequences are as well, such as the loss of freedom. This could occur when being prosecuted for crimes like tax fraud or selling medicine without an active ingredient. These losses often occur in combination with each other.

So why do some people still engage frequently in this deceptive behaviour? Is it because they just cannot help it because it is engraved in their personality? Or is there something else that influences a person to deceive and with-it risking loss? To find out what influences the risky decision to deceive, one needs to determine the underlying factors.

Cognition in Harsh Environments

A common explanation for people engaging in deception or crime is that they have a low or no self-control (Gailliot, Gitter, Baker, & Baumeister, 2012). This approach suits society because the fault lies within the individual. It seems like there is just nothing someone else could do, the person in question should pull themselves together and practice self-control (de Ridder, van der Weiden, Gillebaart, Benjamins, & Ybema, 2019). No one can deny that one's personality does play a role when one decides how to behave (Schmeichel & Zell, 2007), but one should consider if personality is the only underlying reason. In addition to internal factors, like personality, for risk-taking behaviour there are also external factors that influence whether someone engages in deception.

Frankenhuis, Panchanathan, and Nettle (2016) introduce the theoretical approach of influence of harsh and unpredictable environments on cognition. This is based on evolutionary

"Life History Theory" (LH) (Gadgil & Bossert, 1970; Partridge & Harvey, 1988; Stearns, 1989). It is theorised that an organism in their life has only a limited amount of resources. These resources are allocated towards the goals to survive and reproduce. There are some key efforts to meet these goals, which can be differentiated between an effort to maintaining oneself (*somatic effort*) and ensuring that one's lineage or genes survive (*reproductive effort*) (Partridge & Harvey, 1988). Depending on the environment a population shows patterns of physiological development and behaviour, differentiating on a continuum from fast to slow life strategies. Patterns show, for example, in different sizes of individuals and mating behaviour. In the end the individuals which are the fittest, so the ones that are best adapted to their environment, have the best chances to achieve their goals (Gadgil & Bossert, 1970).

Frankenhuis et al. (2016) theorise that the influence of environments does not only affect animals and plants, but also humans. There are two environmental variables that influence the development of LH strategies, namely harshness and unpredictability (Ellis, Figueredo, Brumbach, & Schlomer, 2009). Harshness refers to "the rates at which extrinsic factors cause disability and death at each age in a population" (Belsky, Schlomer, & Ellis, 2012, p. 663). An important cue of harshness is the socioeconomic status (SES) of a person or population because it correlates with a lot of forms of morbidity and mortality (Belsky et al., 2012). A low SES manifests itself, for example, in a neighbourhood with derelict buildings, littering on streets and residents in old and torn clothes. Unpredictability is defined as "stochastic variation in salient environmental conditions" (Belsky et al., 2012, p. 664). Since unpredictability is not possible to manipulate in a one-time measure design, this study will focus on environmental harshness.

Frankenhuis et al. (2016) theorise that humans have evolved cognitive mechanisms that 'read' cues from their environment, like cues of harshness, and then behave in a way that maximises fitness. If an individual lives in an environment (e.g. a neighbourhood), where the cues of harshness are high, like low SES of the residents, they must adapt to it. Adaptation in this context does not focus on the best possible outcome for one's long-term health and safety, but on the most successful way to survive and pass on one's genes (Belsky et al., 2012). Since there is only a limited amount of energy an individual can spend, they must make trade-offs between different efforts. Hence, individuals invest more energy resources into one part of their life than in another (Belsky et al., 2012). Every trade-off has benefits and consequences and there is not one perfect strategy. A behaviour that improves fitness in one environment, might not improve fitness in a different environment. There is no universal 'optimal' behavioural strategy, it depends on the characteristics of the environment.

As in the LH Theory for animals and plants, humans also display patterns in their behaviour, which lie on a continuum from slow to fast strategies (Griskevicius, Tybur, Delton, & Robertson, 2011). This shows itself as a cognitive focus on a more present or a future oriented lifestyle, depending on cues of the humans' environment (Frankenhuis et al., 2016). If a person is exposed to environmental harshness, this may result in "vigilance to detect threats and opportunities […], impulsive reactions […] and future discounting to motivate the capture of immediate benefits" (Frankenhuis et al., 2016, p. 77). This may explain why an individual would deceive or engage in other risky behaviour, because the possible consequences are traded for the immediate benefit. A decision that would not make sense for someone, whose "reproductive fitness" (Belsky et al., 2012, p. 670) was not threatened, may make a lot of sense for someone who experiences this threat in a harsh environment. If survival seems uncertain, a potential loss in the future (e.g. a damage to social reputation after deception) seems less threatening and a reward in the present seems more appealing.

Empirical Evidence

The impact of harshness on risk-taking and possibly deception can be seen in numerous studies. For instance, Griskevicius et al. (2011) studied how mortality cues, which were used to manipulate perceived harshness, influenced risk preferences. They compared the influence of newspaper articles between groups. The articles displayed either a lot of cues of mortality, and therefore a higher perceived harshness, or none. The article which was used to increase perceived harshness, reported an increase of violence and violent deaths. These are reports of cues of mortality. Then they tested the participants' willingness to take a financial risk with a questionnaire. The outcome showed that people, who reported lower childhood SES are more prone to take risks, when they are confronted with cues of mortality (Griskevicius et al., 2011).

It was also shown in this research that people who report lower childhood SES, prefer immediate, smaller rewards over bigger, delayed rewards when primed with mortality cues. A 2x2 study design was used. Two groups were tested, one was primed with mortality cues and one was not. The preference of risk and time was tested within subjects. Risk was again measured as a financial risk and this was coupled with the delay discounting measure of receiving a smaller amount of money right away or a bigger amount later in time (Griskevicius et al., 2011).

Lastly, a preference for immediate rewards in individuals with low childhood family income, when being primed with mortality cues was supported. Again, two groups were compared. The household family income presented a more objective SES measure than in the

previously mentioned studies since those only asked for their subjective experience of their childhood environment. Participants were primed with the same articles, suggesting an increase in mortality cues or not, as in the beforementioned studies. Afterwards, their time preference of a reward was measured as in the second study they conducted (Griskevicius et al., 2011). The outcome showed, that if people are confronted with cues of mortality, they may shift their preference towards immediate rewards.

Another influence of a harsh environment, on trust and paranoia, found by Nettle, Pepper, Jobling, & Schroeder (2014) shows how humans' attitudes and emotions are influenced by their environment, even after a short amount of time. Low trust levels can influence a community within a neighbourhood, by reducing prosocial behaviour and the motivation of social control (Nettle et al., 2014). These attitudes toward an environment may cause different behaviour in an individual, therefore this study on trust and paranoia is relevant for the current research.

A two-part experiment in two different neighbourhoods was conducted (Nettle et al., 2014). The two neighbourhoods' population differed in residents' SES, in which one population had a high SES and the other one a low SES. They administered questionnaires to samples of both neighbourhoods to measure their trust and paranoia levels. Then, they sent student volunteers as visitors to the neighbourhoods for approximately 45 minutes. Afterwards they measured their trust and paranoia levels.

The outcome shows that the trust levels in the residents of the neighbourhoods' population with a higher SES are higher than the ones of the residents with a lower SES. It also shows that residents of the neighbourhood with a lower SES are more paranoid than residents of the other neighbourhood. This effect of the different neighbourhoods also shows in the visitors' measures. The measures for social trust (the trust one has towards strangers) and paranoia mirror the results of the residents (Nettle et al., 2014). This indicates that one may be influenced by cues of a harsh environment even after a short amount of time.

Current study

The theoretical approach by Frankenhuis et al. (2016), theorises that humans adapt to the cues of their environment and that in harsh environments humans are more prone to patterns of 'fast' LH strategies. Empirical evidence by Griskevicius et al. (2011) and Nettle et al. (2014) support the influence of harsh environments on risk taking and a person's attitude and emotions.

The current study aimed to investigate if the same influence of cues of harshness applies to deception as a risky behaviour. Additionally, it tested if the perception of one's environment

was influenced. Therefore, perceived safety, relaxation and stress were measured. The manipulation of this study was a new way to influence participants' decision to deceive. The study compared participants' deceptive behaviour across two different computer-generated neighbourhoods, one with a lot of cues of harshness, one with no cues of harshness. These environments were presented in videos which were screen recordings of a 3D environment created with a game engine. The cues of harshness were shown in a deprived neighbourhood as derelict buildings, trash lying on streets, vandalised objects like park benches or a bus stop with broken windows. Additionally, sirens and people fighting were audible. In comparison the non-deprived neighbourhood showed clean streets and greenery in a park, as well as people chatting friendly in their driveway.

One advantage over previous research is the manipulation in a video. This ensured safety for the participants since the exposure to a deprived neighbourhood bears certain risks for a participant. Another advantage was increased comparability of the participants because the virtual environment was much more controlled than the real world, which decreased the chance of other factors influencing the participants (Nettle et al., 2014). Still the immersion of the current study was more impressive on the participants than articles, which were used before (Griskevicius et al., 2011).

After watching one of the videos, a measure of deception was implemented by a virtual dice roll, where participants could lie about the outcome. This is a commonly used task to measure deception (e.g. Sip et al., 2010). Participants believed that there was a possibility to be detected, but they did not know how likely it was. With this, the loss of social status became a risk, because of the possibility to be detected by the researcher. Additionally, a financial loss of not winning the lottery or when being detected getting excluded from it, was at stake. These manipulation and measure were aiming to create a more realistic situation for participants, to keep it safe, and more comparable, than in studies before.

It was predicted that cues of harshness would have a causal effect on the perceived safety, stress, relaxation, and the decision to deceive. This way it was expected to support the theoretical approach of Frankenhuis et al. (2016). Simultaneously, the new video manipulation created new possibilities to test the external factors that influence a person's cognition. The reasons for a person's behaviour could be expected to not be only internal, but external as well. For society this would entail that it should be considered to help individuals, who live in deprived neighbourhoods by changing and improving their environment. This influence of cues of harshness, shown in Figure 1 and Figure 2, was tested based on the following hypotheses:

1. Exposure to cues of harshness has a …
    a. negative causal effect on the participants' perceived safety compared to no exposure to cues of harshness.
    b. negative causal effect on the participants' perceived relaxation compared to no exposure to cues of harshness.
    c. positive causal effect on the participants' perceived stress compared to no exposure to cues of harshness.
2. Exposure to cues of harshness has a positive causal effect on the participants' decision to deceive compared to no exposure to cues of harshness.

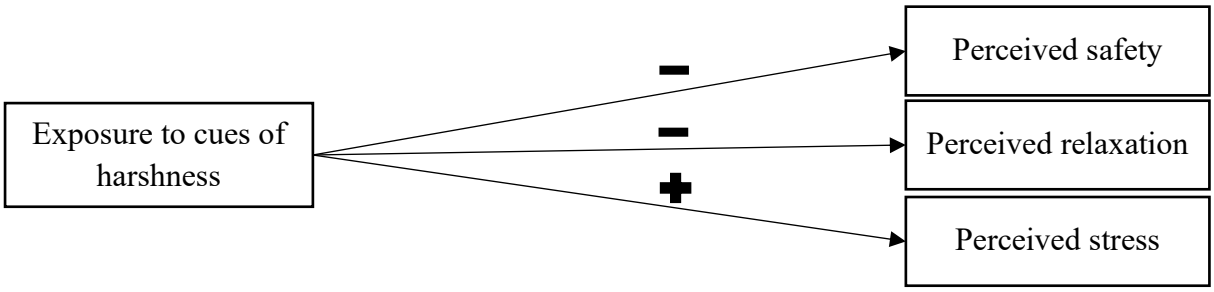

Figure 1. Model of hypothesised relationships between cues of harshness and perceived safety, relaxation, and stress.

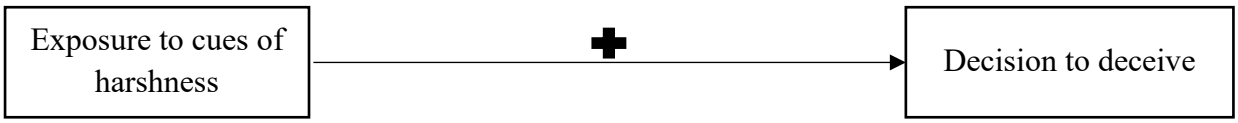

Figure 2. Model of hypothesised relationship between cues of harshness and the decision to deceive.

Method

Design

A between-subjects design was used in an online experiment. The independent variable namely the exposure to cues of harshness, was divided into an exposure condition and a no exposure condition. Additionally, a control condition was implemented to ensure a true baseline, which the no exposure condition can be compared to. The influence on the dependent variables namely the 'decision to deceive', 'perceived safety', 'perceived stress' and 'perceived relaxation' was tested.

Participants

The 106 voluntary participants were gathered by convenience sampling and via social media. Additionally, the online research participation platform of the University of Twente (SONA) was used to find participants. When students entered their SONA identification in the survey, they would receive 0.5 credits for participating in the study. It is required for a Bachelor Psychology student at the University of Twente to achieve 15 research credit points.

Participants were between 18 and 65 years old. The average age was 25.86 (*SD* = 11.09). There were 43% male and 57% female participants. The main nationality was German (81%). The inclusion criteria to take part in the study were to be 18 years or older, to have sufficient English skills and access to a Laptop, PC or Desktop and headphones. The study was approved by the Ethics Committee of the Faculty of Behavioural Management and Social Sciences of the University of Twente (request number 200244).

Materials

Two 3D virtual environments were built on the game engine Unity Version 2017.4.39f1, to resemble a deprived and a non-deprived neighbourhood. 2D videos from a first-person perspective were created within these environments and uploaded on YouTube (not publicly accessible, shown in Appendix C). The videos were filmed by 'walking' with the first-person camera, to suggest the feeling of actually walking around the neighbourhood.

The deprived neighbourhood had a lot of environmental cues of harshness, while the non-deprived neighbourhood had no cues of harshness. The cues of harshness were presented visually, for example through rubbish lying on the street, derelict or vandalised buildings or destroyed objects like benches or bus stations, shown in Figure 3 (left picture). There were also audible cues introduced, like people fighting and police sirens.

The visual cues to create a non-deprived neighbourhood were, for example clean looking streets, greenery in a well-kept park and middle-class looking houses, shown in Figure 3 (right picture). The audible cues were, for example people having a friendly conversation and birds chirping.

Figure 3. Screenshots of deprived and non-deprived neighbourhood, showing a park environment with a basketball hoop, benches, and trashcans, with houses in the background.

For the control condition footage of train simulation computer games that were similar to the two Unity environments regarding style and graphic design was uploaded on YouTube. The video of the deprived neighbourhood was three minutes and 28 seconds long, the video of the non-deprived neighbourhood three minutes and 39 seconds and the control video three minutes and 28 seconds.

A HTML script was written to create a virtual dice roll, to generate the illusion of chance when rolling it (see Appendix D). The dice roll was created to give the participants an option to deceive.

A questionnaire was created using the online survey software Qualtrics. The survey contained demographical questions on gender, age, education level, and nationality, as well as the SONA identification, if needed.

Two questions assessed whether participants experienced any technical problems with playing the video or audio (e.g. “Did you experience any technical issues watching the video?”). Two items assessed the extent to which they were immersed while watching the videos (e.g. “Were you able to identify with the character from whose point of view the video is recorded?”).

Within this manipulation check the ‘perceived safety’ (“Please rate how safe you felt being in the virtual world of the video.”) and ‘perceived relaxation’ (“Please rate how relaxed you felt being in the virtual world of the video.”) were measured. The answers were reported on a Seven-Point-Likert-Scale, ranging from one *not at all* to seven *very much*. Also, the ‘perceived stress’ (“Please rate how stressed you felt being in the virtual world of the video.”) was tested, with a reversed answer scale (from *not stressed at all* to *very stressed*) (see whole questionnaire in Appendix E).

Procedure

Participants accessed the online study via a link to the online survey tool Qualtrics, which was distributed via the university's online research participation platform and via social media. After they read a welcome sheet with information about the study (see Appendix A) and giving informed consent (see Appendix B), they were asked multiple questions on demographic variables such as age, gender and education.

Participants were equally and randomly assigned to one of the three videos of the non-deprived neighbourhood (NN; $N = 38$), deprived neighbourhood (DN; $N = 32$) or control ($N = 36$). Right after watching their video, they rolled a virtual dice. To ensure naivety, participants were told that the outcome of the dice roll was random. To measure their 'deceptive behaviour', they were told that the number they would indicate would be how many times they would participate in a lottery for a 25€ voucher from the study. They were told that there would be random checks for deception and that they would be excluded if they were caught. The outcome of the dice roll was two for all participants. They were asked to indicate the outcome of the dice roll. By doing so, they could either be honest or deceive about the outcome to increase their chance of winning. Next, they answered seven questions, to assess if the manipulation worked. These included questions about the dependent variables of 'perceived safety', 'perceived stress', and 'perceived relaxation'. Since this study was part of a larger study, additional 27 questions were asked to assess early adversity of a participant and their risk-taking behaviour. The questions measured different aspects of their early life, but they will not be elaborated more in this paper.

At the end of the study they were debriefed on the true purpose of the study and informed that everyone would have an equal chance of winning the lottery. They were also shown links to meditations and help-phone-lines in case they were disturbed or stressed by the videos and questions (see Appendix F).

Results

Descriptive Statistics

The analysis of the data was conducted with IBM SPSS Statistics 26 for Windows-PC. The descriptive statistics displayed in Table 1 below show mean, standard deviation, minimum, and maximum value of each dependent variable per group. It is noticeable that the mean values of the outcome of the dice rolls are all two or close to two, with no or only a very small standard deviation. This indicates that almost all participants decided to state the truth and did not deceive about the outcome of their dice roll.

The means of ‘perceived safety’ and ‘perceived relaxation’ were as expected higher in the NN and the control condition than in the DN. Also, the means of the ‘perceived stress’ were lower in the NN and the control condition than in the DN. This was expected as well.

Table 1

Means, standard deviations, minimum value, and maximum value of each groups’ dependent variables.

Condition	N	Variables	*M*	*SD*	Min.	Max.
DN	32	Outcome Dice Roll	2.00	.000	2	2
		Perceived Safety	2.656	1.494	1	7
		Perceived Stress	4.19	1.554	1	6
		Perceived Relaxation	2.88	1.385	1	6
NN	38	Outcome Dice Roll	2.11	.388	2	4
		Perceived Safety	4.82	1.557	2	7
		Perceived Stress	2.76	1.635	1	6
		Perceived Relaxation	4.37	1.792	1	7
Control	36	Outcome Dice Roll	2.00	.000	2	2
		Perceived Safety	5.75	1.556	3	7
		Perceived Stress	2.72	1.846	1	7
		Perceived Relaxation	4.75	1.811	1	7

Note. *M* = Mean; *SD* = Standard Deviation; Min. = Minimum value picked; Max. = Maximum value picked; DN = deprived neighbourhood; NN = non-deprived neighbourhood; N = number of participants per condition

Hypothesis 1a

The hypothesis, exposure to cues of harshness has a negative causal effect on the participants' perceived safety compared to no exposure to cues of harshness, was tested.

First the assumptions for an ANOVA were tested (Appendix G). The assumption of independence was met for all conditions in all variables, due to the design of the study. The second assumption of normally distributed residuals was checked. It was tested by examining histograms of the distribution of the scores of each group (Appendix G).

The scores of 'perceived safety' in the DN condition were skewed to the right and the distribution was pointier and heavier tailed, it seemed non-normal. The histogram of the scores of 'perceived safety' in the NN condition showed a slight skewness to the left and a flatter, lightly tailed distribution, it again seemed non-normal. The histogram of the distribution of 'perceived safety' in the control condition was heavily skewed to the left and flatter and light tailed, this distribution as well seemed non-normal.

The Kolmogorov-Smirnov Test supported the observations made on the histograms of each condition. It showed significant scores in all three groups (Appendix G). Therefore, the assumption of normally distributed residuals was violated. Then the third assumption of homogeneity of variance was tested. Levene's Test of homogeneity was significant and therefore indicated unequal variances of 'perceived safety' across groups (Appendix G). Thus, this assumption was violated as well.

Due to these outcomes, an ANOVA was not found suitable to analyse the data. A non-parametric test, which does not assume normality, was chosen, the Kruskal-Wallis Test. The Kruskal-Wallis Test determines differences between multiple independent groups. It shows whether there is a significant difference between the dependent variable across different conditions. The variable of 'perceived safety' is significantly affected by the independent variable of cues of harshness, $H(2) = 43.672$, $p = .000$.

Therefore, a pairwise comparison was conducted to find out between which conditions the difference in 'perceived safety' lies (see Table 2). Pairwise comparison with adjusted *p*-values showed that there was no significant difference between the NN and the control group. It did show a significant difference between the DN and the NN group. The effect size of cues

of harshness on 'perceived safety' was large and negative. The control group and the DN group showed a similar significant difference. Again, with a large and negative effect.

Table 2

Pairwise comparison of participants' safety scores across groups including significance and effect size

Comparison	z-score	N	*r*	Adjusted *p*
Safety				
DN vs NN	-4.466	70	-.534	.000
DN vs control	-6.506	68	-.756	.000
NN vs control	-2.190	74	-.266	.086

Note. N = sum of participants in compared groups; *p* adjusted by Bonferroni correction; $r=(\frac{z}{\sqrt{N}})$; $r_{small} < .3 < r_{medium} < .5 < r_{large}$

The data supported hypothesis 1a: exposure to cues of harshness had a negative causal effect on the participants' perceived safety compared to no exposure to cues of harshness.

Hypothesis 1b

The hypothesis, exposure to cues of harshness has a negative causal effect on the participants' perceived relaxation compared to no exposure to cues of harshness, was tested.

To support or reject the hypothesis the assumptions for an ANOVA were tested (see Appendix H). The normality was determined by examining the histograms of each condition and running the Kolmogorov-Smirnov Test. The distribution of the scores of 'perceived relaxation' in the DN condition was slightly skewed to the right and the kurtosis indicated a flatter, light tailed distribution. The distribution of the scores of 'perceived relaxation' in the NN condition was skewed to the left and flat and light tailed. And lastly, the distribution of the scores in the control condition seemed slightly skewed to the left and flat and light tailed. All distributions appeared non-normal (Appendix H).

The Kolmogorov-Smirnov Test was significant in all three conditions, therefore the distribution of the variable of 'perceived relaxation' is non-normal. Thus, this assumption was violated. A Levene's Test was conducted to test for equal variances of the variable 'perceived relaxation' across groups. Results indicate that variances were equal (Appendix H).

Even though two out of the three assumptions for an ANOVA were met, a non-parametric Kruskal-Wallis Test was chosen to compare the conditions, since this one does not assume normality. The test showed a significant effect of cues of harshness on the 'perceived relaxation' of the participants, $H(2) = 19.335$, $p = .000$. Therefore, a pairwise comparison between the conditions was conducted to indicate between which conditions exactly the difference in 'perceived relaxation' was (see Table 3). Pairwise comparison with adjusted *p*-values showed that there was no significant difference between the NN group and the control group. It showed a significant difference between the DN group and the NN group. The effect size of cues of harshness on 'perceived relaxation' was medium and negative. The difference between the DN group and the control group was significant as well. The effect size here was large and negative.

Table 3

Pairwise comparison of participants' relaxation scores across groups including significance and effect size

Comparison	z-score	N	*r*	Adjusted *p*
Relaxation				
DN vs NN	-3.331	70	-.398	.003
DN vs control	-4.209	68	-.510	.000
NN vs control	-.961	74	-.112	1.000

Note. N = sum of participants in compared groups; *p* adjusted by Bonferroni correction; $r=(\frac{z}{\sqrt{N}})$; $r_{small} < .3 < r_{medium} < .5 < r_{large}$

The data supported hypothesis 1b: exposure to cues of harshness had a negative causal effect on the participants' perceived relaxation compared to no exposure to cues of harshness.

Hypothesis 1c

The hypothesis, exposure to cues of harshness has a positive causal effect on the participants' perceived stress compared to no exposure to cues of harshness, was tested.

Firstly, the assumptions for an ANOVA were tested, to determine if the conditions could be analysed with an ANOVA (see Appendix I). The assumption of normally distributed residuals was tested by examining the distribution of the scores in a histogram for each

condition and conducting the Kolmogorov-Smirnov Test. The histogram of the distribution of the scores of 'perceived stress' in the DN condition showed a left skewed and flatter, light tailed distribution. The distribution of the scores in the NN condition showed a right skewed and again slightly flat, light tailed distribution. The distribution of the scores in the control condition showed a right skewed and a very flat, light tailed distribution. Therefore, in all conditions the distributions seemed non-normal (Appendix I).

This was supported by the Kolmogorov-Smirnov Test which was significant for each condition. The Levene's Test was conducted to check the homogeneity of variance between the conditions and the significant results showed that variances were unequal (Appendix I). Thus, both assumptions, normally distributed residuals and homogeneity between variances were violated and an ANOVA was not found suitable for these data.

The Kruskal-Wallis Test a non-parametric test (which does not assume normality) was chosen to determine whether there is a difference between the groups. The test showed a significant difference between the groups, $H(2) = 15.787$, $p = .000$. Therefore, a pairwise comparison was conducted to determine, which groups differed from each other in 'perceived stress' (see Table 4). There was no significant difference found between the NN group and the control group. The difference between the DN group and the NN group was significant. It had a medium positive effect size. The difference between the DN group and the control group was also found significant. Here the effect on 'perceived stress' was also medium and positive.

Table 4

Pairwise comparison of participants' stress scores across groups including significance and effect size

Comparison	z-score	N	*R*	Adjusted *p*
Stress				
DN vs NN	3.363	70	.402	.002
DN vs control	3.589	68	.435	.001
NN vs control	.281	74	.033	1.000

Note. N = sum of participants in compared groups; *p* adjusted by Bonferroni correction; $r=(\frac{z}{\sqrt{N}})$;

$r_{small} < .3 < r_{medium} < .5 < r_{large}$

To conclude, hypothesis 1c, exposure to cues of harshness had a positive causal effect on the participants perceived stress compared to no exposure to cues of harshness, is supported by the data.

The outcome of the analysis of the data for hypothesis 1a-c is illustrated in Figure 4. The figure shows boxplots of each dependent variable per condition. Here in direct comparison, the difference between the groups and therefore the influence of cues of harshness become obvious.

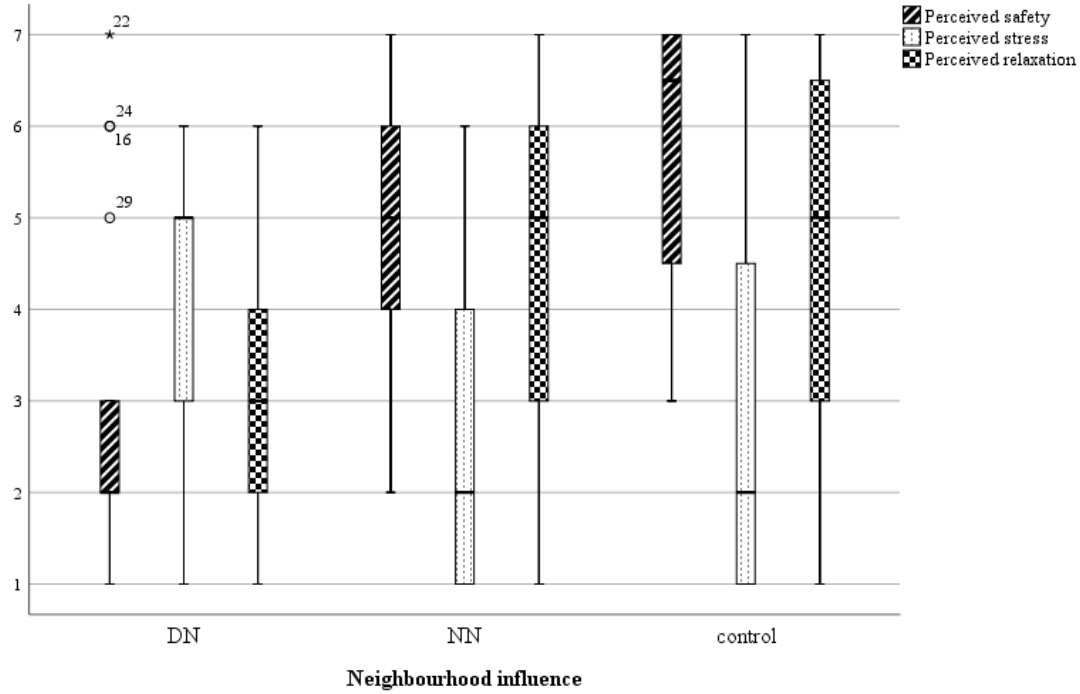

Figure 4. Compared boxplots of influence of cues of harshness in each condition on 'perceived safety', 'perceived stress', and 'perceived relaxation'; DN = deprived neighbourhood; NN = non-deprived neighbourhood

Hypothesis 2

Hypothesis 2, exposure to cues of harshness has a positive causal effect on the participants decision to deceive compared to no exposure to cues of harshness, was tested.

To compare the groups with each other assumptions for an ANOVA needed to be tested (see Appendix J). The assumption of normally distributed residuals was tested by examining histograms of each groups' scores and by conducting the Kolmogorov-Smirnov Test. The histograms for each group displayed a uniform distribution at the score of two (Appendix J). The Kolmogorov-Smirnov Test only showed a result for the NN condition, since the DN and

the control group displayed no variance at all. The outcome for the NN group was significant (Appendix J). Combining the observations with the test result the assumption of normality was considered violated.

A Levene's Test was conducted to test for equal variances of the variable of the 'decision to deceive' across groups. Results indicate that variances were unequal (Appendix J). Therefore, it was preferred to conduct a Kruskal-Wallis Test over an ANOVA. The test revealed no significant difference between the dependent variable 'decision to deceive' across the three conditions, $H(2) = 5.472$, $p = .065$.

Therefore, data did not support hypothesis 2: exposure to cues of harshness had no positive causal effect on the participants decision to deceive compared to no exposure to cues of harshness.

Discussion

The aim of this study was to find out if exposure to environmental cues of harshness has a positive causal effect on the 'decision to deceive' and 'perceived stress', and a negative causal effect on 'perceived safety' and 'perceived relaxation'. The findings partly support Frankenhuis' et al. (2016) theoretical approach on cognition in harsh environments. The cognition of participants was influenced but their behaviour was not.

A significant effect of cues of harshness on 'perceived safety', 'perceived stress' and 'perceived relaxation' was found. Cues of harshness decreased 'perceived safety' and 'perceived relaxation' and increased 'perceived stress'. There was no difference found between the NN and the control group, which supports the hypotheses further. There was no effect on the 'decision to deceive', in any of the experimental groups.

Main findings

The results of the current study partly support previous research on the influence of harshness on peoples' decision making. The self-reported lower feeling of safety and relaxation, as well as the increased feeling of stress, due to the cues of harshness support previous empirical research on harsh environments.

As stated by Nettle et al. (2014), even a short amount of time in a neighbourhood with cues of harshness leads to decreased social trust and increased paranoia. 'Perceived safety' and social trust seem to be correlated (Delbosc & Currie, 2012). Also, 'perceived stress' is a causal factor for increased paranoia (Lincoln, Peter, Schäfer, & Moritz, 2009) and therefore lower

levels of 'perceived relaxation'. Thus, the current study can be seen as a support of the research of Nettle et al. (2014). The findings of their study and the current study align and support the theoretical approach of Frankenhuis et al. (2016). This again presses the idea that one's cognition and therefore maybe as well one's behaviour is influenced by the environment one is placed in.

But the hypothesis that cues of harshness cause 'deceptive behaviour' was dismissed. In the current study no participant was influenced by the environment to deceive. Since the manipulation of the videos worked, which can be seen in the manipulation check of 'perceived safety, stress, and relaxation', there needs to be another reason why the findings in this study do not align with the theory. According to Frankenhuis et al. (2016) people who are influenced by harsh environments tend to engage more frequently in risky behaviour and consider less possible long term consequences.

Limitations and future research

Some limitations in this study could have had an influence on the participants which would have caused them to stay honest, even though their perception was influenced by their environment.

There seems to be a difference between being exposed to these environments before the age of five and afterwards. In their longitudinal study Simpson, Griskevicius, Kuo, Sung, and Collins (2012) found that if a person grows up in an environment that is characterised by harshness and unpredictability before they turn five years old, they are more likely to engage in aggressive, delinquent, and criminal behaviour later on in life. This could indicate that these early years are very formative for an individual. If the participants of this study would not have experienced harshness at a young age, they may be less prone to engage in such behaviour.

In a lot of studies the combination of environmental cues of harshness and unpredictability is studied (Chang et al., 2019; Hill, Ross, & Low, 1997). It could be possible that the effect on a person's behaviour is larger if both factors are present. This study did not have the possibilities to manipulate an environment to show cues of unpredictability, since unpredictability is perceived through time and cannot be measured in a one-time experiment. Therefore, the combination might have the power to make a person deceive but not each variable on its own, or at least not in the same intensity.

Another possibility for the missing deceptive behaviour could be the influence of local norms (Schroeder, Pepper, & Nettle, 2014). The local social environment seems to affect peoples' choice to engage in "antisocial behaviour" (Schroeder et al., 2014, p. 16). In their study

on local norms of cheating Schroeder et al. (2014) introduce the idea that people are more likely to deceive, if they perceive their environment as antisocial. They compared citizens from two different neighbourhoods. One in which frequencies of antisocial behaviour are low and one with a high frequency. They discovered that one's environment does influence the frequency of deception, by playing a game with the citizens in which they were enabled to take money from each other. They also discovered the higher the frequency, the less they punished such behaviour. Therefore, it may be possible that this "norm violation" leads to more and more antisocial behaviour (Schroeder et al., 2014, p. 12).

Due to convenience sampling, mostly people within the social environment of the researcher were asked to participate. In the environment of the researcher the local norm towards deception is, that deception is wrong and should be punished. Since the participants mostly belong to a similar environment, their local norms may have held them back to deceive, even though they were influenced by their environment. Therefore, there may have been no variance in the local norms of the participants and the outcome was that all participants stayed truthful. Another limitation of the study was a quite small sample size. This combined with convenience sampling may have led to a not representative sample of the population.

Additionally, there were some study design choices, which may have counteracted on the decision to deceive. One would be that there were too few options to pick from when it came to the possibility to deceive. If people would have felt like their chances were diminished by a smaller amount like two out of ten instead of two out of six, they might have more reasons to deceive. The way it was they may not have considered their odds bad enough to decide to deceive. Further, the bait of a 25€ voucher might have been too small. Since the participants were mostly part of the social environment of the researcher 25€ may not have been enough money to risk being caught.

While this study tried to influence a person with a video to increase replicability and comparability and reduce the risk for participants, there are some future suggestions to add to this study or to expend it towards another level. The original idea was to conduct this study not online but in person and to expose the participants to the neighbourhoods by Virtual Reality (VR). Since special circumstances occurred through a worldwide pandemic, the opportunity to meet people in laboratory facilities was not possible anymore. Still, introducing the conditions via VR would have the benefit of a deeper immersion into the neighbourhoods. By immersing into VR, the participants interpret the cues they get as they would in real life and act accordingly. Therefore VR will be comparable to real life reactions, as suggested in a study by Roberts et al. (2019).

Another addition could be to measure physical reactions of a participant, while they are immersed in the VR. For example, through blood pressure, heart rate and galvanic skin response (GSR), stress could be determined (Widanti, Sumanto, Rosa, & Fathur Miftahudin, 2015). This would increase the reliability of measures, since they would be objective and not only subjective reports from participants. This way the influence of cues on one's behaviour could be defined more precisely in a measure that would report physical change, additionally to participants' perception.

Conclusion

This study aimed to answer the question "Does environmental harshness influence our decision to deceive?". It examined based on the theoretical approach of Frankenhuis et al. (2016) if the 'decision to deceive' is influenced by cues of harshness. Additionally, it tested if 'perceived safety, stress, and relaxation' were influenced by cues of harshness.

The results showed that participants 'perceived safety and relaxation' are negatively influenced by cues of harshness. It also showed that 'perceived stress' is positively influenced by cues of harshness. There is no causal effect on the 'decision to deceive'.

This study can be considered as a steppingstone for future investigation into measuring the influence of environmental harshness with VR. With more controlled environments it will be easier in the future to compare results, while still receiving the same reactions as in the real world from participants.

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Appendices

Appendix A Opening statement for Online Survey

Welcome!

You are invited to take part in a study investigating how people experience the virtual environment that is shown in a video. The project is conducted by Wiebke Nothhelfer (BSc Psychology student at University of Twente) and supervised by Jeanette Hadaschik (Department of Psychology of Conflict, Risk and Safety, University of Twente). The study is approved by the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences at University of Twente.

Please take time to read the following information carefully before you decide whether or not to take part, it is important for you to understand what participation in the study will involve.

We are looking for women and men who are above 18 years old.

Participants need

- a stable internet connection
- to use a laptop screen, desktop screen or tablet pc. The screen of a phone is too small.
- headphones to listen to the audio in the video
- to be in a quiet place without distractions
- to have good command of the English language

Participation is completely voluntary and anonymous.

If you are interested in taking part, you are asked to watch a video, listen to the accompanying audio, and complete questionnaires. Instructions on completing the questionnaires are provided. It may take approximately 30 minutes to complete. You can stop participating at any point of the study, without giving any reason.

Some of the information that is asked in this survey can be considered to be of sensitive nature.

All data collected during the study will be kept strictly confidential and anonymous. That is, your responses cannot and will not be traced to your person and no identifying information will appear in any documents or in the final report. We do not ask for personal identifiers. Only the main researchers have access to the collected data. Therefore, we ask you to answer as honestly as possible.

By taking part you can win one of two 25 Eur vouchers (VVV, Amazon or similar, depending on your country of residency). Your email address will be stored separately from your responses and would only be used in case you win a voucher. At the end of the data collection and after the winners have been contacted, all email addresses will be deleted permanently.

Before you can start with the survey, we ask you to read the information on the next page carefully, and agree by clicking ‘YES’.
Thank you in advance for your participation! Should you have any questions about this study, please feel free to contact the researcher.

Wiebke Nothhelfer
w.nothhelfer@student.utwente.nl

Jeanette Hadaschik, MSc
j.hadaschik@utwente.nl

Appendix B Informed Consent

By clicking **YES** below, I agree to the following:

I understand that my participation is voluntary. I also understand that I have the right to withdraw my consent at any time without needing to give a reason, if I experience any discomfort or distress.

Furthermore, the following points are clear to me:

All data that are collected by the researcher are treated completely anonymously and cannot and will not be traced back to my identity.

I understand and agree that the purpose and hypotheses of the current study cannot be revealed to me because it could bias my answers. However, after completion of the study I will receive a full debriefing.

I agree to keep the procedures and explanation of this study to myself and will not pass this information on to others because this might negatively influence the study results.

I agree to participate in the study:

Appendix C Videos with instructions

Instructions for DN and NN:

Please imagine that the following video is recorded **from your point of view**.

You are on your way back home and you walk through a neighbourhood that you are not very familiar with. Try to imagine that you are the person walking around.

Please focus your whole attention on the environment in the video.

You can only proceed to the next page after you have finished watching the video.

Adjust the volume so that you can listen to the sounds in the video.

Please watch the whole video in **full screen** mode and **do not pause**.

Select the highest quality of 1080 pixels.

Link to YouTube video of deprived neighbourhood:

https://youtu.be/W6ScSgzfjek

Link to YouTube video of non-deprived neighbourhood:

https://youtu.be/ZYtIp2b0kIs

Instructions for control:

Please imagine that the following video is recorded **from your point of view**.

Please focus your whole attention on the environment in the video.

You can only proceed to the next page after you have finished watching the video.

Adjust the volume so that you can listen to the sounds in the video.

Please watch the whole video in **full screen** mode and **do not pause**.

Select the highest quality of 720 pixels.

Link to YouTube video of control condition:

https://youtu.be/uohaTU4L03E

Appendix D Dice roll HTML script

```
<html>
<body>
<center>
The dice is rolling, click to stop it
<br>
<br>
<br>
<p id="number"></p>
<br>
<br>
<button id="b" onclick="clearInterval(myVar); writeFinalNumber();"> Stop The Dice </button>
</center>
</body>
<script>
// This function writes final number
function writeFinalNumber(){
var finalNumber = "2"; // define final number here
document.getElementById('number').innerHTML = finalNumber;
}
var numberUpdateInterfal = "50"; // define here how fast the running number will be updated in ms
var myVar = setInterval(myTimer, numberUpdateInterfal);
function myTimer() {
var randomNumberRange = "6"; // Define range of random numbers from 1 to X
  document.getElementById("number").innerHTML = Math.floor(Math.random()*(randomNumberRange-1)+1.5);
}
</script>
<style>
#number{
font-size:90px;
}
```

```
#b{
width:200;
height:25px;
}
</style>
</html>
```

Appendix E Manipulation Check

1. Did you experience any technical issues watching the video?
   I had problems playing/watching the video ...

   1 2 3 4 5 6 7

   Not at all Very much

2. Did you experience any technical issues listening to the audio?
   I had problems listening to the audio ...

   1 2 3 4 5 6 7

   Not at all Very much

3. While watching the video, did you have a sensation of 'being there' (in the video environment)?
   Please rate your sensation of being in the video environment, on the following scale from 1 to 7, where 7 represents your normal experience of being in a place.
   I had a sense of “being there” ...

   1 2 3 4 5 6 7

   Not at all Very much

4. Were you able to identify with the character from whose point of view the video is recorded?

   1 2 3 4 5 6 7

   Not at all Very much

5. Please rate how safe you felt being in the virtual world of the video.
   While watching the video in the virtual world I felt ...

   1 2 3 4 5 6 7

   Not safe at all Very safe

6. Please rate how stressed you felt being in the virtual world of the video.
   While watching the video in the virtual world I felt ...

   1 2 3 4 5 6 7

   Not stressed at all Very stressed

7. Please rate how relaxed you felt being in the virtual world of the video.

   While watching the video in the virtual world I felt ...

1	2	3	4	5	6	7
Not relaxed at all						Very relaxed

Appendix F Debriefing after study was completed

THANK YOU!

You have reached the end of this survey. We very much appreciate your contribution to our research.

DEBRIEFING: This study's aim is to investigate whether there is a relationship between the environment that participants experience in a video and their decision-making regarding honesty. In addition, our early experiences in family and neighbourhood might also have an influence on later decision-making. We are interested to see whether the video environment has an influence on participants' choice to indicate the true number that they received in the dice roll. We are not interested in individual responses but rather in comparing trends across different video environments.

Every participant will have an equal chance of winning one of the two vouchers and nobody will be removed from the prize draw based on their response. The winners will be notified via email after data collection has ended. Afterwards, all email addresses will be deleted.

Results from this study might help us to further understand how not only our 'fixed' personality characteristics, but also our environments influence our decisions. This might ultimately help us to advance interventions on risk-taking and decision-making.

If you have concerns about your participation or would like to withdraw from the study, you can contact the researchers.

Please do not share any information about this study with others as it would negatively affect the outcome.

As some of the questions are of sensitive nature regarding childhood experiences, the following resources might be useful for those seeking information or support.

If you are feeling stressed at the moment, try this brief meditation: https://www.youtube.com/watch?v=sG7DBA-mgFY

Netherlands /Belgium:

https://www.deluisterlijn.nl/

https://www.tele-onthaal.be/

https://www.rijksoverheid.nl/onderwerpen/geestelijke-gezondheidszorg/vraag-en-antwoord/waar-vind-ik-hulp-bij-psychische-problemen

Germany:

https://www.telefonseelsorge.de
https://www.stiftung-gesundheitswissen.de/gesundes-leben/psyche-wohlbefinden/hilfe-bei-psychischen-problemen-diese-stellen-koennen-sie-sich

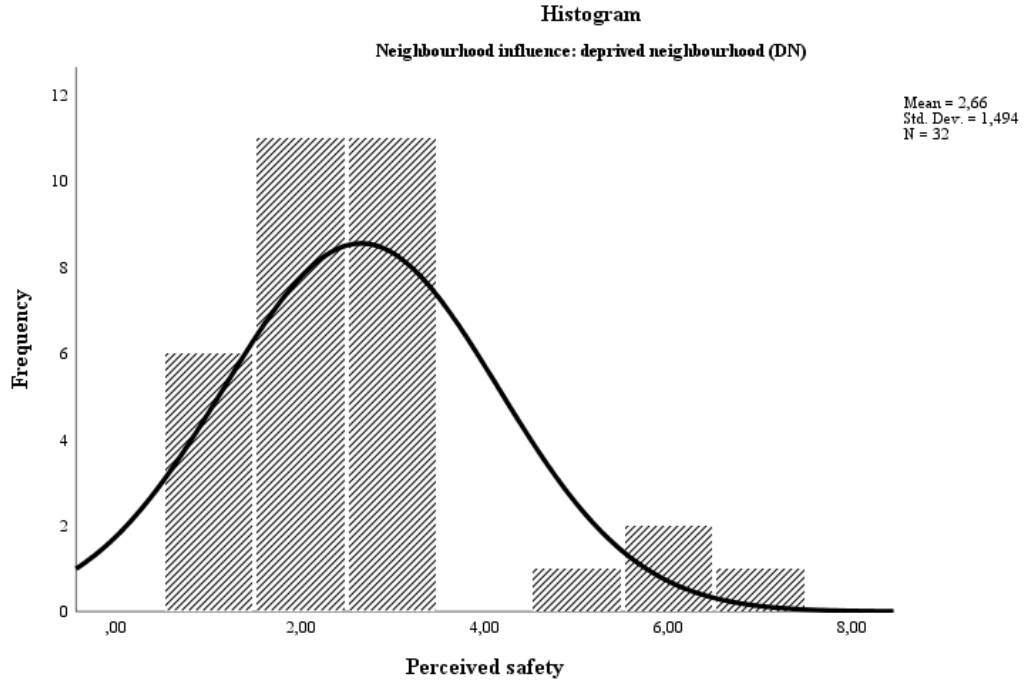
UK:
https://www.samaritans.org
https://www.mind.org.uk

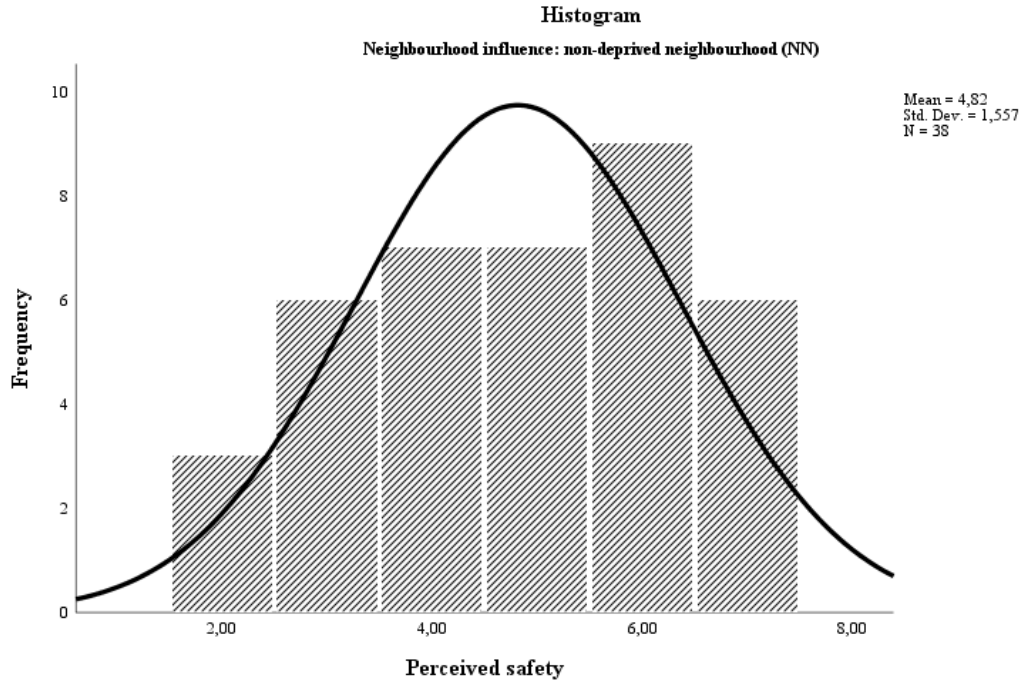
Should you have any questions about this study, please feel free to contact the researchers.

Wiebke Nothhelfer
w.nothhelfer@student.utwente.nl

Jeanette Hadaschik, MSc
j.hadaschik@utwente.nl

Appendix G Assumption testing outcome hypothesis 1a





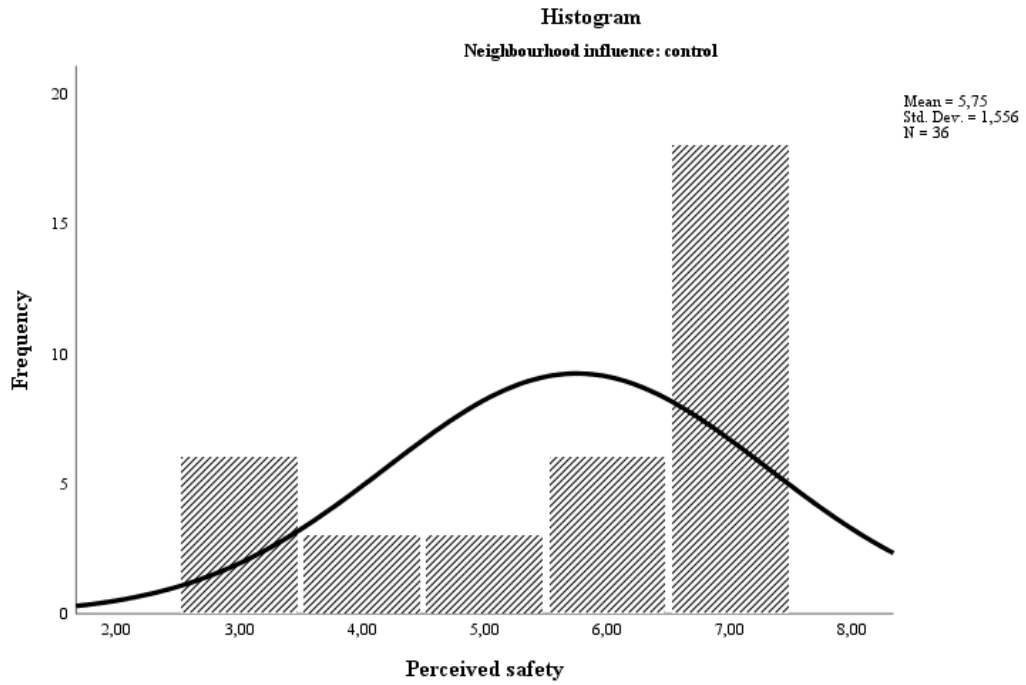


Figure 5. Perceived safety scores in DN, NN, and control; 1 = not safe at all; 7 = very safe

Table 5

Test of Normality 1a

		Kolmogorov-Smirnov Test		
	Neighbourhood influence	*D*	df	*p*-value
Perceived safety	DN	0.284	32	.000
	NN	0.171	38	.007
	Control	0.289	36	.000

Note. D = Kolmogorov-Smirnov Test Statistic

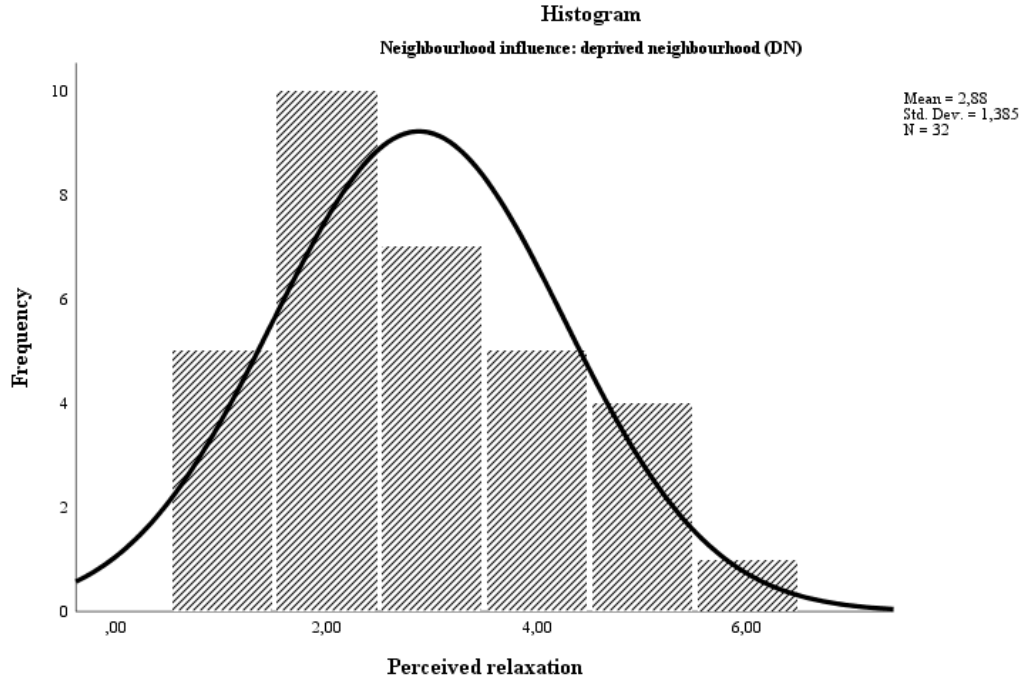
Table 6

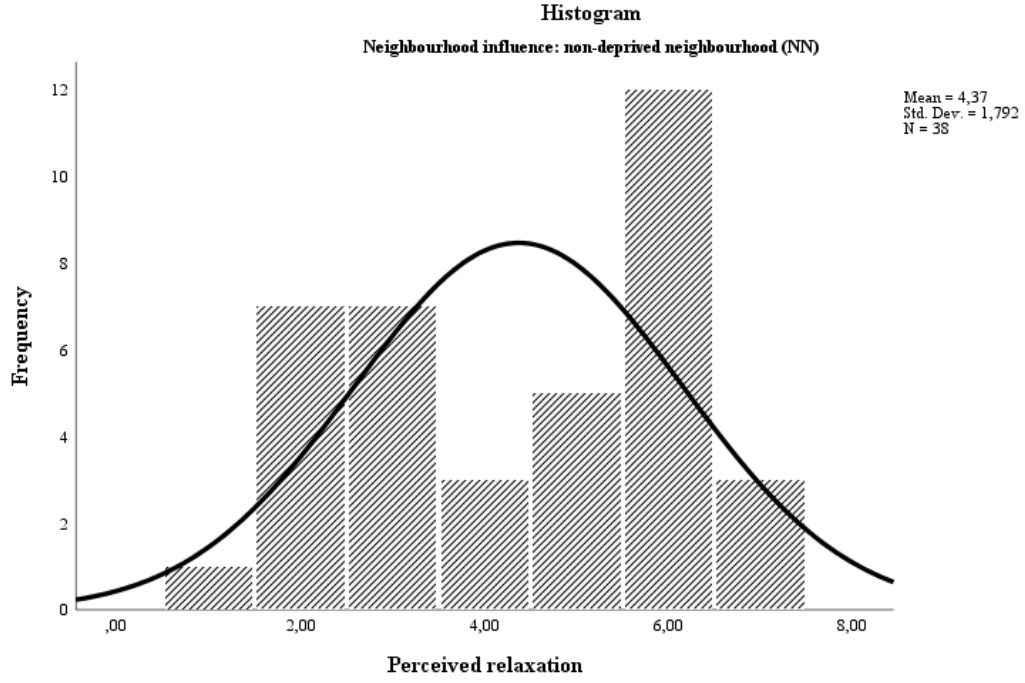
Test of Homogeneity of Variance 1a

	Levene's Test			
	F	df1	df2	*p*-value
Perceived safety	3.355	2	103	.039

Note. F = Levene's Test Statistic

Appendix H Assumption testing outcome hypothesis 1b





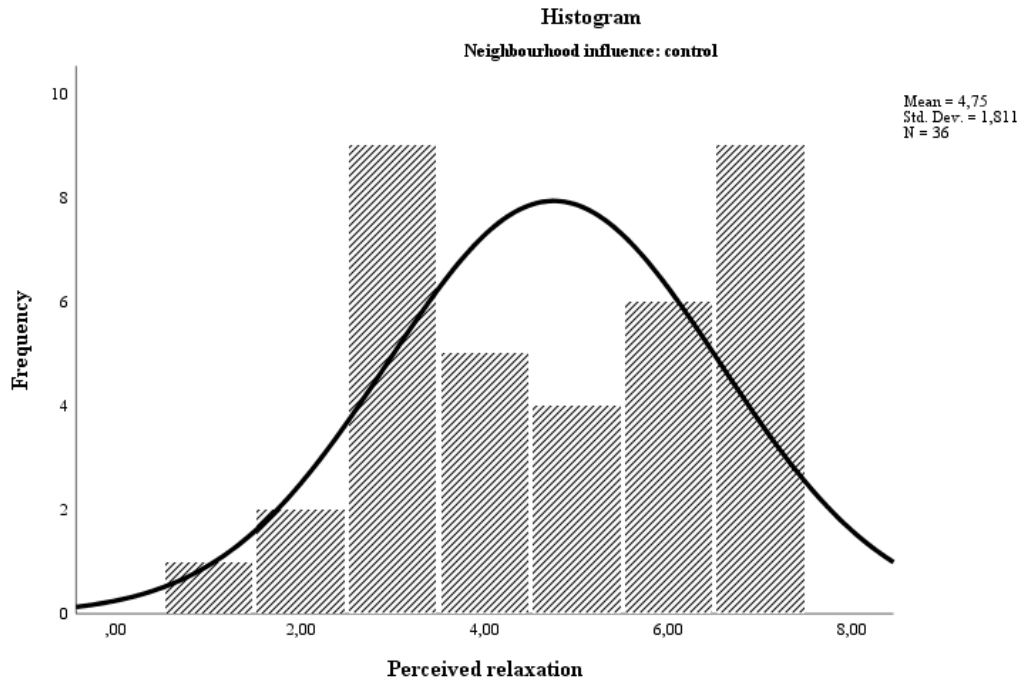


Figure 6. Perceived relaxation scores in DN, NN, and control; 1 = not relaxed at all; 7 = very relaxed

Table 7

Test of Normality 1b

		Kolmogorov-Smirnov Test		
	Neighbourhood influence	*D*	df	*p*-value
Perceived safety	DN	0.205	32	.001
	NN	0.213	38	.000
	control	0.172	36	.009

Note. D = Kolmogorov-Smirnov Test Statistic

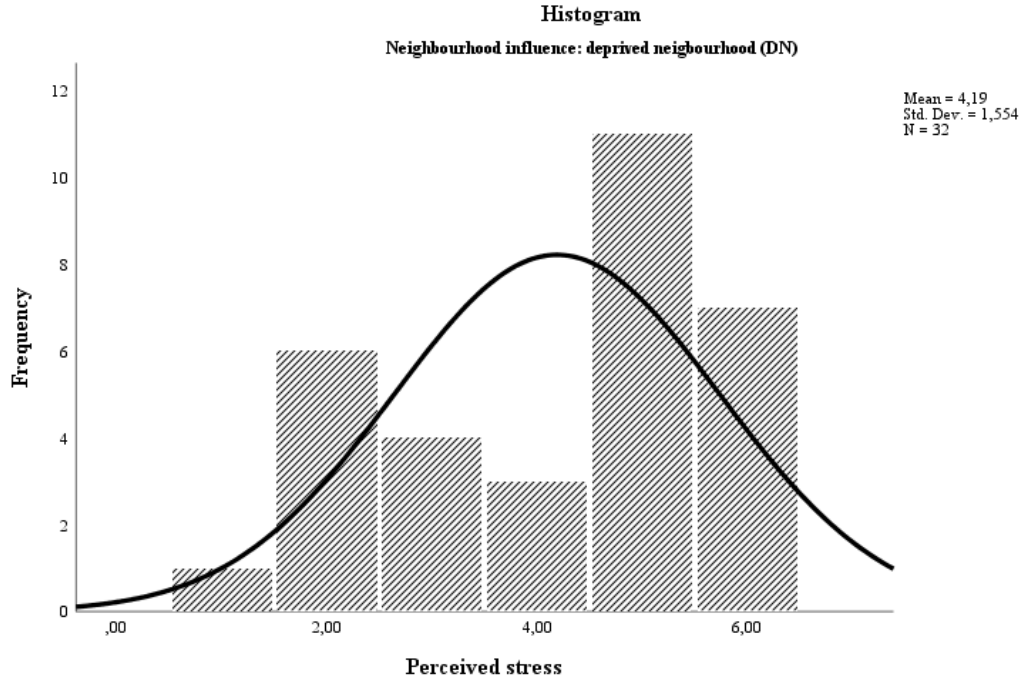
Table 8

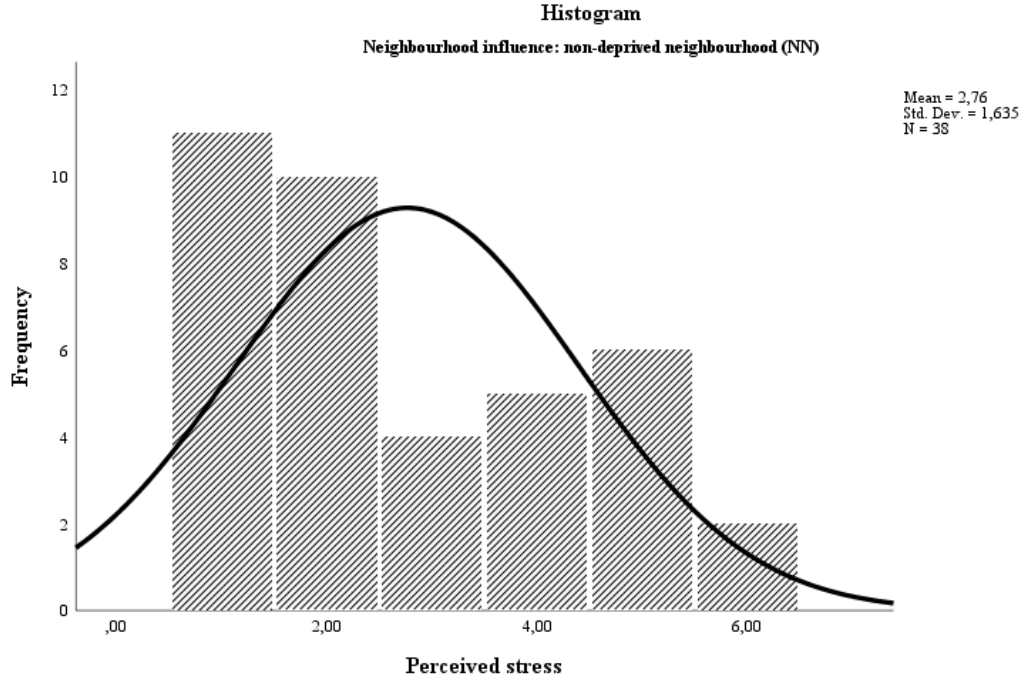
Test of Homogeneity of Variance 1b

	Levene's Test			
	F	df1	df2	*p*-value
Perceived safety	.531	2	103	.589

Note. F = Levene's Test Statistic

Appendix I Assumption testing outcome hypothesis 1c





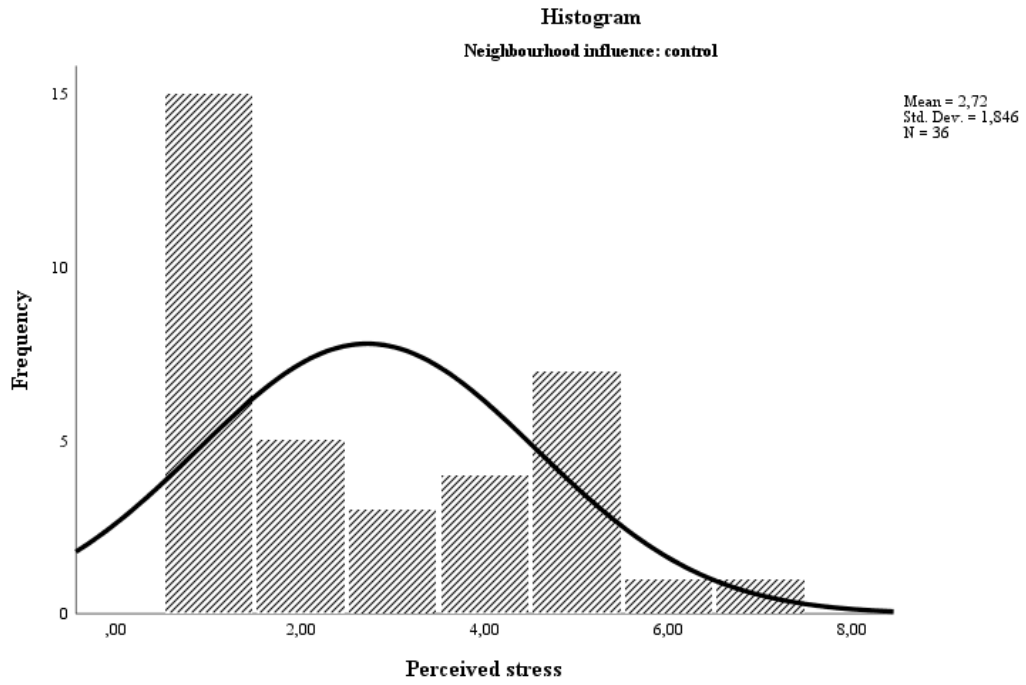


Figure 7. Perceived stress scores in DN, NN, and control; 1 = not stressed at all; 7 = very stressed

Table 9

Test of Normality 1c

		Kolmogorov-Smirnov Test		
	Neighbourhood influence	*D*	df	*p*-value
Perceived safety	DN	0.262	32	.000
	NN	0.232	38	.000
	control	0.241	36	.000

Note. D = Kolmogorov-Smirnov Test Statistic

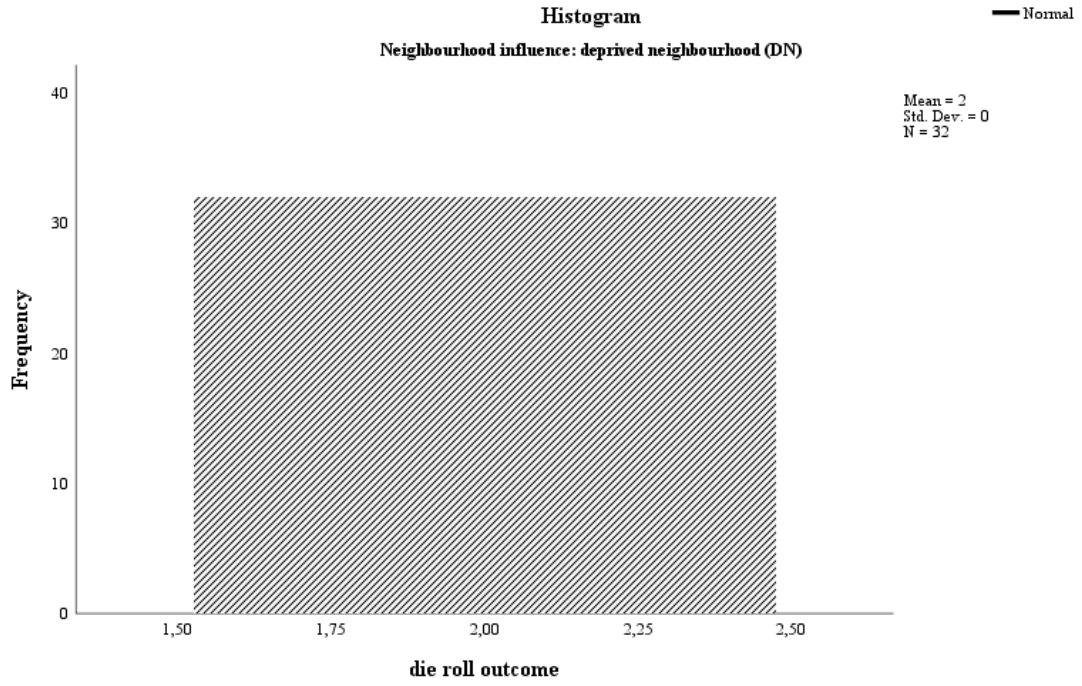
Table 10

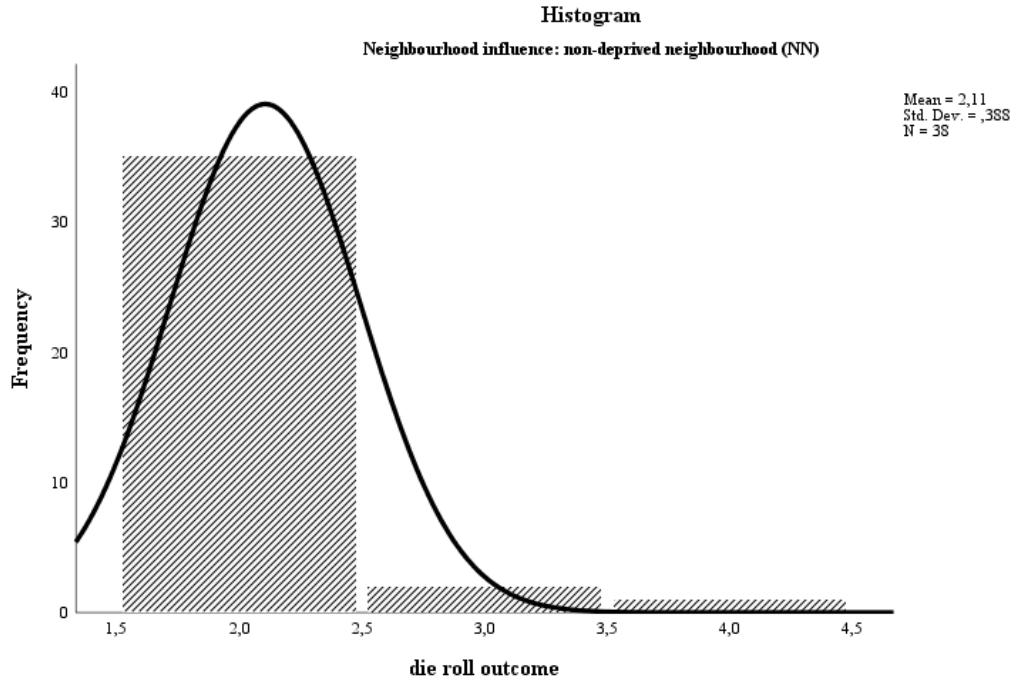
Test of Homogeneity of Variance 1c

	Levene's Test			
	F	df1	df2	*p*-value
Perceived safety	7.231	2	103	.001

Note. F = Levene's Test Statistic

Appendix J Assumption testing outcome hypothesis 2





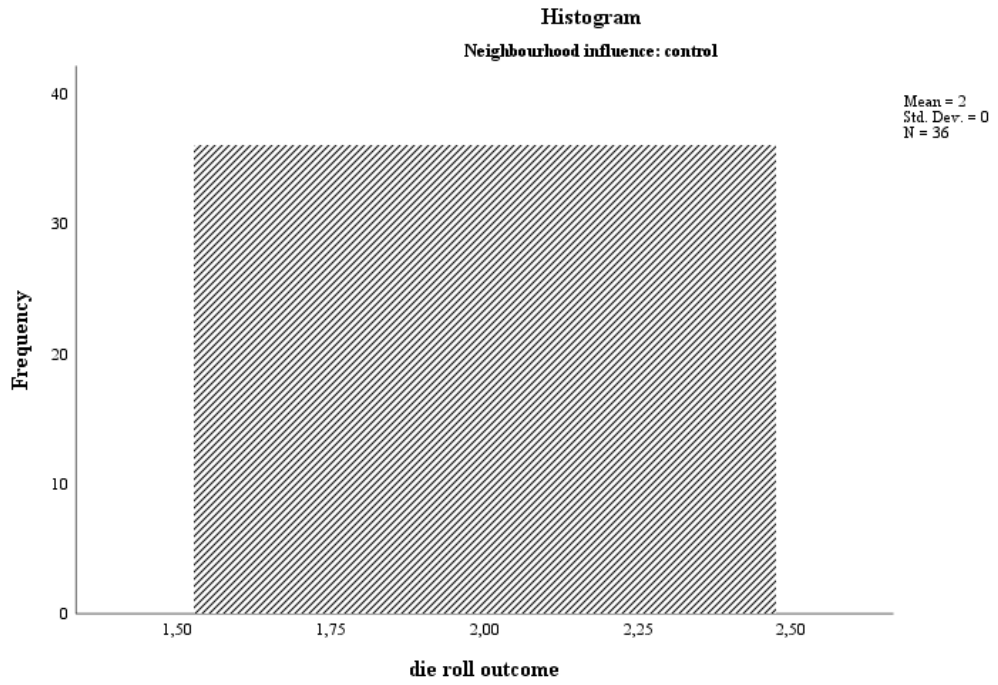


Figure 8. Dice roll outcome scores in DN, NN, and control

Table 11

Test of Normality 2

		Kolmogorov-Smirnov Test		
	Neighbourhood influence	*D*	df	*p*-value
Perceived safety	DN		32	
	NN	0.528	38	.000
	control		36	

Note. D = Kolmogorov-Smirnov Test Statistic; missing scores = no variance

Table 12

Test of Homogeneity of Variance 2

	Levene's Test			
	F	df1	df2	*p*-value
Perceived safety	12.186	2	103	.000

Note. F = Levene's Test Statistic