Master Thesis:

The Measurement of Emotional States present during Deception

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ABSTRACT

Het is vaak gepoogd om te ontmaskeren wanneer een persoon liegt door huidgeleiding ofwel electro-dermal activity (EDA) te meten. EDA blijkt echter beïnvloed te worden door emoties. Dit maakt het moeilijk om met EDA een onderscheid te maken tussen een leugenachtig persoon of een emotioneel persoon. Een onderzoek door Proverbio et al. (2013) wees uit dat Electro-encefalografie (EEG) wellicht in staat is om leugenachtige reacties wel van emotionele reacties te kunnen onderscheiden. In het onderzoek werd EEG namelijk gebruikt om te ontmaskeren wanneer een deelnemer leugenachtig reageert op zowel emotionele als niet-emotionele stimuli. In Proverbio et al. (2013) werd echter niet gemeten of de deelnemers ook daadwerkelijk emotioneel beïnvloed werden gedurende het experiment. Het is daarom nog steeds onduidelijk of EEG in staat is om een leugenachtig persoon te ontmaskeren, wanneer deze persoon emotioneel beïnvloed word. In dit verslag wordt een soortgelijk experiment als dat van Proverbio et al. (2013) uitgevoerd waarin zowel EDA als EEG gemeten werd. EDA wordt gemeten om te zien hoe deceptie, emotionele stimuli en relateerbare stimuli de gevoelens van deelnemers beïnvloedden. Relateerbaarheid werd gemeten aangezien bleek dat stimuli die relateerbaar zijn voor de deelnemers mogelijk invloed kunnen hebben op EDA (Nikula, 1993). Relateerbaarheid werd gedurende dit experiment gedefinieerd als het verschil tussen subjectieve en objectieve stimuli. Bij 16 vrouwelijke proefpersonen werd huidgeleiding gemeten. Aan deze proefpersonen werd gevraagd om te liegen of de waarheid te vertellen over vragen die verschilden in emotionaliteit en relateerbaarheid. Uit de resultaten bleek dat EDA niet beïnvloed werd door deceptie, emotionaliteit of relateerbaarheid. Het bleek zelfs dat participanten steeds minder opgewonden werden gedurende het experiment. Om EEG en EDA in de toekomst beter te kunnen vergelijken is het noodzakelijk om het experiment te herhalen met emotionele stimuli die overeenkomen met de persoonlijke zorgen van alle participanten. Het toevoegen van een beloning en motivatie om te liegen kan er dan ook voor zorgen dat deelnemers zich meer opwinden tijdens het liegen.

It has often been attempted to reveal when a person lies by measuring electro-dermal activity (EDA). EDA, however, appears to be easily influenced by emotions. This makes it hard to use EDA to distinguish a deceitful person from an emotional person. Proverbio et al. (2013) indicated

that Electroencephalography (EEG) might be capable of differentiating between a deceptive response and an emotional response. In the study EEG was used to reveal when a participant responds deceptively to both emotional and non-emotional stimuli. Proverbio et al. (2013), however, solely looked at the difference between emotional and non-emotional stimuli. It was not measured if the participants' emotional states were also influenced during the experiment. It is thus unclear whether EEG is capable of revealing a deceptive person, when this person is influenced emotionally. In this report a similar experiment as Proverbio et al. (2013) was conducted, where both EDA and EEG were measured. EDA was measured in order to establish how deception, stimulus emotionality and stimulus relatability influenced participants emotionally. Relatability was measured since stimuli that are more relatable to participants can potentially influence EDA (Nikula, 1993). During this experiment relatability was defined as the difference between subjective and objective stimuli. For 16 female participants skin conductance was measured. These participants were asked to lie or tell the truth about questions that differed in emotionality and relatability. It appeared that EDA was not influenced by deception, stimulus emotionality or stimulus relatability. It even appeared that arousal felt by the participants decreased during the course of the experiment. In order to better compare EEG and EDA in the future it would be necessary to repeat the experiment with emotional stimuli that correspond to all participants' personal concerns. The addition of a reward and motivation to lie can also potentially cause participants to be more aroused when deceiving.

Introduction

Deception is a complex process that has different facets. Deception is a broader process than lying. The standard definition of lying according to Mahon (2008) is 'Making a believed-false statement to another person with the intention that that other person believes that statement to be true'. Deception, however, goes beyond lying as it includes a planned element (Ekman, 1992; Humphreys, & Peelo, 2013). In Ekman (1992) deceit is stated to occur when a person intentionally misleads someone without the recipient's awareness. Deception is often associated with telling lies over a long time-period (Humphreys, & Peelo, 2013). These lies can include limited disclosure, exaggerating, distorting or presenting irrelevant information (Kagle, 1998). Kagle (1998) distinguishes two different types of lies; concealment and falsification. Concealment refers to the liar withholding certain information, thus creating an incomplete or false representation of the truth. Falsification on the other hand refers to the liar granting false information to distort the truth. When lying, it is often solely necessary to use concealment. For instance, when a heavy smoker would lie about his smoking habits it would suffice to solely conceal the amount of cigarettes he smokes. When deceiving, however, it is often necessary to use both concealment and falsification. The use of both concealment and falsification are often necessary during deception, as the goal of deception often involves the deceiver convincing a recipient of a false belief. For instance, when committing credit card fraud a deceiver can use an alias to create a false persona. In this case the deceiver not only concealed certain information, the deceiver also gave false information.

An important aspect of both deception and lying are the emotions felt by the deceiver. Vrij, & Grenhag (2012) for instance indicated that deceivers show stronger emotions than truth tellers. Examples of emotions typically felt during deception are fear, anxiety, excitement, guilt, and shame (Frank, Yarbrough, & Ekman, 2006; Frank, & Svetieva, 2012; Chan et al., 2015). Fear during deception is often experienced as the fear of discovery (Frank, & Svetieva, 2012). Anxiety during deception can be induced due to stressful or emotionally arousing situations (Giesen, & Rollison, 1980). Excitement during deception is often felt when the deceiver successfully tricked the recipient (Vrij, 2008). Guilt and shame during deception can be felt as a consequence of breaking personal morals (Ekman, 2001). Guilt during deception can be experienced when participants feel remorse for a specific action (Seiter, & Brunschke, 2007). Shame is felt during

deception when the deceiver imagines being misjudged for the deception (Seiter, & Brunschke, 2007). The fear of discovery and feelings of anxiety can increase when motivation to deceive is high (Giesen, & Rollison, 1980; Frank, & Ekman, 1997). This can cause higher emotional levels for liars than for truth tellers (Frank, & Ekman, 1997).

A common way to reveal a deceptive person is by measuring Electro-dermal Activity (EDA). EDA is influenced by the Autonomic Nervous System (Boucsein, 2012). When deception causes an aroused state, activity in the sweat glands is heightened. In turn sweat gland activity influences skin conductivity. When measuring EDA these fluctuations in skin conduction are measured. EDA can, however, also be influenced by emotional states that influence the Autonomic Nervous System (Boucsein, 2012). It is thus very difficult to establish if a person is deceptive or emotional. In order to take deception research forward it is necessary to distinguish the effects of emotions from the act of deception. Proverbio et al. (2013) claimed to have found a reliable cognitive marker of deception using Electroencephalography (EEG). When measuring EEG, electrodes are placed on the scalp in order to measure brain activity. In the study performed by Proverbio et al (2013) participants were requested to respond honestly or deceitfully to either emotional or non-emotional stimuli. The emotional stimuli were used in an attempt to influence participants' emotional state. EEG was used to measure how the N400 component and the Late Positive component (LPC) were influenced by deception and stimulus emotionality. Supposedly the N400 component measured was able to distinguish between the effects of deception and emotion. The LPC was found to be an unreliable marker of deception. Proverbio et al. (2013), however, did not measure the emotional states felt by participants. It is thus uncertain whether participants were influenced emotionally when viewing emotional stimuli. Quite possibly, participants recognized the difference between emotional stimuli and non-emotional stimuli, without themselves being emotionally influenced. Since Proverbio et al. (2013) did not measure emotional states, it is uncertain whether the N400 component is influenced by participants' emotional states.

During the current study a variation of the research by Proverbio et al. (2013) was performed. During the current study both EDA and EEG were measured, however, this paper solely discusses the EDA measurements made. Participants were requested to respond truthfully or deceptively to various stimuli. These stimuli differed in emotionality (High vs. Low) and relatability (Subjective vs. Objective). A change in EDA between high and low emotional stimuli

would indicate that participants are influenced emotionally by the emotionality of experimental stimuli. Relatability was added as a variable, since stimuli that are more personally relatable to participants can potentially influence participants' emotional states (Nikula, 1993). During this study relatability was defined as a difference between subjective stimuli and objective stimuli. Subjective stimuli reflected participants personal experiences, thus answers to these questions could differ per participant. Objective stimuli were factual in nature, thus the answers to these questions were the same for all participants. It was expected that subjective stimuli would be found more relatable than objective stimuli.

During this introduction first a review of the research by Proverbio et al. (2013) is given, followed by a section describing the value of EDA measurement. The goal of this paper is to establish how deception, stimulus emotionality and stimulus relatability influenced EDA, in order to examine how participants' emotional states were influenced. During the course of this paper it is discussed how EEG as a marker of deception can potentially be improved by simultaneously measuring EDA.

The study of Proverbio et al. (2013)

Proverbio et al. (2013) used EEG to explore if a reliable distinction could be made between deception and emotional states. The affective content of the experimental stimuli was established prior to the experiment by conducting a pre-study using 20 judges. During the pre-study sentences were rated on a 3-point scale (not at all, somewhat emotional, extremely emotional). Neutral sentences rated as emotional by more than 40% of judges were discarded. Emotional sentences rated as neutral by more than 40% of judges were also discarded. During the experiment participants were seated in front of a computer screen. Prior to stimulus presentation the participants were instructed to lie or answer truthfully to the questions displayed. After receiving the instruction, participants had to respond to either emotional or non-emotional questions. All the questions asked during the experiment needed to be answered with a 'yes' or a 'no'. Participants were asked to respond to these questions as quickly and accurately as possible, by pressing a corresponding key. During the experiment EEG was measured for all participants. Proverbio et al. (2013) analyzed both the N400 and Late Positive component of EEG. These measures and the results reached by Proverbio et al. (2013) will be discussed in the next sections.

The N400 component

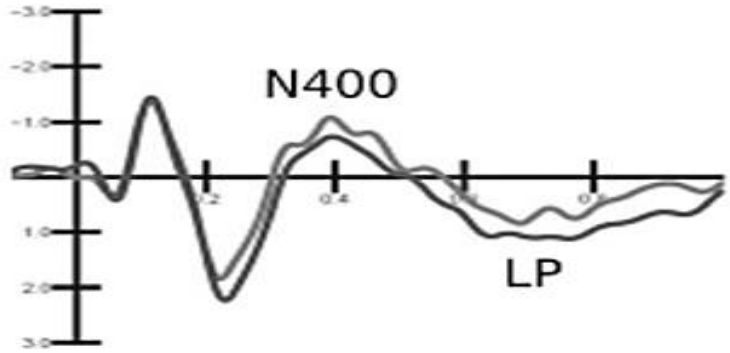

Figure 1; The N400 component of EEG, occurring at 400 ms after stimulus presentation. And the Late Positive component (LPC) of EEG, occurring after around 400-500 ms after stimulus presentation.

The N400 component is a component of EEG that occurs at around 400 ms after a stimulus has been presented (Figure 1). It is know that the N400 component measured over central prefrontal sites contains valuable information about language processing (Proverbio et al., 2013; Hagoort, Hald, Bastiaansen, & Petersson, 2004; Fogelson, Loukas, Brown, & Brown, 2004; Kuperberg, Sitnikova, Caplan, & Holcomb, 2003). The N400 component has been shown to be related with inconsistencies in language semantics (Meek, Phillips, Boswell, & Vendemia, 2012). The N400 component appears to be more negative when a sentence grants misleading information about the target word (Kuperberg, 2015). For instance, when a sentence has an unexpected ending (e.g., 'I drink my thee with sugar and **CAT**') it appears that a more negative N400 will be present (Fogelson et al. 2004). This increased negativity in the N400 component does not occur when a sentence ends in an expected manner but is displayed in an unexpected way. For instance, when a sentence ends with an unexpected font, this will not influence the N400 component (e.g., 'I drink my thee with **SUGAR**'**)**. The N400 component has also been associated with workload memory (Biferno, 1985; Salisbury, 2004). It appears that when viewing sentences with an unexpected ending, the N400 component becomes more negative for participants with the largest capacity and flexibility of working memory (Salisbury, 2004).

Proverbio et al. (2013) found that the N400 component measured over the prefrontal areas was a reliable neural marker of deception. Especially in the left hemisphere it seemed that the

N400 component was solely influenced by deception. It thus appeared that the N400 component was more negative when responding deceitfully. There was no difference in the N400 component when responding to an emotional or a non-emotional stimulus. Proverbio et al. (2013) state that this increased negativity is likely an indicator of an increased mental workload when deceiving. Proverbio et al. (2013) thus consider that the N400 component was a reliable neural marker for deception, since the N400 component was not influenced by emotionality.

The Late Positive component

The Late Positive Component (LPC) is also a component of EEG that is usually dominant over parietal sites (Matsuda, & Nittono, 2015). Typically the LPC occurs around 400–500 ms after a stimulus has been shown and lasts for a few hundred milliseconds (Figure 1). The LPC is often used as an arousal indicator, since the LPC appears to be more positive when participants are aroused by a stimulus (Bamford, et al. 2015; Minnix et al. 2013; Moran et al. 2013). Since the LPC is an arousal indicator it can be influenced by numerous factors, including for instance emotionality (Proverbio et al. 2013). Cuthbert et al, 2000 showed that the LPC is higher for emotionally arousing images compared to neutral images. The LPC is also influenced by the emotion regulation strategy chosen (Moran, Jendrusia, & Moser, 2013). Participant's regulation strategies can be influence prior to the experiment in order to affect LPC when viewing stimuli. For instance, when participants are instructed to interpret negative images more neutrally, LPC decreases when viewing negative images (Hajcak, & Nieuwenhuis, 2006; Moser et al., 2006, 2009; Moser et al., 2010; Thiruchselvam et al., 2011). Proverbio et al. (2013) found that the LPC was an insufficient neural marker of deception. The LPC measured by Proverbio et al. (2013) reached its maximum amplitude over central sites. The LPC did not suffice as a marker of deception since it was influenced by both stimulus emotionality and deception. It was thus impossible to distinguish between a deceitful participant and a participant that responded to an emotional stimulus.

Shortcomings of Proverbio et al. (2013)

The research performed by Proverbio et al. (2013) does, however, possess certain shortcomings. Proverbio et al. (2013) used EEG as a measure of cognition to find a differentiator between deception and emotionality. In order to make this distinction Proverbio et al. (2013) chose to use emotional questions hoping to induce an emotional state. In doing so, Proverbio et al. (2013) did not measure whether the emotional questions caused an emotional response from the participants. The only indicator that participants were possibly influenced by the emotional questions is an increase in the LPC. Since Proverbio et al. (2013) did not monitor participants' emotional states, it is possible that the LPC did not reflect the emotional states felt by the participants. Possibly the increase in the LPC found by Proverbio et al. (2013) is an indicator that participants simply recognized the emotional differences between the questions. It thus remains unclear whether participants actually experienced an emotional response when confronted with emotional questions. Proverbio et al. (2013) also did not monitor the emotional states occurring when responding truthfully or deceptively. During deception the deceiver can experience different levels of emotions, such as for instance an increase in arousal (Frank, & Ekman, 1997; Vrij, & Grenhag, 2012). Since Proverbio et al. (2013) did not monitor emotional states, it is unclear whether the N400 component is able to expose a deceptive participant when arousal felt during deception is high or low.

During the current study EDA is measured in order to establish if emotional stimuli are capable of influencing participants' emotional state. The results of this experiment thus pose implications for the research performed by Proverbio et al. (2013). If EDA is not influenced by stimulus emotionality, it would appear that stimulus emotionality failed to influence participants emotionally. In this case it is unclear whether the N400 component is actually unaffected by participants' emotional states. If EDA is influenced by both deception and stimulus emotionality, EDA would be unable to differentiate between the effects of deception and emotionality. In this case EDA would be comparable to the LPC as an arousal indicator. In this scenario there is an increased likelihood that the N400 component is unaffected by participants' emotional states. If EDA is not influenced by deception and emotionality it would appear that participants' emotional states are not influenced. This indicates that during the experiment performed by Proverbio et al. (2013) participants might have cognitively recognized the difference between deception and stimulus emotionality, without actually feeling that difference.

In the following section an overview is given of EDA research. In this section the relationship between EDA, deception and emotions is discussed further.

Electro-dermal Activity

The Origins of Electro-dermal Activity

It is well known that the process of sweat secretion is very important in thermoregulation (Wenger, 2003) and in keeping the skin flexible (Jänig, 2006). The changing activity of sweat glands is set in motion by the sympathetic branch of the autonomic nervous system (Bach et al., 2011). Sweat secretion changes the electrical properties of the skin, a process known as electro-dermal activity (EDA). The higher the sweat rises the lower the resistance and the higher the resulting skin conductance. Increases in skin conductance can lead to a skin conductive response (SCR; Lagopoulos, 2007). During research multiple measures can be used to quantify SCRs. Typical measures used include counting the Number of SCRs and measuring the Total Amplitude of SCRs (Dawson, Schell, & Fillion, 2006). When measuring the Number of SCRs, the Number of SCRs occurring 1-5 seconds after stimulus presentation are counted. These SCRs are believed to be caused by the stimulus (Dawson, Schell, & Filion, 2006). The Total Amplitude of SCRs is used as a measure in order to portray the intensity of the SCRs measured. This measure also uses the SCRs occurring 1-5 seconds after stimulus presentation. The highest amplitudes measured during each individual SCR are added in order to attain the Total Amplitude of SCRs. Despite the Number of SCRs and the Total amplitude of SCRs being different measures, certain similarities between the measures are bound to occur. For instance, when the Number of SCRs is zero the Total Amplitude of SCRs must also be zero. Since both the Number of SCRs and the Total Amplitude of SCRs describe different aspects of EDA, both measures are influenced by emotional states. Since the Number of SCRs and the Total Amplitude of SCRs are different measures, the use of both measures can increase reliability of EDA measurement.

The greatest application of EDA has been in the field of psychophysiology and the detection of deception (Lagopoulos, 2007). EDA is often measured during the Guilty Knowledge Test (GKT) and Guilty Actions Test (GAT). During the GKT participants are asked relevant and neutral questions. For example, when the GKT is used during a gun theft crime, specific details

of the gun are asked that only the culprit could know. If EDA is higher when denying relevant questions, the person is considered to be deceptive. A variation on the GKT is the GAT. The GAT is very similar to the GKT, however, during the GAT participants are asked questions regarding a particular action. Once again if physiological responses are higher when answering relevant questions, the person is considered deceptive.

The influence of Emotional States on Electro-dermal Activity

Despite EDA being a fairly common measure for detecting deception, it is actually an arousal indicator (Boucsein, 2012). An example of a research using the GKT to show the importance of arousal in detection deception is Giesen and Rollison (1980). During this study participants were listed in a high or low anxiety group, based on reported anxiety. Anxiety was measured using Lykken's Activity Preference Questionnaire. Participants were either subjected to guilty treatment or innocent treatment. Participants subjected to the guilty treatment committed a mock crime prior to the lie detection procedure. Contrarily, participants subjected to the innocent treatment performed a neutral activity prior to the lie detection procedure. The stimuli embedded in both the mock crime and neutral activity were similar, only the knowledge obtained by participants was different. Participants committing the mock crime obtained 'guilty knowledge'. Participants performing the neutral activity only obtained 'innocent associations'. Results of this experiment showed that for high anxiety participants SCRs were higher during guilty treatment than during innocent treatment. For low anxiety participants there was no difference between the scenarios. Since high anxiety participants are easier aroused than low anxiety participants this indicates that arousal perceived when deceiving is an important factor in distinguishing a guilty person from an innocent person. This association between arousal and deception has been explained by Skinner (1953). According to Skinner (1953) the arousal increase present when deceiving is caused by the punishment participants received when deceiving. Since deception is associated with these consequences, arousal is increased when participants are deceiving.

Aside from deception causing higher levels of arousal, it is also possible for certain stimuli to cause higher levels of arousal (Campos, Marcos, & González, 1999). For instance, the emotional content of stimuli can influence participants' emotional state (Banks, Bellerose, & Douglas, 2012; Najström, & Jansson, 2007; Giesbrecht et al., 2010). Sierra et al. (2006)

examined whether depersonalization disorder patients (DPD patients) were affected differently by certain facial expressions. SCRs were measured for chronic DPD patients, patients with anxiety disorder and healthy participants. All participants viewed pictures of happy or disgusted expressions. It appeared that anxiety patients exhibited higher EDA than healthy or DPD patients for disgusted expressions. All participants showed similar EDA for happy expressions. Stimuli viewed during deception detection can also trigger an emotional state. Emotional states felt during deception detection can in turn influence EDA measurement when deceiving (Geng-Yue et al., 2005).

The degree to which participants associate with stimuli also influences EDA. In a study performed by Nikula (1993) participants had to view words which closely associated with their personal concerns or with others personal concerns. It appeared that more SCRs were present when participants viewed words related to their personal concerns compared to words related to other concerns. This influence of personal concerns on EDA is supported by Stormark, Laberg, Nordby, & Hugdahl (2000), who investigated the difference in SCRs for alcoholic and non-alcoholic participants. All participants had to identify the color of Stroop versions of emotional, neutral and alcohol related colored words. Alcoholics showed higher EDA to alcohol related words, compared to other words. This indicates that depending on relatability, words can influence EDA.

Research Questions

Prior to the experiment it was thought that deception would influence EDA. This is believed since various studies show that deception can influence EDA (Skinner, 1953; Giesen and Rollison, 1980; Lagopoulos, 2007). It was thought that EDA would not be higher for emotional questions than for non-emotional questions. Despite emotional states being able to influence EDA, it was expected that the emotionality questions composed in this experiment would not trigger an emotional state. This was expected since emotional stimuli were not necessarily relatable for every participant. For instance, when confronted with the stimulus ‘Do pedophiles rape children?’ participants might recognize that the stimulus is emotional, however, participants were not expected to be influenced emotionally. It was thought that stimulus relatability would influence EDA. This was expected since various articles show that EDA is influenced by words

containing participants' personal concerns (Nikula, 1993; Storkmark et al., 2000; Bonett, & Naveteur, 2006; Saladin et al., 2012). It was thus expected that subjective stimuli (e.g. 'Have you ever been in France?') would correspond more to participants personal situation than objective stimuli (e.g. 'Is egg white the red part of an egg?'). The research questions for this study were; *Do deception, stimulus emotionality and stimulus relatability influence participants' emotional states?* In answering the main research question the following sub-questions need to be answered; *Can a difference between lying and telling the truth be measured using EDA? Can a difference between high and low emotional stimuli be measured using EDA?; Can a difference between subjective an objective stimuli be measured using EDA?*. Since EDA is an arousal indicator, it is known to be influenced by emotional states (Boucsein, 2012). Since deception, stimulus emotionality and stimulus relatability are all known to potentially trigger emotional states, it is possible that EDA is influenced by these factors. In the setup of this experiment, however, it is unclear how EDA is influenced by deception, stimulus emotionality or stimulus relatability.

Methods

Pre-study

In order to assess participants' Emotionality judgments, a pre-study was conducted online where participants needed to rate 296 stimuli (Figure 2). The pre-study was conducted among 10 female and 10 male Dutch students. In contrast to Proverbio et al. (2013) it was chosen to conduct the pre-study using a 5 point Likert scale instead of a 3 point Likert scale (not at all, somewhat emotional, extremely emotional). It was chosen to use a 5 point Likert scale in order to increase sensitivity of the pre-study.

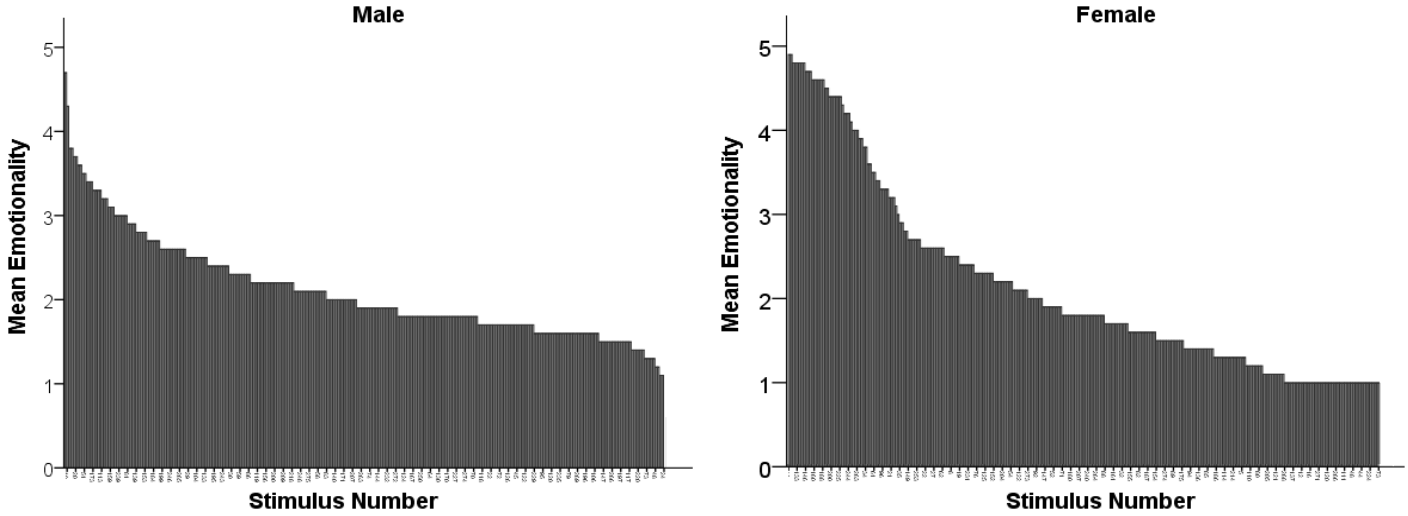

Figure 2; Mean Emotionality scores per stimulus for male and female participants. Emotionality scores range from 1-5, as emotionality scores were rated using a 5 point Likert scale (5 = emotional; 4 = fairly emotional, 3 = not emotional/neutral, 2 = fairly neutral, or 1 = neutral). Male respondents rated questions more neutral, rarely rating a stimulus as highly non-emotional or highly emotional. Female respondents, however, seemed to rate stimuli as highly non-emotional or highly emotional more often.

An independent sample test was used in order to establish whether there was a difference in mean emotionality judgement ratings. It appeared that there was no significant difference between mean male (M = 2.11, SD = 1.120) and mean female (M = 2.13, SD = 1.447) emotionality ratings ($t(18) = 0.085$, $p = .933$). An independent sample test was also used to establish whether there was a difference in the standard deviation of emotionality judgment ratings. Results of this analysis indicated that there was a significant difference in variance of emotionality judgments between male and female participants ($t(18) = 2.871$, $p = .01$). Male respondents rated stimuli as neutral, more often than female participants. Female respondents, however, seemed to rate stimuli as highly non-emotional or highly emotional more often than male respondents. Since female participants rated stimuli less neutral than male participants, it was thought that stimulus emotionality would potentially influence the emotional states of female participants more profoundly. It was thus chosen to conduct the experiment solely with female participants. Emotionality scores obtained from the female respondents during the pre-study were used to split the stimuli in two groups. The highest ratings were used to conceive the high emotionality group and the lowest ratings were used to conceive the low emotionality group.

Participants

A total of 16 participants took part in the experiment. All participants were Dutch right-handed female students at the University of Twente. It was chosen to only include female student due to results obtained from the pre-study. The average age of the participants is 20.9 years old, and age varied between 19 and 24 years. Participants who studied behavioral studies received 4 credits for participating in this research.

Material

The experiment was executed using two computers, a GSR module and a 17" CRT monitor with a 60 Hz refresh frequency. The first computer was used to run the experiment. The second computer was used by the observer to monitor the measurements made during the experiment. The experiment was performed at a resolution of 1024 x 768 pixels. Free software from ThesisTools (thesistools.com) was used to collect data for the pre-study.

Stimuli selection

The stimuli for this study were selected from among the 296 stimuli used by Proverbio et al. (2013). Since Proverbio et al. (2013) used stimuli translated in Italian, it was necessary that all stimuli were translated to Dutch. It was decided to translate stimuli to Dutch and not English, since it appears that sentences are found to be more emotional when viewed in the native language (Caldwell-Harris, 2015).

It was decided to validate the translated stimuli by conducting a pre-study. From among the 296 stimuli, 255 stimuli were selected as this enabled the use of unique digital codes for each expression when using BrainVision software. The 255 stimuli selected were either highest or lowest on emotionality, excluding the most moderately emotional stimuli. Data for one participant was deleted due to faulty measures. Nine stimuli were also deleted, as it was impossible to identify these stimuli during data transformation.

Design

This experiment closely resembled the research performed by Proverbio et al. (2013), yet the design of the current study differs.

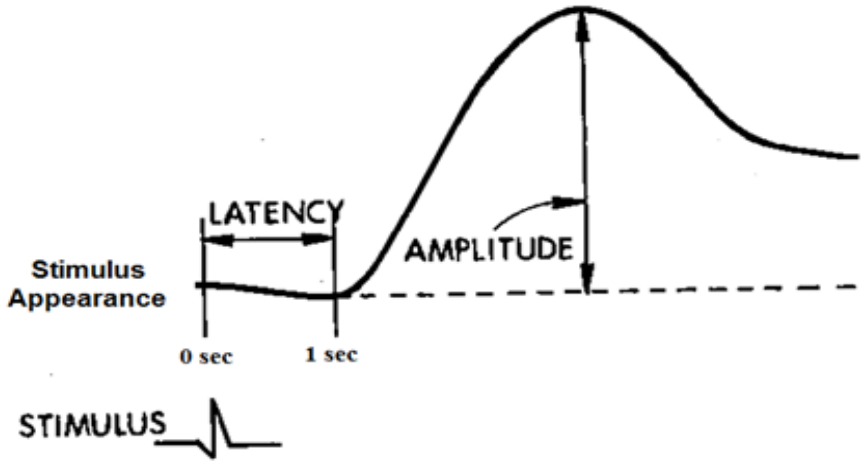

Figure 3; The components of a SCR (Dawson, Schell and Filion, 2006). When using SCRs as a measure the first second after stimulus presentation is considered latency, as activity during this time is not necessarily caused by the stimulus. The SCRs occurring between 1-5 seconds after stimulus presentation are used. The highest amplitude minus the lowest amplitude measured during an SCR are used to attain the amplitude of an SCR.

Dependent variables in this study are the 'Number of SCRs' and the 'Total Amplitude of SCRs'. Number of SCRs were attained by counting how many SCRs occurred 1-5 seconds after the stimulus was presented (Figure 3). This 1-5 second measurement period was used as it is believed that any SCR occurring in this time period is induced by the stimulus. The Total Amplitude of SCRs was attained by adding together the amplitudes of each SCR that occurred 1-5 seconds after the stimulus (Figure 3).

Table 1

The four different stimulus groups used during this study based on Relatability (Personal vs Impersonal) and Emotionality (High vs Low).

Relatability	Emotionality	
	High	Low
Subjective	Do you like beating dogs to death with sticks?	Have you ever been to France?
Objective	Is rape a serious criminal offence?	Is egg white the red part of an egg?

Note: The emotional, subjective stimuli, consisting of questions designed to elicit an emotional response, while formulated as a subjective question. The emotional, objective stimuli, consisting of questions designed to elicit an emotional response, while formulated as an objective question. The non-emotional, subjective stimuli, consisting of neutral questions formulated as a subjective question. And the non-emotional, objective stimuli, consisting of neutral questions formulated as an objective question.

This study consisted of within-subject independent variables, Emotionality (High vs. Low), Relatability (Personal vs. Impersonal) and Deception (Truth vs Lie). The questions used in this experiment could thus be distributed in four stimulus categories (Table 1). The choice for within-subject independent variables was made, as the effects of Emotionality, Personal and Deception were thought to differ for each individual participant. When using only within subject variables, these individual differences are accounted for since the results can be analyzed on an individual level.

Procedure

The experiment was conducted on one computer in a separate room at the University of Twente. Participants were asked to fill in an informed consent and handedness test. Participants were then seated in front of a computer, where a CRT module was located. Instructions about the experiment were given on the screen during the experiment.

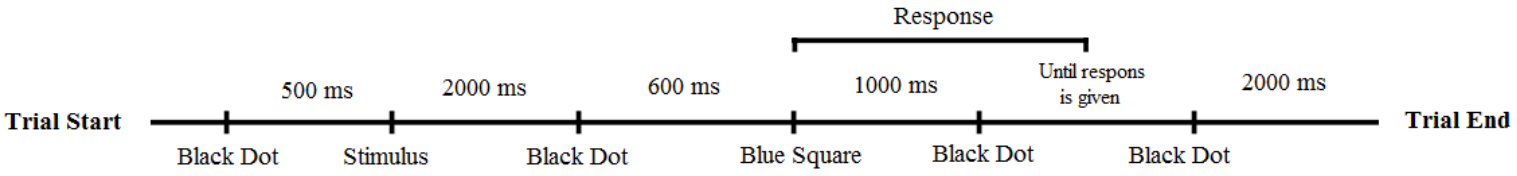

Figure 4; A description of the event occurring during each trial in milliseconds. At the start of every trial a black dot was displayed in the center of the screen for 500 ms, followed by a stimulus. The stimulus would remain on the screen for 2000 ms, after which the black dot appeared again for 600 ms. Next a blue square was shown for 1000 ms, indicating that participants could respond 'yes' or 'no' to the stimulus using the ← or → key. If participants took longer than 1000 ms to respond, the black dot would be apparent until a response was given. After responding the black dot would be presented on the screen for 2000 ms, after which the next trial would start

The experiment consisted of 255 trials, during which stimuli were shown in a random order. These trials were divided in four blocks, alternating truth and lie blocks. Prior to each block a brief practice phase was conducted, consisting of eight trials. A description of the events occurring during each trial is given in Figure 4. At the end of the experiment participants were requested to answer a small questionnaire. This was necessary since the answers to certain personal stimuli given by the participant could not be anticipated. In the questionnaire participants were asked to answer truthfully to various stimuli, in order to establish how these stimuli should be grouped in the 'Deception' variable.

Data analyses

Using MATLAB (www.mathworks.com) EDA data was down sampled to 16Hz. First EDA data was processed using a Continuous Decomposition Analysis (CDA) as executed in Ledalab (Benedek, & Kaernback, 2010). This CDA was used to obtain an estimate of the skin conductance level (SCL). A Trough-to-Peak analysis was then conducted where the phasic activity was reported. SCR amplitude was set at a threshold of .03 µS (Boucsein, 2012). Boucsein (2012) recommended the use of visual checks performed on plots of skin conductance data. It was chosen to perform these visual checks in order to identify failed measurements, incorrect classification of SCRs and absence of SCRs. The data obtained from these erroneous measurements were removed. Also all SCR amplitudes exceeding 1.0 µS were discarded. The Mean Number of SCRs and Mean Total Amplitude of SCRs per participant after corrections are displayed in Figure 5.

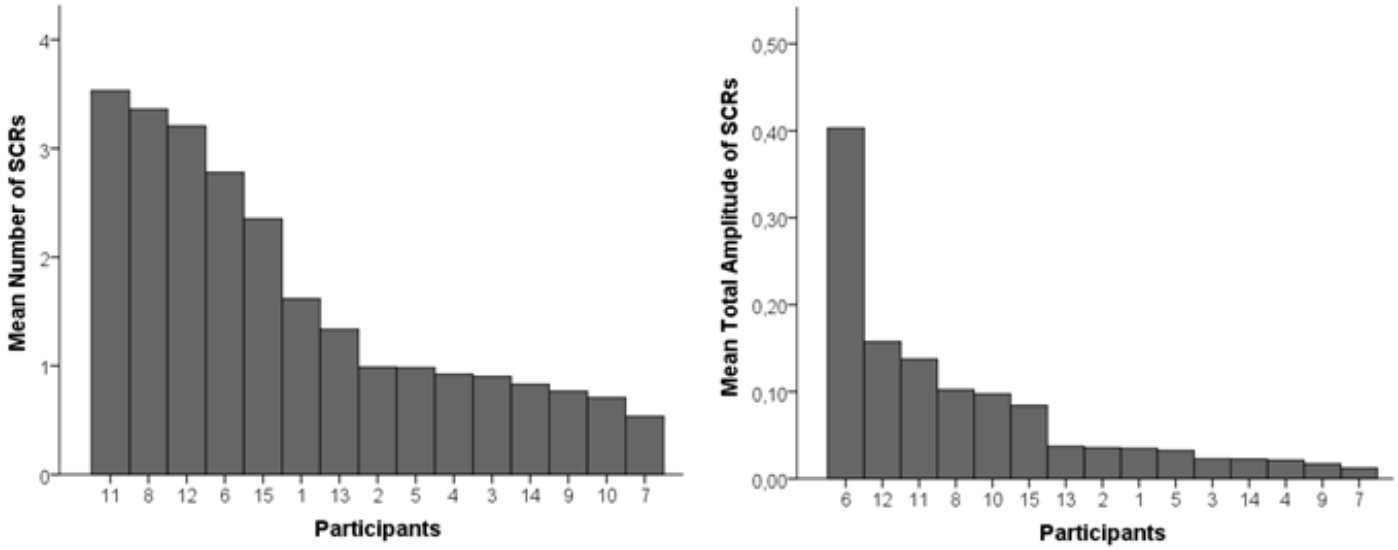

Figure 5; Mean Number of SCRs and Mean Total Amplitude of SCRs measured during the course of the experiment, displayed per participant. After correcting the datasets it appeared that the Number of SCRs per subject and mean amplitude per subject were skewed. This was to be expected, as there are various studies that show individual differences when measuring SCRs (Mardaga, & Hansenne, 2010; Mardaga, Laloyaux, & Michel, 2006).

Between-subject variability was accounted for using the method discussed by Ben-Shakhar (1985). In doing so, all participants obtained a very similar mean Number of SCRs and mean Total Amplitude of SCRs (Figure 6).

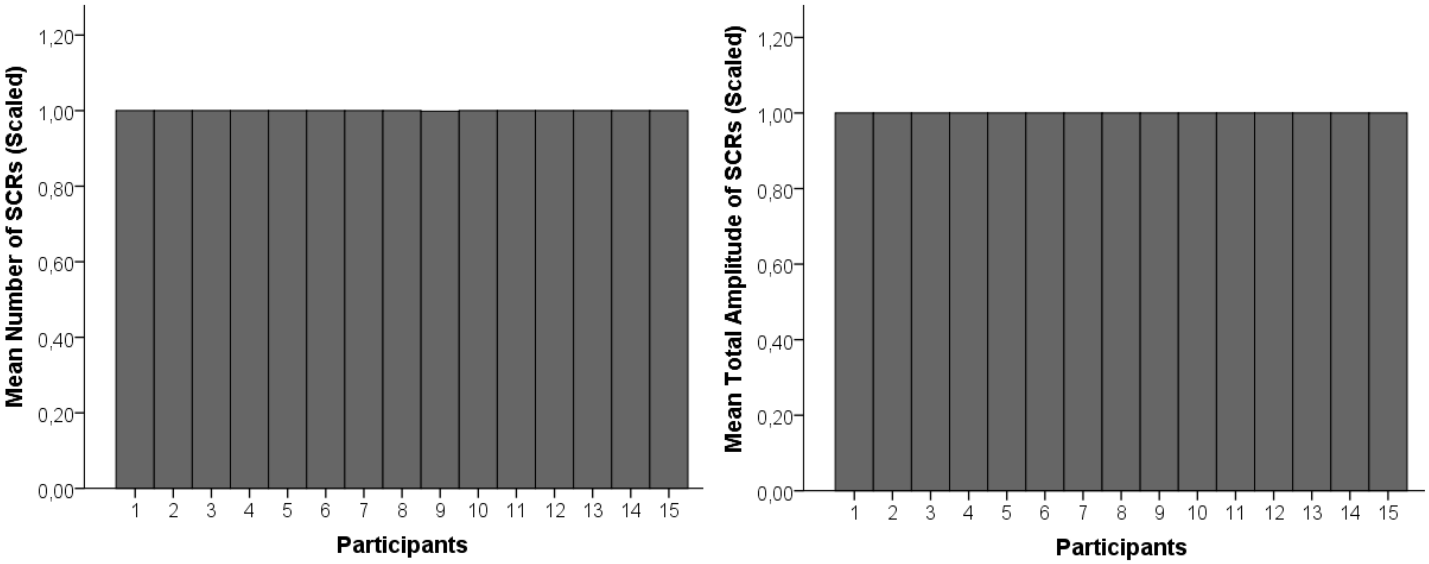

Figure 6; Scaled Mean Number of SCRs and Scaled Mean Total Amplitude of SCRs measured during the course of this experiment, displayed per participant. The Mean Number of SCRs and Mean Total Amplitude of SCRs were scaled using the Ben-Shakhar transformation. In order to scale the Number of SCRs using the Ben-Shakhar transformation, the following formula was used for each participant; (SCR / Mean SCR). In order to scale the Total

Amplitude of SCRs using the Ben-Shakhar transformation the following formula was used for each participant; (Amplitude / Mean Amplitude).

It was chosen to analyze the data using Generalized Estimating Equations (GEE). In order to establish if Deception, Emotionality and Relatability influenced EDA, two 3x2 regression analysis were performed. The first 3x2 regression analysis used Number of SCRs as a dependent variable. During this regression analysis Deception (Lie vs. Truth), Emotionality (Low vs. High) and Relatability (Subjective vs. Objective) were used as independent variables. The second 3x2 regression analysis used Total Amplitude of SCRs as a dependent variable. During this regression analysis Deception (Lie vs. Truth), Emotionality (Low vs. High) and Relatability (Subjective vs. Objective) were also used as independent variables.

Results

The Number of SCRs

When examining the Number of SCRs it appears that the participants were influenced by the order in which the blocks were presented (χ^2 = 10.108, df = 3, p = .018). It seemed that the Number of SCRs steadily decreased during the first three blocks. During the final block the Number of SCRs increased slightly (Figure 7).

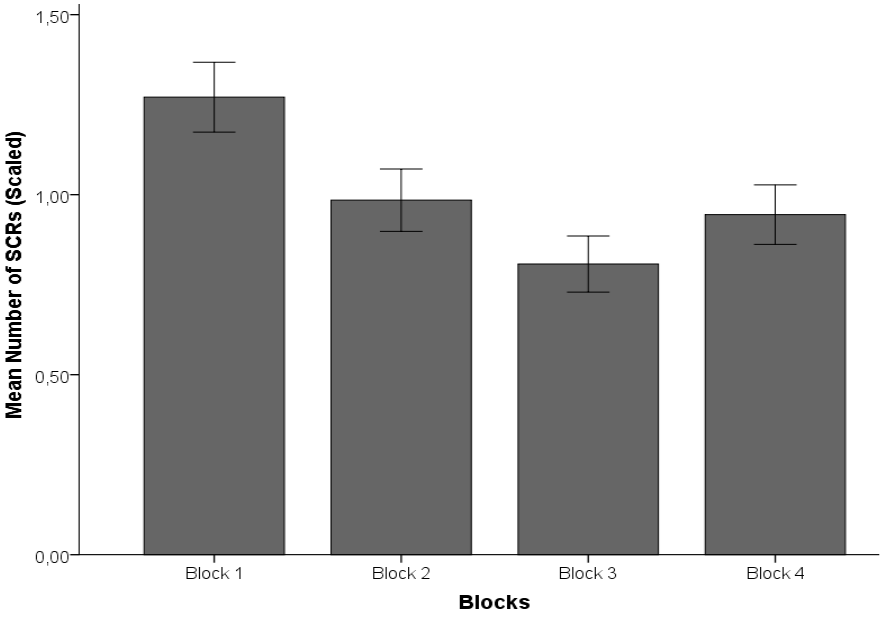

Figure 7; Mean Scaled Number of SCRs for Blocks 1-4. The Number of SCRs steadily decreased during the first three blocks. During the final block the Number of SCRs increased slightly.

Deception

When taking the Number of SCRs as a dependent variable, it appears that there was no Deception effect ($\chi^2 = 1.615$, df = 1, p = .204). On average it seems that the Number of SCRs was slightly higher when telling the truth (M = 1.06) than when lying (M = .94). When looking at the participants individually, there was a difference in the Number of SCRs between participants (Figure 8). The individual differences between lying and telling the truth were, however, not very reliable, as indicated by the error bars in Figure 8.

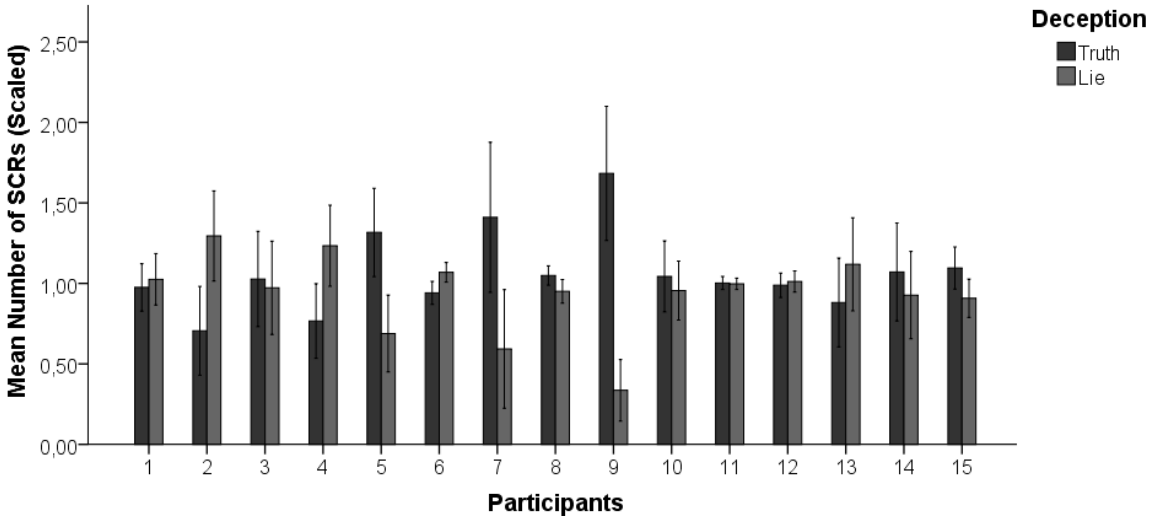

Figure 8; Mean Scaled Number of SCRs per participant when lying, or telling the truth. Four participants showed slightly more SCRs when lying. Seven participants showed slightly more SCRs when telling the truth. And for four participants it appears that SCRs were similar when lying or telling the truth. It thus seems that deception affected each participant differently. It is seen that for three participants the difference between lying and telling the truth is reliable. For the remaining participants there is no reliable difference between lying and telling the truth.

Emotionality

There is no Emotionality effect ($\chi^2 = .835$, df = 1, p = .316) present when using the Number of SCRs as a dependent variable. This absence of an Emotionality effect indicates that the Number of SCRs were similar for stimuli with high emotional content (M = 1.02) and low emotional

content (M = .99). On average the Number of SCRs appears to be equal for both high and low emotional stimuli. The mean Number of SCRs per participant for high and low emotional stimuli is displayed in Figure 9. When viewing the error bars in Figure 9, it seems that the Emotionality variable did not reliably affect any of the participants.

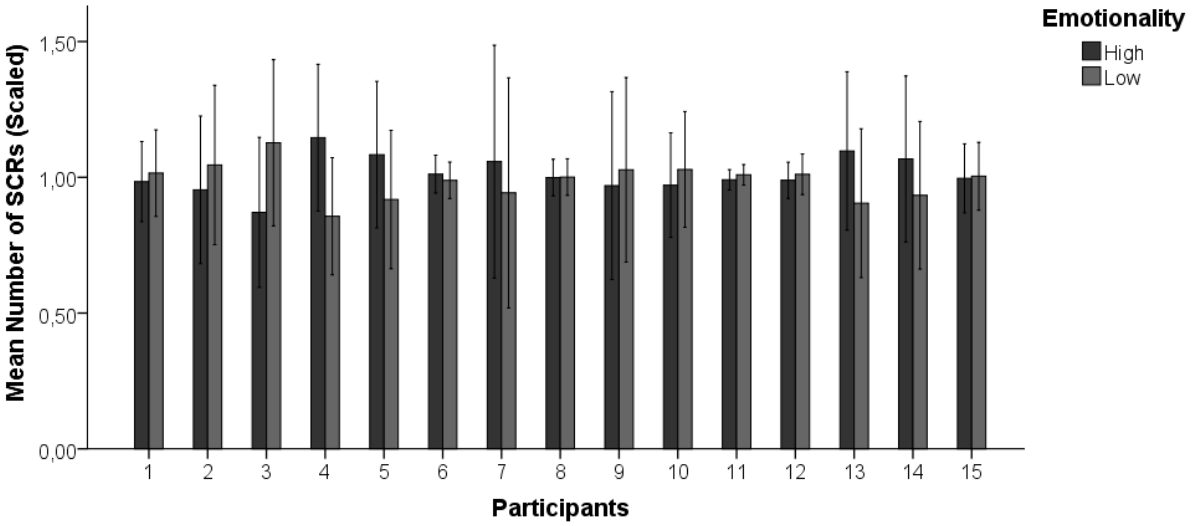

Figure 9; Mean Scaled Number of SCRs per participant for high and low emotional stimuli per participant. It seems that seven participants showed an equal amount of SCRs for high and low emotional stimuli. Five subjects showed more SCRs for high emotional stimuli and three participants elicited more SCRs for low emotionality stimuli. It appears that no participant showed a reliable difference in the Number of SCRs between high or low emotional stimuli.

Relatability

When the Number of SCRs is used as a dependent variable it appears that there is no Relatability effect (χ^2 = .206, df = 1, p = .650). The average Number of SCRs were similar for subjective stimuli (M = 1.02) and objective stimuli (M = .99). When looking at the results various individual differences became apparent (Figure 10). When viewing the error bars displayed in Figure 10, it appears that the Number of SCRs of every participant was not reliably influenced by stimulus relatability.

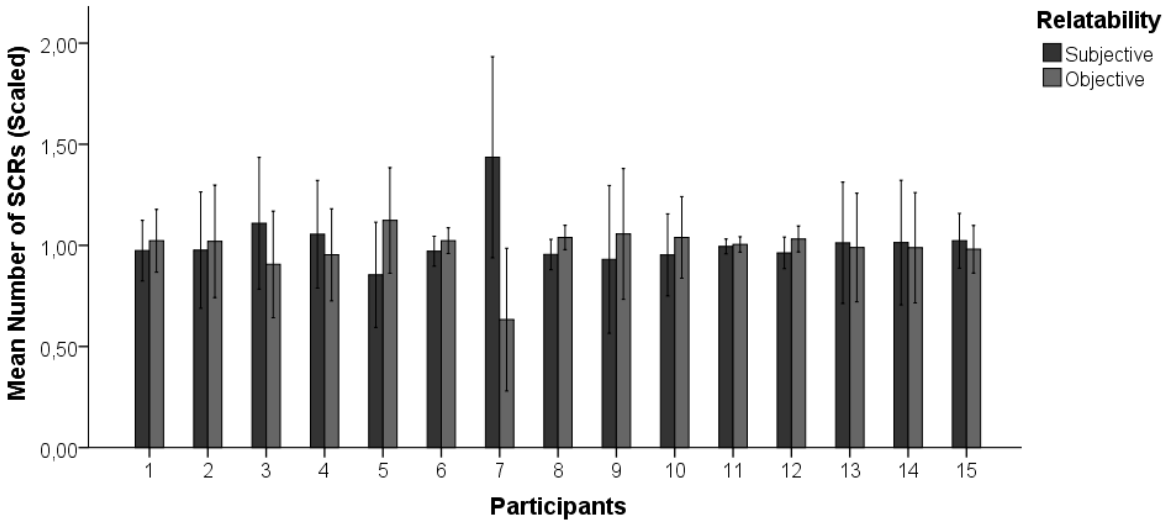

Figure 10; Mean Scaled Number of SCRs per participant for subjective and objective stimuli. It appears that for three participants SCRs were slightly higher for subjective stimuli. For three participants SCRs were slightly higher for objective stimuli. And for the other participants SCRs were similar regardless of stimuli being subjective or objective. It appears that no participant showed a reliable difference between subjective and objective stimuli.

Deception x Emotionality

When using the Number of SCRs as a dependent variable it appears that there is no Lying x Emotionality effect present ($\chi^2 = .015$, df = 1, p = .902). As previously stated the mean Number of SCRs was slightly higher when telling the truth. This difference in Number of SCRs when lying or telling the truth was present, regardless of stimuli being emotional or non-emotional (Figure 11).

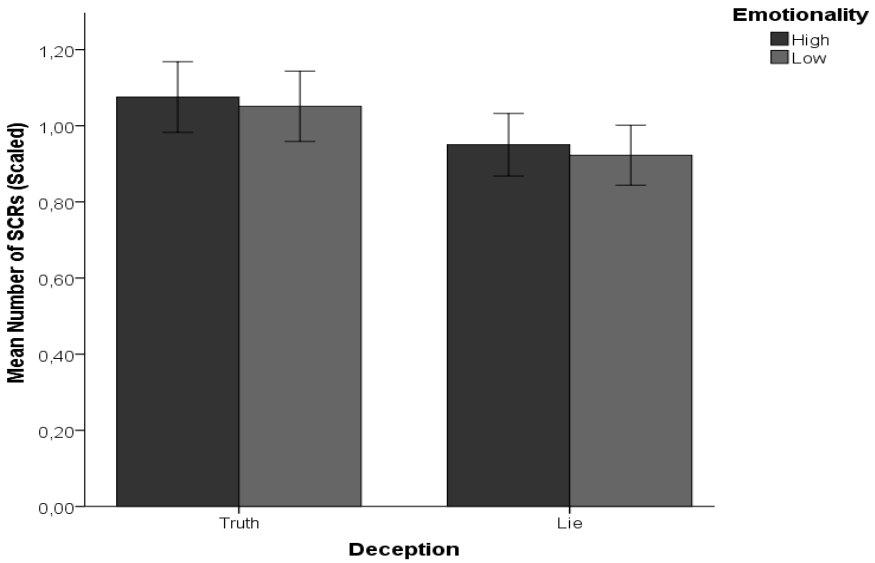

Figure 11; Mean Scaled Number of SCRs when lying, or telling the truth in response to high, or low emotional stimuli. The difference in Number of SCRs when lying or telling the truth was consistent, regardless of stimuli being emotional or non-emotional.

Deception x Relatability

There was no Deception x Relatability interaction effect found when using the Number of SCRs as a dependent variable (χ^2 = 2.316, df = 1, p = .128). The difference between subjective and objective stimuli varied for truthful and deceptive responses (Figure 12) The error bars displayed in Figure 12 indicate, however, that there are no reliable difference between subjective and objective stimuli regardless of participants telling the truth or lying.

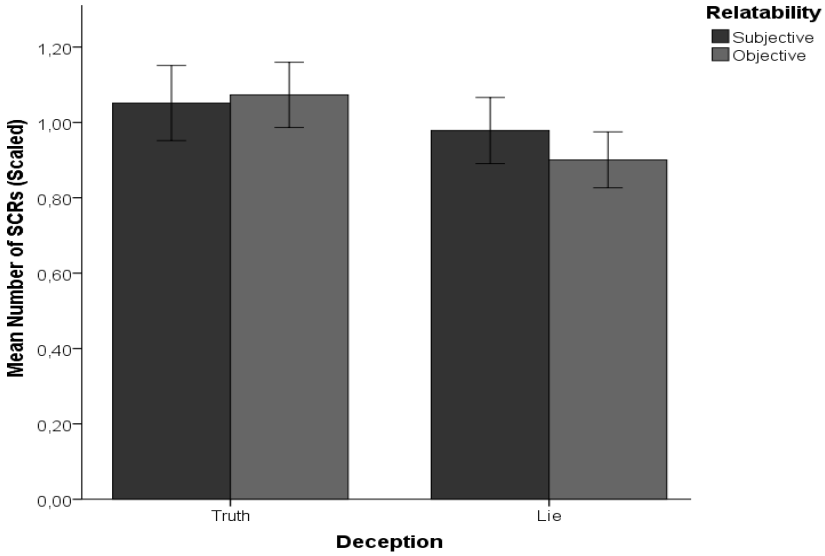

Figure 12; Mean Scaled Number of SCRs when lying, or telling the truth in response to subjective, or objective stimuli. When telling the truth, on average it appears that SCRs are similar for subjective or objective stimuli. When lying, however, it appears that on average SCRs were slightly higher for subjective stimuli.

Emotionality x Relatability

When using the Number of SCRs as a dependent variable, no Emotionality x Relatability interaction effect was present ($\chi^2 = .015$, df = 1, p = .984). It appears that there was no difference between subjective stimuli and objective stimuli, regardless of stimuli being emotional or non-emotional (Figure 13).

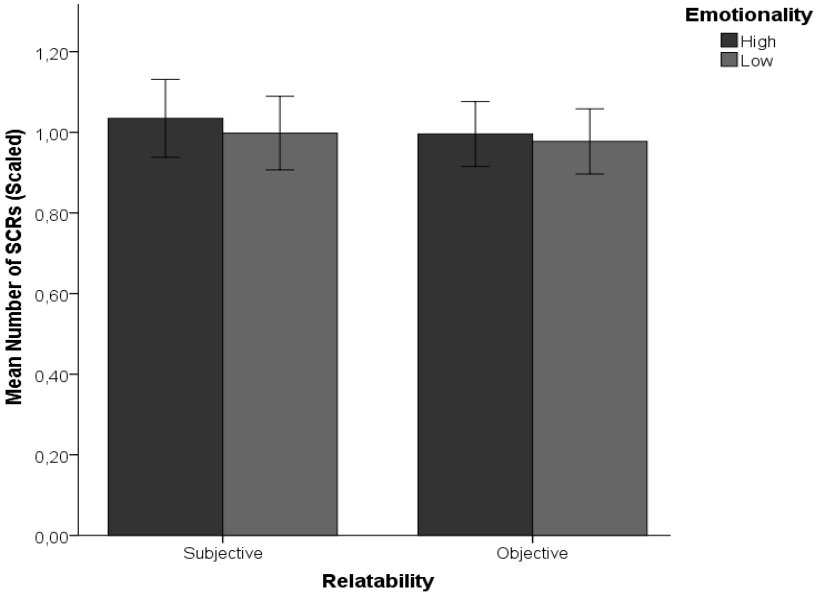

Figure 13; Mean Scaled Number of SCRs for subjective stimuli with high, or low levels of emotionality. And Mean Scaled Number of SCRs for objective stimuli with high, or low levels of emotionality. It appears that there was no difference between subjective stimuli and objective stimuli, regardless of stimuli being emotional or non-emotional.

Total Amplitude of SCRs

When viewing the Total Amplitude of SCRs it appears that participants were influenced by the order in which the blocks were presented ($\chi^2 = 17.761$, df = 3, $p < .001$). It seemed that the Total Amplitude of SCRs decreased during the first three blocks of the experiment. During the final block it appeared that the Total Amplitude of SCRs increased (Figure 14).

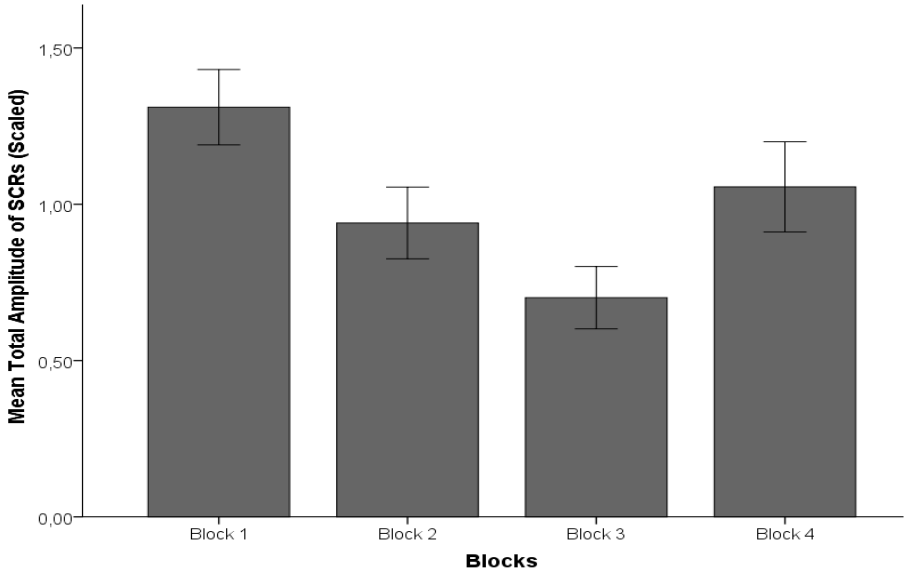

Figure 14; Scaled Mean Total Amplitude of SCRs for Blocks 1-4. Total Amplitude of SCRs decreased during the first three blocks of the experiment. During the final block it appeared that the Total Amplitude of SCRs increased.

Deception

With Total Amplitude of SCRs as a dependent variable it seems that no Deception effect was apparent (χ^2 = .824, df = 1, p = .364). On average it seems that the Total Amplitude of SCRs was similar when lying (M = 1.02) and telling the truth (M = .99). The effect of telling the truth or lying on the Total Amplitude of SCRs differed per participant (Figure 15). When viewing the error bars in Figure 15, however, it seems that the individual differences between lying and telling the truth are not very reliable.

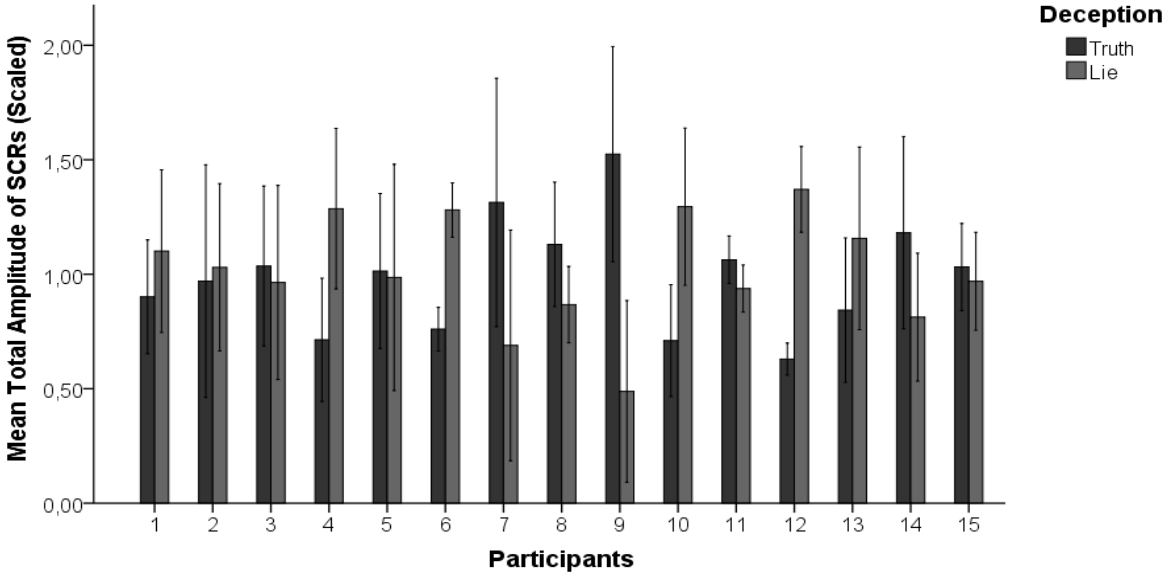

Figure 15; Scaled Mean Total Amplitude of SCRs per participant when lying, or telling the truth. It seemed that for four participants the Total Amplitude of SCRs was equal when lying or telling the truth. For five participants the Total Amplitude of SCRs was higher when telling the truth, while for six participants Total Amplitude of SCRs was higher when lying. There were only three participants that showed a reliable difference between lying and telling the truth. For the remaining participants there was no reliable difference between lying and telling the truth.

Emotionality

When using the Total Amplitude of SCRs as a dependent variable an insignificant Emotional effect was found (χ^2 = .035, df = 1, p = .852). On average it appears that amplitude was similar for high emotional stimuli (M = 1.02) compared to low emotional stimuli (M = .99). When looking on the individual level it appeared that the Total Amplitude of SCRs for high and low emotional stimuli varied per participant (Figure 16). When viewing the error bars displayed in Figure 16 it appears, however, that the individual differences between high and low emotional stimuli are not reliable.

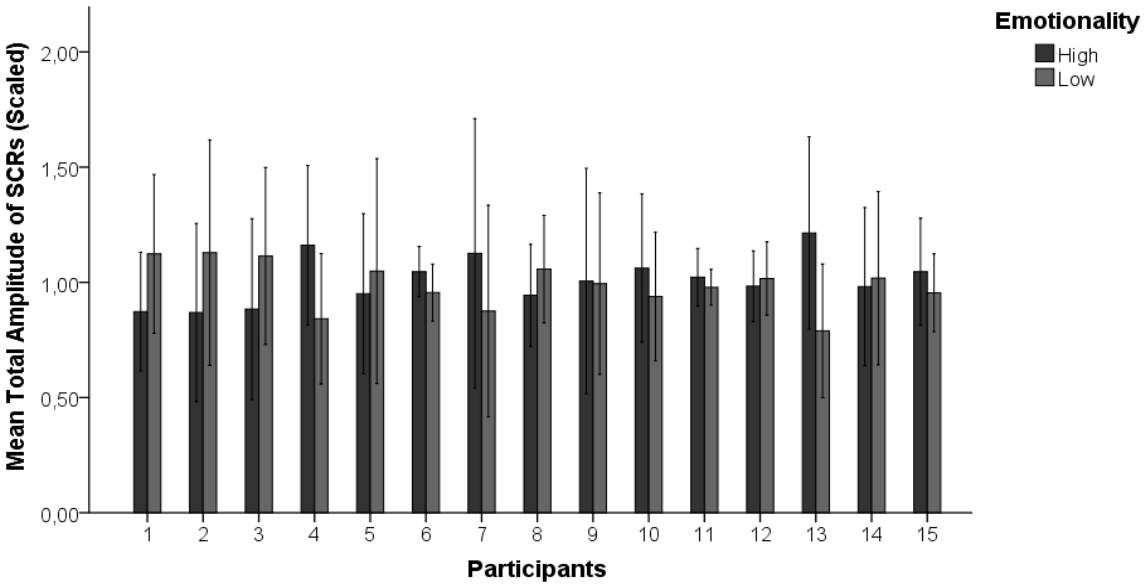

Figure 16; Scaled Mean Total Amplitude of SCRs per participant for high and low emotional stimuli. It appears that for five participants the Total Amplitude of SCRs was similar for high and low emotional stimuli. For five participants the Total Amplitude of SCRs was higher for low emotional stimuli, and for five participants the Total Amplitude of SCRs was higher for high emotional stimuli. It seems that none of the participants showed a reliable difference in Total Amplitude of SCRs between high and low emotional stimuli.

Relatability

When using the Total Amplitude of SCRs as a dependent variable it seems that there was a slightly significant Relatability effect ($\chi^2 = 1.476$, df = 1, p = .224). On average it appears that the Total Amplitude of SCRs was slightly higher for subjective stimuli (M = 1.04) than for objective stimuli (M = 0.97). It does appear that the difference between subjective and objective stimuli, varies per participant (Figure 17). When viewing the error bars displayed in Figure 17 it appears, however, that the individual differences between subjective and objective stimuli are not reliable.

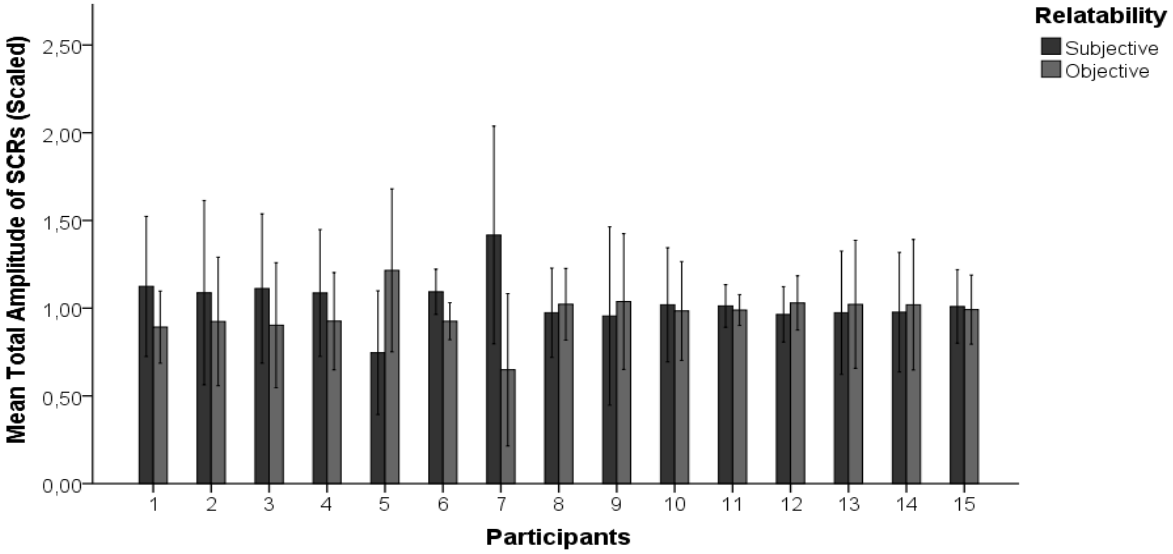

Figure 17; Scaled Mean Total Amplitude of SCRs per participant for subjective and objective stimuli. For six participants the Total Amplitude of SCRs were higher for subjective stimuli, while for two participant the Total Amplitude of SCRs were higher for objective stimuli. For seven participants the Total Amplitude of SCRs was similar regardless of stimuli being subjective or objective. It seems that none of the participants showed a reliable difference between subjective and objective stimuli.

Deception x Emotionality Interaction

When viewing the Total Amplitude of SCRs as an independent variable it appears that there was an insignificant Emotionality x Lying effect ($\chi^2 = 1.071$, df = 1, p = .301). It appears that Total Amplitude of SCRs was higher when responding deceptively to high emotional stimuli (Figure 18). When viewing the error bars in Figure 18, however, it appears that this difference in Total Amplitude of SCRs is not reliable.

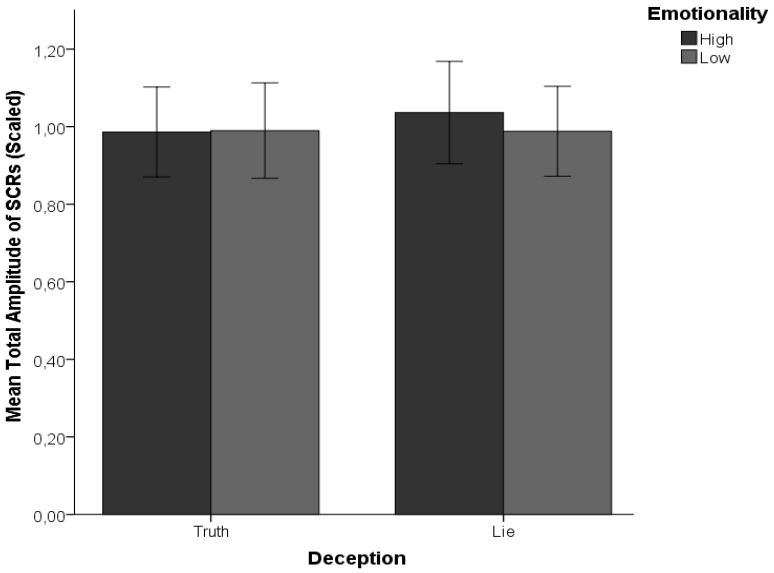

Figure 18; Scaled Mean Total Amplitude of SCRs when telling the truth, or lying in response to high, or low emotional stimuli. For high emotional stimuli it appears that Total Amplitude of SCRs was slightly higher when lying. When telling the truth it appears that Total Amplitude of SCRs was similar for low and high emotionality stimuli. This difference in Total Amplitude of SCRs seems to be unreliable.

Deception x Relatability

An insignificant Deception x Relatability interaction is found, when using the Total Amplitude of SCRs as a dependent variable ($\chi^2 = 1.932$, df = 1, p = .165). As previously stated it appears that on average the Total Amplitude of SCRs was slightly higher for subjective stimuli compared to objective stimuli. This difference between subjective and objective stimuli was the same when lying or telling the truth (Figure 19).

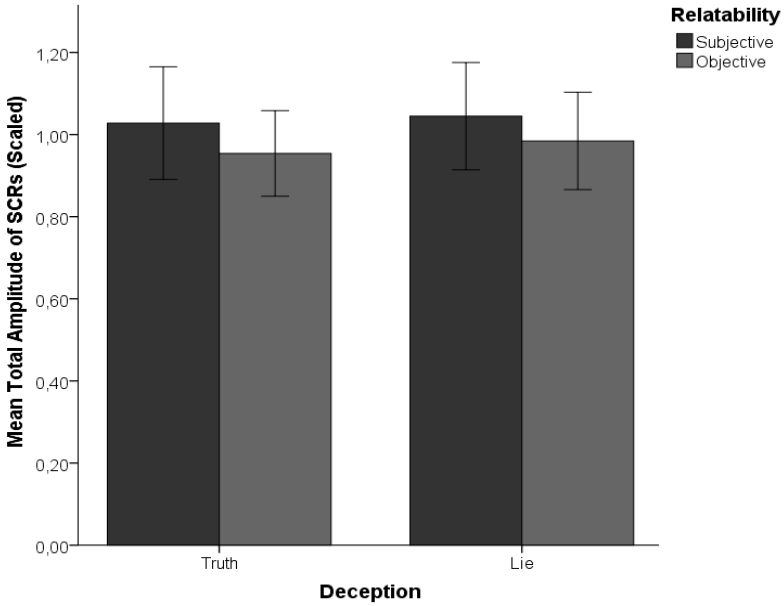

Figure 19; Scaled Mean Total Amplitude of SCRs when telling the truth, or lying in response to subjective, or objective stimuli. The difference between subjective and objective stimuli was the same when lying or telling the truth.

Emotionality x Relatability

When using the Total Amplitude of SCRs as a dependent variable, it appears that there was no Emotionality x Relatability interaction ($\chi^2 = .100$, df = 1, p = .752). It seems that the difference in Total Amplitude of SCRs between subjective and objective stimuli was not influenced by stimulus emotionality (Figure 20). There were no reliable differences found between subjective and objective stimuli, regardless of stimuli being high or low in emotionality (Figure 20).

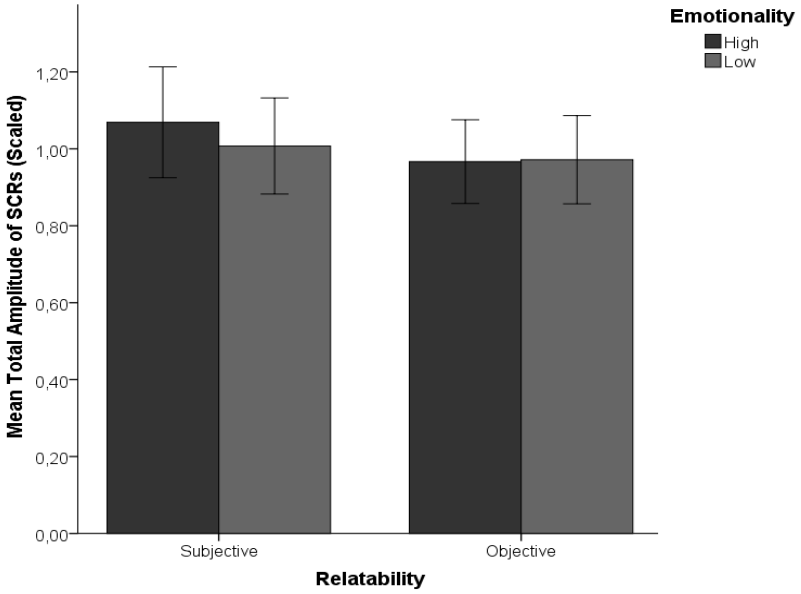

Figure 20; Scaled Mean Total Amplitude of SCRs for subjective stimuli with high, or low levels of emotionality. And Scaled Mean Total Amplitude of SCRs for objective stimuli with high, or low levels of emotionality. Despite being far from significant, it does appear that on average the SCRs for highly emotional, subjective, stimuli were slightly higher than SCRs for the other stimuli. This difference in Total Amplitude of SCRs was, however, not reliable.

Discussion

The research question pursued during this study was; '*Do deception, stimulus emotionality and stimulus relatability influence participants' emotional states?'* In answering this question the influence of deception, stimulus emotionality and stimulus relatability on EDA were analyzed.

When viewing the results it appears that deception, stimulus emotionality and stimulus relatability did not influence EDA. There was a trend present showing that stimulus relatability increased EDA felt by participants. Also, it appears that there was an order effect present, showing that EDA dropped during the course of the experiment. EDA only increased in the final block, which was probably caused by participants being aware that at this point the experiment was almost over. This indicates that participants potentially found the experiment to be fairly repetitive, causing arousal levels to be low during the course of the experiment.

In the experiment performed by Proverbio et al. (2013), it appeared that the N400 component was able to expose when a participant was deceptive. The incapability of EDA to expose a deceptive participant during the current study, indicates that participants were not aroused when responding deceptively to experimental stimuli. This would indicate that the N400 component measured by Proverbio et al. (2013) might be a more sensitive in measuring deception than EDA, when arousal levels during deception are low. It is unclear, however, if the N400 component would also perform better than EDA at revealing a deceptive participant when arousal levels during deception are higher. Proverbio et al. (2013) also claimed that the N400 component was not influenced by the effects of emotional states. When using EDA to measure emotional states it appeared, however, that participants emotional states were not influenced by stimulus emotionality. Thus it remains uncertain whether the N400 component can truly distinguish between deception and emotional states. It would also seem that EDA is influenced differently by stimulus emotionality than the LP component. This could be an indication that the LP component solely indicates whether participants recognized the difference between emotional and non-emotional stimuli. EDA might thus be a better indicator to analyze whether participants' emotional states are influenced differently by emotional or non-emotional stimuli. In the following sections each variable measured during this study is addressed in more detail.

Deception

When looking at the results it appears that EDA was unable to expose deceptive participants. It seems that the effects of deception differed per participant. Results were especially surprising when analyzing the Number of SCRs, as on average it appeared that the Number of SCRs was higher when telling the truth. Since EDA is an indicator of arousal (Boucsein, 2012), it appears

that on average participants were not aroused when lying. Performing the experiment in a different setting can potentially change the outcome of EDA measurement (Lole et al., 2014). The setting of the experiment can be changed in multiple ways in order to increase the level of arousal perceived when lying. A possibility is to increase arousal by adding a reward or punishment to the experiment. The presence of reward or punishment gives participants a motivational factor to lie. A study by DePaulo et al. (2003) indicated that when participants were motivated to deceive, that participants showed more cues of deception, compared to participants that were not motivated to deceive (DePaulo et al., 2003). Thus indicating that motivation potentially increases arousal when deceiving (Gustafson, & Orne, 1963; Elaad, 2013). Elaad (2013) used the GAT in order to detect critical information from goal-oriented and task-oriented informed innocent participants. All participants took part in a mock crime procedure. Goal-oriented participants were given no instructions prior to the GAT and were thus purely motivated to prove innocence. Task-oriented participants were instructed to prove innocence by cooperating to the GAT. Participants also differed in incentive level. In each of the motivational conditions half of the participants completed the GAT with a high incentive level. These participants were told that course credits would be given on successful completion of their goal. The other half of the motivational conditions completed the GAT with a low incentive level. No reward was promised to these participants. A control group was also used, which consisted of uninformed innocent participants. It appeared that participants which were both goal-oriented and had a higher incentive for success showed stronger responses to crime-related information. This indicates that motivation and rewards have the potential to increase arousal felt when deceiving.

In case of the current study, performing a Guilty Knowledge Test (GKT) or Guilty Action Test (GAT) would make the setting of the experiment a lot more natural. During the current experiment answering deceptively caused some very strange scenarios. This was especially noticeable when answering deceitfully to certain emotional questions. An example of such a scenario is when participants were confronted with the sentence ‘Have you ever abused a child with a knife?’. Since it is fair to state that no participants that took part in this study ever abused a child with a knife, it could be expected that participants truthful response would be ‘no’. When asked to lie about this statement, however, participants had to lie by answering ‘yes’. Since the answer given in this instance is so absurd, participants likely did not relate to the given answer.

Since lower relatability is also found to influence EDA (Nikula, 1993), this potentially caused arousal levels to be lower when deceiving in the course of this study.

Emotionality

It appears that emotionality as measured during the pre-test, is inconsistent with the measurements made during the experiment. The inability of EDA to reflect emotionality is surprising, considering EDA and emotionality are often thought to be linked (McGinnies, 1949; Chung, 2007; Mardaga, & Hansenne, 2011; Najström, & Jansson, 2007). During the current study emotional stimuli were used in an attempt to trigger an emotional response. For most participants, however, the stimuli were unable to trigger an emotional response that could be observed through EDA. Despite the difference between emotional and non-emotional stimuli being very obvious, it appears that participants were not themselves influenced by stimulus emotionality.

Participants were possibly not influenced by stimulus emotionality since participants had trouble relating personally with emotional stimuli. For instance the emotional stimulus 'In Auschwitz lot of children disappeared' could be relatable for some participants, but does not have to be relatable for everybody. As Nikula (1993) indicated, EDA is influenced more by words that correspond with participants personal concerns than words containing other concerns. In order for EDA to measure a consistent difference between emotional and non-emotional stimuli, it is necessary for emotional stimuli to also be relatable to all participants. Increasing relatability of emotional stimuli could potentially cause emotional stimuli to influence EDA. This can be achieved by choosing stimuli that reflect concerns felt by the participants (Bonett, & Naveteur, 2006). For instance, Saladin et al. (2012) looked at the emotional effects of smoking cues on smokers. Smoking cues consisted of for instance, cigarette packs or lighters. During this study male and female smokers were subjected to smoking cues or neutral cues. It appeared that participants showed more SCRs in response to smoking cues than neutral cues. For the current study a higher level of relatability can be achieved by using stimuli that are known to be relatable for all participants. For instance when participants consist of students only, it could be chosen to conduct the experiment prior to the exam period. In this instance, emotional stimuli concerning exams might be more relatable for the participants.

In previous studies the use of visual stimuli also seemed to trigger arousal levels that can be measured using EDA (Banks, Bellerose, & Douglas, 2012; Giesbrecht et al., 2010). In research performed by Banks, Bellerose, & Douglas (2012) EDA was measured in response to emotional stimuli. The stimuli consisted of emotionally expressive faces, which displayed happy, sad, angry, fearful, disgusted or neutral expressions. During the experiment participants had to perform two tasks. During one task participants had to judge what emotion was displayed, during the other task participants had to make an age judgment. Results showed that SCRs were higher for negative emotions, compared to neutral emotions. It would thus appear that the use of pictures may appear more relatable to all participants. The use of emotional words seems to be more dependent on participants' personal concerns (Nikula, 1993; William, 1943).

Relatability

When looking at the difference between subjective and objective stimuli it appears that there is was a slight trend present. This trend indicates that subjective stimuli caused higher Total Amplitude of SCRs than objective stimuli. It is important to note that this trend should not be treated as a significant result in order to prevent a Type I error. When a Type I error occurs it means that the null hypothesis is too hastily discarded (Houle et al., 2013). The results of this study thus suggest that there is no difference in EDA after viewing subjective stimuli and objective stimuli. It also appeared that the EDA was unable to expose deceptive participants viewing subjective stimuli. This result was not expected as it appears to be easier to distinguish deception from the truth if participants are more aroused or anxious (Gen-yue et al., 2005; Giesen, & Rollison; 1980).

The relatability variable conceived in this experiment was designed to influence to what degree participants related to certain statements. For instance, when viewing the question 'Have you ever slept in an igloo?' participants were encouraged to relate personally to the question, since the question is formulated in a subjective manner. When viewing the question 'Does Ice-cream need to be served with pepper?' participants were not encouraged to relate personally to the question since the question was formulated in an objective manner. The relatable stimuli used during this study, however, did not necessarily contain information that was relational to the participants' personal concerns at that moment. The relatable stimuli used could only be

considered more relatable because the stimuli were either formulated in a subjective or objective manner. The relatability variable used during this study can potentially influence EDA if the relatable stimuli are strengthened.

It is possible to strengthen the effects of relatability by taking into account personal concerns of the participants. It is found that stimuli concerning participants' personal concerns or situations can cause higher EDA (William, 1943; Orr, & Pitman, 1993; Pineles et al., 2013; Singleton, Ashwin, & Brosnan, 2014). Bonnet, & Naveteur (2006) recorded EDA for participants with chronic low back pain and healthy participants. All participants passively viewed words that were, pain descriptors, emotional words or neutral words. It appeared that for low back pain sufferers SCRs were higher for pain descriptors or emotional words, compared to neutral words. For healthy participants there was no difference in EDA for the words presented. This indicates that EDA is influenced by how participants relate to words. In case of the current research it is potentially possible to increase relatability of various stimuli by including concerns that are relatable to the participants. Including stimuli that address relatable concerns of participants can thus potentially influence EDA more than simply formulating stimuli to be subjective or objective.

Future Research

In order to better understand how EDA and EEG are influenced by deception and emotional states it would be beneficial to conduct more experiments in which EDA and EEG measurement are combined. In combining these measurements it would become possible to obtain a complete picture of both cognitive and physiological responses. It would be interesting to compare EDA and EEG measurement during an experimental setup where both deception and stimulus emotionality influence arousal. In order for participants to feel a difference between emotional and non-emotional stimuli it would be necessary to increase relatability of emotional stimuli. This can for instance be achieved by corresponding stimuli to participants' personal concerns. By questioning participants during the pre-study about various concerns, it can be established what topics are more relatable to the research group. In doing so, relatability can be increased beyond simply examining the difference between subjective and objective stimuli. By creating emotional stimuli that address relatable concerns and non-emotional stimuli that address non-relatable

concerns, the difference between emotional stimuli and non-emotional stimuli can be increased. Another method of increasing arousal felt when deceiving during the course of the experiment is a change in research setting. When for instance employing the GKT or GAT in the experimental setting, participants first witness a fake crime prior to the experiment. During the experiment participants are asked questions regarding the fake crime. Participants lie during the experiment in order to avoid getting caught. When explicitly motivating participants to deceive and promising a monetary reward for successful deception prior to the experiment, it is possible to further increase arousal felt when deceiving during the experiment (Elaad, 2013). It would be very informative to determine how body and mind relate when deceiving in a more arousing setting.

References

Annett, M. (1970). A classification of hand preference by association analysis. British Journal of Psychology, 61, 303-321.

Bach, D. R., Daunizeau, J., Kuelzow, N., Friston, K. J., & Dolan, R. J. (2011). Dynamic causal modeling of spontaneous fluctuations in skin conductance. *Psychophysiology*, *48*(2), 252-7. http://doi.org/10.1111/j.1469-8986.2010.01052.x

Bamford, S., Broyd, S. J., Benikos, N., Ward, R., Wiersema, J. R., & Sonuga-Barke, E. (2015). The late positive potential: A neural marker of the regulation of emotion-based approach-avoidance actions? *Biological Psychology*, *105*, 115-123.

Banks, S. J., Bellerose, J., Douglas, D., & Jones-Gotman, M. (2012). Bilateral Skin Conductance Responses to Emotional Faces. *Applied Psychophysiology and Biofeedback*, *37*(3), 145-152. http://doi.org/10.1007/s10484-011-9177-7

Benedek, M., & Kaernbach, C. (2010). Decomposition of skin conductance data by means of nonnegative deconvolution. *Psychophysiology*, *47*(4), 647-658.

Ben-Shakhar, G. (1985). Standardization within individuals: Simple method to neutralize individual differences in skin conductance. *Psychophysiology*, *22*, 292-299

Biferno, M. A. (1985). Mental workload measurement : event-related potentials and ratings of workload and fatigue.

Bonnet, A., & Naveteur, J. (2006). Electrodermal responses to words in chronic low back pain patients: a comparison between pain descriptors, other emotional words, and neutral words. *The Clinical Journal of Pain*, *22*(8), 686-691.

Boucsein, W. (2012). Electrodermal activity. New York, NY: Springer

Caldwell-Harris, C. L. (2015). Emotionality Differences Between a Native and Foreign Language Implications for Everyday Life. *Current Directions in Psychological Science*, *24*(3), 214-219. http://doi.org/10.1177/0963721414566268

Campos, A., Marcos, J. L., & González, M. A. (1999). Relationship between properties of words and elicitation of skin conductance response. *Psychological Reports, 85(3),* 1025-1030.

Chung, S., Min, Y., Lee, B., Tack, G., Yi, J., You, J., Jun, J., & Min, B. (2007). Development of the Real-Time Subjective Emotionality Assessment (RTSEA) system. *Behavior Research Methods, 39(1),* 144-150.

Cuthbert, B. N., Schupp, H. T., Bradley, M. M., Birbaumer, N., & Lang, P.J., (2000). Brain potentials in affective picture processing: covariation with autonomic arousal and affective report. *Biological Psychology, 52 (2),* 95–111.

Elaad, E. (2013). Effects of goal- and task-oriented motivation in the guilty action test. *International Journal of Psychophysiology*, *88*(1), 82-90.

Ekman, P. (1992). Telling Lies: Clues to Deceit in the Marketplace, Politics, and Marriage, New York: W.W. Norton.

Ekman, P. (2001). Telling lies: Clues to deceit in the marketplace, politics, and marriage (3rd ed.). New York: W.W. Norton & Company.

Frank, M. G., & Svetieva, E. (2012). Lies worth catching involve both emotion and cognition. *Journal of Applied Research in Memory and Cognition*, *1*(2), 131–133. http://doi.org/10.1016/j.jarmac.2012.04.006

Frank, M.G., Yarbrough, J.D., Ekman, P. (2006). Investigative interviewing and the detection of deception. *Investigative interviewing: rights, research, regulation,* 229-255.

Fogelson, N., Loukas, C., Brown, J., & Brown, P. (2004). A common N400 EEG component reflecting contextual integration irrespective of symbolic form. *Clinical Neurophysiology, 115*(6), 1349-1358. http://doi.org/10.1016/j.clinph.2004.01.010

Gen-yue, F., Chang-kai, C., Wei, M., & Xiao-feng, N. (2005). The effect of emotionality in lie-detection questions on skin conductance response. *Chinese Journal of Clinical Psychology, 13(3),* 321-323.

Giesbrecht, T., Merckelbach, H., van Oorsouw, K., & Simeon, D. (2010). Skin conductance and memory fragmentation after exposure to an emotional film clip in depersonalization disorder. *Psychiatry Research, 177*(3), 342-349.

Giesen, M., & Rollison, M. A. (1980). Guilty Knowledge versus Innocent Associations : Effects of Trait Anxiety and Stimulus Context on Skin Conductance. *Journal of Research in Personality, 14*, 1-11.

Gustafson, L. A., & Orne, M. T. (1963). Effects of heightened motivation on the detection of deception. *Journal of Applied Psychology, 47(6),* 408-411.

Hagoort, P., Hald, L., Bastiaansen, M., & Petersson, K. M. (2004). Integration of word meaning and world knowledge in language comprehension. Science, 304(5669), 438–441.

Hajcak, G., Nieuwenhuis, S., (2006). Reappraisal modulates the electrocortical response to unpleasant pictures. *Cognitive, Affective, & Behavioral Neuroscience, 6 (4),* 291–297.

Houle, T. T., Turner, D. P., & Penzien, D. B. (2013). Type I error in headache research. *Headache*, *53*(7), 1031–1033. http://doi.org/10.1111/head.12144

Humphreys, L., & Peelo, M. (2013). Understanding Deception: Disentangling Skills from Conviction. *Howard Journal of Criminal Justice*, *52*(1), 55–64. http://doi.org/10.1111/j.1468-2311.2012.00725.x

Jänig, W. (2006). The integrative action of the autonomic nervous system. Neurobiology of homeostasis. Cambridge: University Press.

Kuperberg, G. R. (2015). Separate streams or probabilistic inference? What the N400 can tell us about the comprehension of events. *Language, Cognition and Neuroscience*, *31*(5), 602–616. http://doi.org/10.1080/23273798.2015.1130233

Kuperberg, G. R., Sitnikova, T., Caplan, D., & Holcomb, P. J. (2003). Electrophysiological distinctions in processing conceptual relationships within simple sentences. Cognitive Brain Research, 17(1), 117–129. doi:10.1016/S0926-6410(03)00086-7

Lagopoulos, J. (2007). Electrodermal activity. *Acta Neuropsychiatrica*, *19*(5), 316-317. http://doi.org/10.1111/j.1601-5215.2007.00247.x

Lole, L., Gonsalvez, C. J., Barry, R. J., & Blaszczynski, A. (2014). Problem gamblers are hyposensitive to wins: An analysis of skin conductance responses during actual gambling on electronic gaming machines. *Psychophysiology*, *51*(6), 556-564.

Kagle, J. (1998). Are We Lying to Ourselves about Deception? Social Service Review, 72(2), 234-250.

Mahon, J. E. (2008). The definition of lying and deception. In E. N. Zalta (Ed.), Stanford encyclopedia of philosophy.

Mardaga, S., & Hansenne, M. (2010). Does Personality Modulate Skin Conductance Responses to Emotional Stimuli? *Journal of Individual Differences*, *31*(3), 124-129. http://doi.org/10.1027/1614-0001/a000009

Mardaga, S., & Hansenne, M. (2011). Personality and Skin Conductance Responses to Reward and Punishment. *Journal of Individual Differences*, *33*(1), 17-23. http://doi.org/10.1027/1614-0001/a000057

Mardaga, S., Laloyaux, O., & Hansenne, M. (2006). Personality traits modulate skin conductance response to emotional pictures: An investigation with Cloninger's model of personality. *Personality and Individual Differences*, *40*(8), 1603-1614.

Matsuda, I., & Nittono, H. (2015). Motivational significance and cognitive effort elicit different late positive potentials. *Clinical Neurophysiology*, *126*(2), 304–313.

McGinnies, E. (1949). Emotionality and perceptual defense. *Psychological Review*, *56*(5), 244-251. http://doi.org/10.1037/h0056508

Meek, S. W., Phillips, M. C., Boswell, C. P., & Vendemia, J. M. C. (2013). Deception and the misinformation effect: An event-related potential study. *International Journal of Psychophysiology*, *87*(1), 81–87. http://doi.org/10.1016/j.ijpsycho.2012.11.004

Minnix, J. A., Versace, F., Robinson, J. D., Lam, C. Y., Engelmann, J. M., Cui, Y., & Cinciripini, P. M. (2013). The late positive potential (LPP) in response to varying types of emotional and cigarette stimuli in smokers: A content comparison. *International Journal of Psychophysiology*, *89*(1), 18-25. http://doi.org/10.1016/j.ijpsycho.2013.04.019

Moran, T. P., Jendrusina, A., & Moser, J. S. (2013). The psychometric properties of the late positive potential during emotion processing and regulation. *Brain Research*, *1516*, 66-75. http://doi.org/10.1016/j.brainres.2013.04.018

Moser, J.S., Hajcak, G., Bukay, E., & Simon, R.F., (2006). Intentional modulation of emotional responding to unpleasant pictures: An ERP study. *Psychophysiology, 43 (3)*, 292–296.

Najström, M., & Jansson, B. (2007). Skin conductance responses as predictor of emotional responses to stressful life events. *Behavior Research and Therapy*, *45*(10), 2456-2463. http://doi.org/10.1016/j.brat.2007.03.001

Nikula, R., Klinger, E., & Larson-Gutman, M. (1993). Current Concerns and Electrodermal Reactivity: Responses to Words and Thoughts. *Journal of Personality*, *61*(1), 63-84. http://doi.org/10.1111/j.1467-6494.1993.tb00279.x

Orr, S. P., & Pitman, R. K. (1993). Psychophysiologic assessment of attempts to simulate posttraumatic stress disorder. *Biological Psychiatry*, *33*(2), 127–129. http://doi.org/10.1016/0006-3223(93)90312-2

Pineles, S. L., Suvak, M. K., Liverant, G. I., Gregor, K., Wisce, B. E., Pitman, R. K., & Orr, S. P. (2013). Psychophysiologic reactivity, subjective distress, and their associations with PTSD diagnosis.

Proverbio, A. M., Vanutelli, M. E., & Adorni, R. (2013). Can You Catch a Liar? How Negative Emotions Affect Brain Responses when Lying or Telling the Truth. *Plos One*, *8*(3). http://doi.org/10.1371/journal.pone.0059383

Saladin, M. E., Gray, K. M., Carpenter, M. J., LaRowe, S. D., DeSantis, S. M., & Upadhyaya, H. P. (2012). Gender differences in craving and cue reactivity to smoking and negative affect/stress cues. *American Journal on Addictions*, *21*(3), 210–220.

Salisbury, D. F. (2004). Semantic memory and verbal working memory correlates of N400 to subordinate homographs. *Brain and Cognition*, *55*(2), 396–399. http://doi.org/10.1016/j.bandc.2004.02.057

Seiter, J. S., & Bruschke, J. (2007). Deception and Emotion: The Effects of Motivation, Relationship Type, and Sex on Expected Feelings of Guilt and Shame Following Acts of Deception in United States and Chinese Samples. *Communication Studies*, *58*, 1–16. http://doi.org/10.1080/10510970601168624

Skinner, B. F. (1953). Science and human behavior. New York: The Free Press.

Singleton, C. J., Ashwin, C., & Brosnam, M. (2014). Physiological responses to social and nonsocial stimuli in neurotypical adults with high and low levels of autistic traits: Implications for understanding nonsocial drive in autism spectrum disorders. *Autism Research, 7(6),* 695-703.

Stormark, K. M., Laberg, J. C., Nordby, H., & Hugdahl, K. (2000). Alcoholics' selective attention to alcohol stimuli: automated processing?. *Journal of Studies on Alcohol, 61(1),* 18-23.

Thiruchselvam, R., Blechert, J., Sheppes, G., Rydstrom, A., & Gross, J. J., (2011). The temporal dynamics of emotion regulation: An EEG study of distraction and reappraisal. *Biological Psychology, 87 (1),* 84–92. http://dx.doi.org/10.1016/j.biopsycho.2011.02.009

Wenger, C. B. (2003). Thermoregulation. In I. M. Freedberg, A. Z. Eisen, K. Wolff, K. F. Austen, L. A. Goldsmith, & S. I. Katz (Eds.), Dermatology in general medicine (Volume 1, pp. 119-127). McGrawHill: New York.

William, E. B. (1943). A study of the relations which the galvic skin response and sensory reference bear to judgments of the meaningfulness, significance, and importance of 72 words. *The Journal of Psychology, 16*, 21-34.

Appendices

Appendix A

Translated Pre-study Stimuli

1	Wat is je geslacht?
2	Jij hebt de ziekte lepra
3	De nekwervels worden 'cervicale' genoemd
4	De Smurfen zijn blauw van kleur
5	Jouw schoenmaat is X
6	Je bent nooit in de sneeuw geweest
7	Vrouwen hebben drie borsten
8	Heb je ooit met Spielberg gewerkt?
9	Er moet altijd koffie in een taart
10	Ben je ooit in Frankrijk geweest?
11	De iris is het gekleurde deel van het oog
12	De vierkantswortel van 9 is 2
13	Je bent graag naakt in het openbaar
14	De schaamspleet is oranje van kleur
15	Je wilt kinderen niet injecteren met heroïne
16	Je uitwerpselen zijn meestal bruin
17	In Auschwitz verdwenen veel kinderen
18	Jij hebt een kind gemolesteerd
19	Heb je ooit in een iglo geslapen?
20	Kun je met jouw tong je voorhoofd likken?
21	Limburg wordt door de zee omgeven
22	Een bever is een groot knaagdier
23	Er zit vaak gekookte vis in een pudding
24	Sperma is een troebele vloeistof
25	Je wilt dat je moeder pijnlijk sterft
26	IJs moet je met peper serveren
27	Jij eet graag x
28	Slijm is vaak kleverig
29	De basisschool duurt 5 jaar
30	December is de vijfde maand van het jaar
31	Heb je een mobiele telefoon?

32 Jij wilt geen baby's mishandelen

33 De schaamstreek zit vol met haren

34 Heb je ooit een toneelstuk bijgewoond?

35 Luizen veroorzaken doorgaans jeuk

36 De katheter wordt via een opening aangelegd

37 Jij bent X cm groot

38 Een seriemoordenaar is zeer gevaarlijk

39 Een trommel wordt gespeeld met een boog

40 Heb je ooit aan 'bungee jumping' gedaan?

41 Jij hebt ooit een beha / boxer gedragen

42 Viagra stimuleert de erectie

43 Je hebt een kind doorboord met een haak

44 Een week bestaat altijd uit 5 dagen

45 Jij hebt je moeder gevierendeeld

46 Heb je vroeger beugels gedragen?

47 De bidet wordt gebruikt voor de hygiëne

48 De schil is het centrale deel van een appel

49 Jij bent verminkt

50 Heb je ooit polo gespeeld?

51 Jouw naam is X

52 Angelina Jolie is een zangeres

53 Kun je zwemmen?

54 Aambeien zijn een tandziekte

55 Je bent vaak in Peru geweest

56 Je bent een nazi

57 De clitoris is een cruciaal deel voor voortplanting

58 Jij hebt testikels / borsten

59 Je woont in X

60 Jij hebt wel eens medicatie geslikt

61 Je zou kinderen nooit levend villen

62 17 is een priemgetal

63 Je bezit veel stropdassen

64 Jij produceert zaadcellen / Jij maakt gebruik van tampons

65 Vrouwen hebben normaal twee tepels

66 Honden tot de dood verbranden is wreed

67 Uitzaaiing is de verspreiding van kanker

68 Het is fijn om levend gevild te worden

69 De G-spot is een vervelend gebied

70 Je hebt een penis

71 Je steekt als hobby je nagels in je oog

72 De vagina is het vrouwelijk voortplantingsorgaan

73 Voorspel volgt de penetratie

74 De dood van een familielid raakt je

75 Jij hebt je gezalfd met oorsmeer

76 Jij vermijdt het om naar een lijkhuis te gaan

77 De hartslag wordt met een spuit gemeten

78 Een voetbalteam speelt met 4 spelers

79 Ben je ooit in een trein geweest?

80 Herpes op de lippen is besmettelijk

81 Rook je?

82 De klarinet is een blaasinstrument

83 Je zat op de middelbare school X

84 Jij produceert zweet bij zware inspanning

85 Kun je fietsen?

86 Een zwangerschap duurt negen maanden

87 Als je wakker wordt heb je vuile ogen

88 Je verbrandt graag jouw tong

89 Oorsmeer is heerlijk om te eten

90 Teken zuigen bloed als voeding

91 De paling leeft normaal in de woestijn

92 Jouw ogen zijn roze

93 Ik bezit een computer

94 Het Rijksmuseum staat in Rotterdam

95 Je hebt last van schurft

96 Een maagd heeft seks met wisselende contacten

97 12 is een veelvoud van 5

98 In Spanje vinden stierengevechten plaats

99 Urine is meestal een gele vloeistof

100 ´Music´ betekent ´muziek´ in het Engels

101 Jij hebt ooit in je leven een boer gelaten

102 Je besmet opzettelijk waterleidingen

103 Jij moet wel eens poepen

104 Op het ogenblik heb je schaamhaar

105 Mensen in coma kunnen zwemmen

106 Jij plast regelmatig in het toilet

107 Veel Joden kwamen om in gaskamers

108 Jij bent gelovig / Jij bent atheïst

109 Jij houd van / Jij haat gekruid eten

110 De bh is leider in mannen ondergoed

111 Jij slaapt in een bed vol spinnen

112 Je slaat invalide mensen in elkaar

113 Het Romeinse cijfer X betekend 10

114 Jij hebt een tweede voornaam

115 Jij eet niet graag X

116 Heb je borsten / testikels?

117 'U' in USA staat voor 'United

118 Pornofilms zijn favoriet onder kinderen

119 Het condoom is een anticonceptiemiddel

120 Jij schrijft met de rechterhand

121 Genitale verminking is verplicht in Europa

122 Jij steekt geen naalden in mensen hun navel

123 Diarree verhoogt de ontlastings-consistentie

124 Jij moet een hersentumor laten verwijderen

125 Ben je ooit in Australië geweest?

126 Het is goed om uitwerpselen te eten

127 Vroegtijdige ejaculatie is een longziekte

128 Jij bent vaak in Japan

129 Een pedofiel verkracht kinderen

130 13 is een oneven getal

131 Jij drinkt dagelijks verrot bloed

132 Voor je diploma moet je een these presenteren

133 Een scalpel snijdt de huid

134 De viool is een snaarinstrument

135 Het 'geen parkeerplaats' teken is paars

136 Jij hebt een penis / clitoris

137 Je hebt luizen

138 Erogene zones zorgen voor seksueel plezier

139 Jij hebt geen gecastreerde in je familie

140 Je achternaam is X

141 Er zijn drie wijzen die komen uit het Oosten

142 Ben je ooit in een pretpark geweest

143 Jij hebt iemands tanden eruit getrokken

144 Madonna is een beroemd zangeres

145 De tandarts heeft ooit in je tanden geboord

146 Jij vindt spinnen leuke dieren

147 Een accordeon is een soort drum

148 Het is fout om kattennagels af te scheuren

149 Als je een puist uitknijpt komt er talg uit

150 In het Engels spreek je vis uit als ´fish´

151 Tom Cruise is een beroemd acteur

152 Het hart bestaat uit 6 hartkamers

153 Uitwerpselen ruiken net als parfum

154 Het eiwit is het rode deel van het ei

155 Ik houd van stamppot

156 Neuspeuteren is een goede gewoonte

157 Je hebt nog nooit gestemd

158 Jij houdt van / Jij haat de geur van benzine

159 Bevallen gebeurd via de anus

160 Jezus is op 60 jarige leeftijd overleden

161 Kenia ligt dichter bij de evenaar dan België

162 Een penis is gemiddeld 40 cm lang

163 Jij bezit geen MP3-speler

164 Zwangere vrouwen slaan is goed

165 Het scrotum bevat de testikels

166 Jij hebt een vagina / penis

167 Een jaar bestaat uit 365 dagen

168 De testikels zijn bedoeld voor borstvoeding

169 Je mag etnische minderheden martelen

170 Je springt vaak met een parachute

171 Jij spoelt je ontlasting weg in de wc

172 Je hebt geen fiets

173 Een vibrator is een seksspeeltje

174 Je bent geboren in New Delphi

175 Bij opknoping is de doodsoorzaak verstikking

176 Je hebt een clitoris

177 Onderbroeken zijn van glas gemaakt

178 Jij bent expert in verminking

179 Slijm is vaak groenachtig

180 Houd je van pizza?

181 Heb je ooit een theatershow gezien?

182 Heb je ooit niet thuis geslapen?

183 Je gaat ooit op een dag sterven

184 De Scheve Toren staat in Rome

185 In het sprookje 'Sneeuwwitje' zijn 20 dwergen

186 Je bent nooit aan zee geweest

187 Jij bent wel eens bloed verloren

188 Jij eet graag een placenta

189 Een dag bestaat uit 24 uur

190 Strelen stimuleert seksuele opwinding

191 Jouw moeder heet Assunta

192 Jij hebt een verbrijzelde schedel

193 Heb je ooit een tekening gemaakt?

194 Het Nederlandse parlement zetelt in Utrecht

195 'Hello' is het Engelse woord voor 'Hoi'

196 Heb je ooit op een olifant gereden?

197 Pus is lekker om te likken

198 Jij trekt graag andermans ogen eruit

199 De penis is driehoekig van vorm

200 Heb je ooit op een paard gereden?

201 De falanx is het polsgewricht

202 Menselijk bloed bevat wormen

203 De kameleon leeft op bomen

204 Heb je ooit een tekenfilm gezien?

205 Jij draagt bijna altijd een spijkerbroek

206 Jij eet vlees

207 Het stopbord is rood van kleur

208 Ben jij in een museum geweest

209 Ben je ooit op safari geweest?

210 Jij draagt vaak een kilt

211 Je bent nergens allergisch voor

212 Een trouwring hoort om de middelvinger

213 Veel mensen vinden dat scheten stinken

214 De kolf is een soort schimmel

215 Het orgasme is een onaangename reactie

216 Je bent geboren in 19XY

217 Je ademt insecten in door je neus

218 Jij hebt een duif in zuur opgelost

219 Je hebt 9 tatoeages

220 Een orgie is een seks groep

221 Jij wilt je grootouders lichamelijk martelen

222 Drenthe grenst aan Groningen

223 Daklozen moeten levend verbrand worden

224 Het is leuk om honden met stokken te doden

225 Alle kinderen moeten uitgeroeid worden

226 In Egypte kun je piramides vinden

227 Jij komt liever niet in contact met AIDS

228 Masturbatie is een synoniem voor de hoest

229 Gebruikt maandverband moet vervangen worden

230 Jij houdt van katten of honden

231 De Simpsons zijn geel van kleur

232 Je kunt een drievoudige salto doen

233 Jij hebt wel eens overgegeven

234 Het eten van mensenvlees is fout

235 Nederland grenst in het zuiden aan België

236 Steniging is een normale straf in Nederland

237 Jij haalt er plezier uit om insecten te likken

238 Je hebt X broers

239 Verkrachting is een hevige misdaad

240 Het kruis van de apotheek is wit

241 Je hebt nog nooit in je leven gekookt

242 Bij de eerste keer seks breekt het maagdenvlies

243 Je haar is groen

244 Heb je een rijbewijs?

245 Een minuut bestaat uit 100 seconden

246 Heb je ooit een boek gelezen?

247 Vlieland heeft een zeshoekige vorm

248 De vierde letter in het alfabet is: 'Z'

249 Ben je ooit naar de bioscoop geweest?

250 Jij hebt minstens één T-shirt in jouw kast

251 Mannen hebben twee teelballen

252 Wanneer je je haar borstelt komt er roos uit

253 De Kama Sutra is een politiek verdrag

254 In tiramisu zitten vaak koekjes

255 Er zijn drie hoeken in een bol

256 Er werd veel gemarteld in concentratiekampen

257 Saté is een Indonesische specialiteit

258 In de VS worden soms dodelijke injecties gebruikt

259 Pinoccio werd van tin gemaakt

260 In de ochtend heb je een slechte adem

261 Kun je volleyballen?

262 Inktvis is een typisch kerstgerecht

263 Je vindt het leuk om puisten uit te knijpen

264 Mark Rutte is een wetenschapper

265 Jij eet dagelijks twee bakken vol slijm

266 Je hebt nooit op een motorfiets gereden

267 Je weigert het om iemands keel door te snijden

268 Jij eet regelmatig regenwormen

269 Je was ooit in het ziekenhuis

270 Mensen met een handicap worden bespot

271 Jij vindt het lekker om kots te drinken

272 Jij hebt je naasten met littekens bedekt

273 De penis is het mannelijke voortplantingsorgaan

274 De president van Amerika heet Barack Obama

275 Tijdens een erectie zwelt de penis

276 Je bent een kamikaze

277 Sushi is typisch voor Marokko

278 Je hebt slechte bloedwaardes gehad

Appendix B

Pre-study Analysis

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Mean	Man	10	2,1079	,76484	,24186
	Vrouw	10	2,1318	,45322	,14332
STDEV	Man	10	1,1201	,32701	,10341
	Vrouw	10	1,4474	,15160	,04794

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean	Equal variances assumed	2,411	,138	-,085	18	,933	-,02383	,28114	-,61448	,56682
	Equal variances not assumed			-,085	14,627	,934	-,02383	,28114	-,62440	,57674
STDEV	Equal variances assumed	9,808	,006	-2,871	18	,010	-,32726	,11398	-,56672	-,08779
	Equal variances not assumed			-2,871	12,698	,013	-,32726	,11398	-,57410	-,08042

Appendix C

Experiment; Informed Consent

Ik verklaar hierbij op voor mij duidelijke wijze te zijn ingelicht over de aard en methode van het onderzoek `Het leugenachtige brein en lichaam`. Mijn vragen zijn naar tevredenheid beantwoord. Ik stem geheel vrijwillig in met deelname aan dit onderzoek. Ik behoud daarbij het recht deze instemming weer in te trekken zonder dat ik daarvoor een reden hoef op te geven en besef dat ik op elk moment mag stoppen met het experiment. Indien mijn onderzoeksresultaten gebruikt zullen worden in wetenschappelijke publicaties, dan wel op een andere manier openbaar worden gemaakt, zal dit volledig geanonimiseerd gebeuren. Mijn persoonsgegevens zullen niet door derden worden ingezien zonder mijn uitdrukkelijke toestemming.

Als ik nog verdere informatie over het onderzoek zou willen krijgen, nu of in de toekomst, kan ik me wenden tot Sarah Winkler (e-mail: s.winkler@student.utwente.nl) en tot Quincy Boom (e-mail: q.o.boom@student.utwente.nl).

Voor eventuele klachten over dit onderzoek kunt u zich wenden tot de secretaris van de Commissie Ethiek van de faculteit Gedragswetenschappen van de Universiteit Twente, mevr. J. Rademaker (telefoon: 053-4894591; e-mail: j.rademaker@utwente.nl, Postbus 217, 7500 AE Enschede).

Aldus in tweevoud getekend:

…… ……

Naam proefpersoon Handtekening

Ik heb toelichting verstrekt op het onderzoek. Ik verklaar mij bereid nog opkomende vragen over het onderzoek naar vermogen te beantwoorden.'

…… ……

Naam onderzoeker Handtekening

Appendix D

Annett Handedness Inventory (Annett, 1970)

	Always left	Mostly left	No preference	Mostly right	Always right
Writing a letter					
Throw a ball to hit a target					
To play a racket in tennis, squash, etc.					
What hand is up to handle a broom removing dust from the floor					
What hand is up to manipulate a shovel					
Lighting matches					
Scissors when cutting paper					
To hold a wire to move it through the eye of a needle					
To distribute playing cards					
To hit a nail on the head					
To hold your toothbrush					
To remove the cover from a jar					
	-2	-1	0	1	2

-24 to -9	left handed
-8 to +8	ambidextrous
+9 to +24	right handed

Appendix E

Experimental Stimuli

1 Je bezit een mobiele telefoon
2 Je achternaam is ´van Dijk´
3 Je snuift insecten op
4 Je bent een kamikaze
5 Je bent geboren in New Delphi
6 Je bent graag naakt in het openbaar
7 Je hebt een peuter verkracht
8 Je slaat invalide mensen in elkaar
9 Je steekt als hobby nagels in je oog
10 Je snijdt graag iemands keel door
11 Je wilt kinderen injecteren met heroïne
12 Je woont in Borne
13 Je wilt kinderen levend villen
14 Je bent expert in verminking
15 Je bent gelovig
16 Je eet dagelijks bakken vol slijm
17 Je eet graag een placenta
18 Je eet regelmatig regenwormen
19 Je hebt een kind gemolesteerd
20 Je hebt een tweede voornaam
21 Je hebt een penis
22 Je hebt een verbrijzelde schedel
23 Je bent gezalfd met oorsmeer
24 Je bezit minstens één T-shirt
25 Je hebt ooit een beha gedragen
26 Je komt graag in contact met AIDS
27 Je produceert zweet bij zware inspanning
28 Je schrijft met je rechterhand
29 Je spoelt je ontlasting weg in de wc
30 Je steekt naalden in mensen hun navel
31 Je vermijdt het bezoek aan een lijkhuis
32 Je drinkt graag kots
33 Je wilt baby's mishandelen
34 Jouw naam is Kees
35 Als je wakker wordt heb je vuile ogen
36 De G-spot is een vervelend gebied
37 Je bent een nazi
38 Je besmet opzettelijk drinkwater
39 Je gaat ooit dood
40 Je hebt twee broers
41 Je uitwerpselen zijn meestal bruin
42 Je verbrandt graag jouw tong
43 Je wilt dat je moeder pijnlijk sterft
44 Je drinkt dagelijks verrot bloed
45 Je vindt pizza vies
46 Je likt graag insecten
47 Je hebt lepra
48 Je hebt een duif in zuur opgelost
49 Je hebt een gecastreerde in je gezin
50 Je hebt iemands tanden uitgetrokken
51 Je hebt je moeder gevierendeeld
52 Je hebt ooit een boer gelaten
53 Je moet een hersentumor laten verwijderen
54 Je moet wel eens poepen
55 Je gebruikt tampons
56 Je slaapt in een bed vol spinnen

57 Je trekt graag andermans ogen uit
58 Je wilt je grootouders lichamelijk martelen
59 Jouw schoenmaat is 55
60 Je hebt een clitoris
61 Je hebt borsten
62 Je bent in Australië geweest
63 Je bent ooit in een pretpark geweest
64 Je hebt ooit met de trein gereisd
65 Je bent in Frankrijk geweest
66 Je hebt ooit de bioscoop bezocht
67 Je was ooit op safari
68 Bevallen gebeurt via de anus
69 Testikels zijn bedoeld voor borstvoeding
70 Je hebt een rijbewijs
71 Je hebt ooit aan 'bungee jumping' gedaan
72 Je hebt ooit een boek gelezen
73 Je hebt ooit een tekenfilm gezien
74 Je hebt ooit een tekening gemaakt
75 Je bent ooit een theatershow gezien
76 Je hebt ooit een toneelstuk bijgewoond
77 Je hebt wel eens in een iglo geslapen
78 Je hebt met Spielberg gewerkt
79 Je hebt wel eens niet thuis geslapen
80 Je hebt ooit op een olifant gereden
81 Je hebt wel eens paard gereden
82 Je hebt ooit polo gespeeld
83 Je hebt vroeger een beugel gedragen
84 'Hello' is het Engelse woord voor 'Hoi'
85 IJs wordt met peper geserveerd
86 Als je opstaat heb je een slechte adem
87 Je bent geboren in 1960
88 Je hebt ooit de zee gezien
89 Je hebt ooit sneeuw gezien
90 Je bent in Peru geweest
91 Je bezit veel stropdassen
92 Je haar is van nature groen
93 Je bent volledig bedekt met tatoeages
94 Je bezit een fiets
95 Je hebt last van schurft
96 Je hebt luizen
97 Je hebt ooit gestemd
98 Je hebt ooit gekookt
99 Je hebt ooit op een motorfiets gereden
100 Je had onlangs slechte bloedwaardes
101 Je kunt een drievoudige salto doen
102 Je knijpt graag puisten uit
103 Je was ooit in het ziekenhuis
104 Je bent vaak in Japan
105 Je bent verminkt
106 Je hebt wel eens bloed verloren
107 Je bezit een MP3-speler
108 Je draagt vaak een spijkerbroek
109 Je draagt vaak roze kilts
110 Je eet vlees
111 Je hebt je naasten met littekens bedekt
112 Je hebt wel eens medicatie geslikt
113 Je hebt wel eens overgegeven
114 Je vindt spinnen leuke dieren
115 Jouw moeder heet Assunta
116 Je hebt roze ogen
117 Je kunt fietsen
118 Je kunt jouw voorhoofd likken

119 Je kunt volleyballen
120 Je hebt nu schaamhaar
121 Je rookt
122 Je hebt last van roos
123 ´Music´ betekent ´muziek´ in het Engels
124 13 is een oneven getal
125 17 is een priemgetal
126 Bij het uitknijpen van een puist komt talg vrij
127 Bij opknoping is de doodsoorzaak verstikking
128 Daklozen moeten levend verbrand worden
129 De clitoris is cruciaal voor de voortplanting
130 De dood van een familielid raakt je diep
131 De Kama Sutra is een politiek verdrag
132 Een injectie vindt plaats met een naald
133 De klarinet is een blaasinstrument
134 Een borstpomp is voor borstvergroting
135 Paling leeft in de woestijn
136 Barack Obama is de president van Amerika
137 De schaamspleet is oranje van kleur
138 Er staan piramides in Haarlem
139 Smurfen zijn blauw van kleur
140 Er is ooit in je tanden geboord
141 December is de vijfde maand van het jaar
142 De accordeon is een slagwerkinstrument
143 Een dag bestaat uit 24 uur
144 Een jaar bestaat meestal uit 365 dagen
145 Een maagd heeft vaak seks
146 Een pedofiel verkracht kinderen
147 Een penis is gemiddeld 40 cm lang
148 Een seriemoordenaar is erg gevaarlijk
149 Een trommel wordt bespeeld met een strijkstok
150 Een voetbalteam bestaat uit 4 spelers
151 Er moet altijd koffie in een taart
152 Een bol heeft drie hoeken
153 Erogene zones zorgen voor seksueel plezier
154 Maandverband moet je vervangen
155 Genitale verminking is verplicht in Europa
156 Herpes op de lippen is besmettelijk
157 Eiwit is het rode deel van het ei
158 Het hart heeft 6 hartkamers
159 Uitwerpselen zijn gezond om te eten
160 Het scrotum bevat testikels
161 Het stopbord heeft een rode rand
162 Honden dodelijk verbranden is wreed
163 Je houdt van pizza
164 In Auschwitz verdwenen veel kinderen
165 In de VS worden dodelijke injecties gebruikt
166 In Egypte kun je piramides vinden
167 In het Engels spreek je vis uit als ´fish´
168 In Spanje vinden stierengevechten plaats
169 In tiramisu zitten 'Lange Vingers'
170 Nederland ligt niet op de evenaar
171 Luizen veroorzaken jeuk
172 Madonna is een beroemd zangeres
173 Mannen hebben meestal twee teelballen
174 Nederland grenst aan België
175 Saté is Indonesisch
176 Slijm is vaak groenachtig
177 Slijm is vaak kleverig
178 Sperma is een troebele vloeistof
179 Strelen stimuleert seksuele opwinding
180 Tijdens de erectie zwelt de penis

181 Tom Cruise is een beroemd acteur
182 U' in USA staat voor 'United'
183 Uitzaaiing is de verspreiding van kanker
184 Er zijn veel Joden omgekomen in gaskamers
185 Verkrachting is een hevige misdaad
186 Viagra stimuleert de erectie
187 Vlieland heeft een zeshoekige vorm
188 Voor je diploma moet je ooit iets presenteren
189 Veel mensen vinden dat scheten stinken
190 12 is een veelvoud van 5
191 Aambeien zijn een tandziekte
192 Kinderen moeten uitgeroeid worden
193 Angelina Jolie is een zangeres
194 Ontmaagding is het breken van het maagdenvlies
195 De basisschool duurt 5 jaar
196 De BH is leider in mannenondergoed
197 Het bidet wordt gebruikt voor de hygiëne
198 De hartslag wordt met een spuit gemeten
199 Mensen hebben meestal twee ogen
200 De kameleon leeft op bomen
201 In de rug zitten wervels
202 De penis is driehoekig van vorm
203 De penis is het mannelijke voortplantingsorgaan
204 De schaamstreek zit vol met haren
205 De schil is het centrale deel van een appel
206 De Simpsons zijn geel van kleur
207 De vierde letter van het alfabet is: 'Z'
208 De vierkantswortel van 9 is 2
209 De viool is een snaarinstrument
210 Diarree is waterige ontlasting
211 Nederland grenst aan Duitsland
212 De bever is een groot knaagdier
213 Een minuut bestaat uit 100 seconden
214 Een orgie is een seksgroep
215 Men snijdt huid met een scalpel
216 Een trouwring hoort om de middelvinger
217 Een vibrator is een seksspeeltje
218 Een week bestaat uit 5 dagen
219 Een zwangerschap duurt circa negen maanden
220 Er werd veel gemarteld in concentratiekampen
221 De drie wijzen kwamen uit het Oosten
222 Het eten van mensenvlees is fout
223 Het 'geen parkeerplaats' teken is paars
224 Het is fijn om levend gevild te worden
225 Het is fout om kattennagels af te scheuren
226 Het is leuk om honden met stokken te doden
227 Het kruis van de apotheek is wit
228 Koning Willem-Alexander woont in Enschede
229 Het orgasme is een onaangename reactie
230 De Eiffeltoren staat in Ameland
231 Het Romeinse cijfer X betekent 10
232 Je houdt van stamppot
233 In het sprookje 'Sneeuwwitje' zijn er 20 dwergen
234 Inktvis is een typisch kerstgerecht
235 Men mag etnische minderheden martelen
236 Jezus overleed op 60 jarige leeftijd
237 Limburg wordt door de zee omgeven
238 Mark Rutte is een wetenschapper
239 Masturbatie is synoniem voor de hoest
240 Menselijk bloed bevat vaak wormen
241 Mensen in coma kunnen zwemmen
242 Mensen met een handicap worden bespot

243 Neuspeuteren is een goede gewoonte
244 Onderbroeken zijn van glas
245 Je vindt oorsmeer heerlijk smaken
246 Pinoccio is van metaal
247 Pornofilms zijn favoriet onder kinderen
248 Pus is lekker om te likken
249 Steniging is een normale straf in Nederland
250 Sushi is typisch voor Marokko
251 Uitwerpselen ruiken als parfum
252 Voorspel volgt de penetratie
253 Vrouwen hebben drie borsten
254 Zwangere vrouwen slaan is goed
255 Er zit vaak gekookte vis in een pudding

Appendix F

Number of SCRs Analysis

Model Information

Dependent Variable		SCR_Scaled
Probability Distribution		Normal
Link Function		Identity
Subject Effect	1	Participants
Within-Subject Effect	1	Sentence_code
	2	Order
Working Correlation Matrix Structure		AR(1)

Case Processing Summary

	N	Percent
Included	3641	100,0%
Excluded	1	0,0%
Total	3642	100,0%

Correlated Data Summary

Number of Levels	Subject Effect	Participants	15
	Within-Subject Effect	Sentence_code	246
		Order	4
Number of Subjects			15
Number of Measurements	Minimum		217
per Subject	Maximum		246
Correlation Matrix Dimension			881

Categorical Variable Information

			N	Percent
Factor	Deception	Truth	1828	50,2%
		Lie	1813	49,8%
		Total	3641	100,0%
	Relatability	Personal	1671	45,9%
		Impersonal	1970	54,1%
		Total	3641	100,0%
	Emotionality	Low	1834	50,4%
		High	1807	49,6%
		Total	3641	100,0%
	Order	Block 1	890	24,4%
		Block 2	910	25,0%
		Block 3	915	25,1%
		Block 4	926	25,4%
		Total	3641	100,0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	SCR_Scaled	3641	,000000	11,221374	,99991673	1,334635167

Goodness of Fit[a]

	Value
Quasi Likelihood under Independence Model Criterion (QIC)[b]	6413,202
Corrected Quasi Likelihood under Independence Model Criterion (QICC)[b]	6380,020

Dependent Variable: SCR_Scaled

Model: (Intercept), Order, Deception, Relatability, Emotionality, Deception * Relatability, Deception * Emotionality, Relatability * Emotionality

a. Information criteria are in small-is-better form.

b. Computed using the full log quasi-likelihood function.

Tests of Model Effects

Source	Type III		
	Wald Chi-Square	df	Sig.
(Intercept)	151694,960	1	,000
Order	10,118	3	,018
Deception	1,615	1	,204
Relatability	,206	1	,650
Emotionality	,835	1	,361
Deception * Relatability	2,316	1	,128
Deception * Emotionality	,015	1	,902
Relatability * Emotionality	,000	1	,984

Dependent Variable: SCR_Scaled

Model: (Intercept), Order, Deception, Relatability, Emotionality, Deception * Relatability, Deception * Emotionality, Relatability * Emotionality

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	,854	,1289	,601	1,107	43,884	1	,000
[Order=1]	,331	,1709	-,004	,666	3,759	1	,053
[Order=2]	,049	,1149	-,176	,274	,182	1	,670
[Order=3]	-,139	,1274	-,389	,111	1,191	1	,275
[Order=4]	0[a]	.	.	.	.	.	.
[Deception=1]	,182	,1072	-,028	,392	2,880	1	,090
[Deception=2]	0[a]	.	.	.	.	.	.
[Relatability=1]	,075	,0709	-,064	,213	1,106	1	,293
[Relatability=2]	0[a]	.	.	.	.	.	.
[Emotionality=1]	-,034	,0725	-,177	,108	,224	1	,636
[Emotionality=2]	0[a]	.	.	.	.	.	.
[Deception=1] * [Relatability=1]	-,101	,0666	-,232	,029	2,316	1	,128
[Deception=1] * [Relatability=2]	0[a]	.	.	.	.	.	.
[Deception=2] * [Relatability=1]	0[a]	.	.	.	.	.	.
[Deception=2] * [Relatability=2]	0[a]	.	.	.	.	.	.
[Deception=1] * [Emotionality=1]	,008	,0628	-,115	,131	,015	1	,902
[Deception=1] * [Emotionality=2]	0[a]	.	.	.	.	.	.
[Deception=2] * [Emotionality=1]	0[a]	.	.	.	.	.	.
[Deception=2] * [Emotionality=2]	0[a]	.	.	.	.	.	.
[Relatability=1] * [Emotionality=1]	,002	,1276	-,248	,253	,000	1	,984
[Relatability=1] * [Emotionality=2]	0[a]	.	.	.	.	.	.
[Relatability=2] * [Emotionality=1]	0[a]	.	.	.	.	.	.
[Relatability=2] * [Emotionality=2]	0[a]	.	.	.	.	.	.
(Scale)	1,752						

Appendix G

Total Amplitude of SCRs Analysis

Model Information

Dependent Variable		Amplitude_Scaled
Probability Distribution		Gamma
Link Function		Log
Subject Effect	1	Subject
Within-Subject Effect	1	Block_code
	2	Sentence_code
Working Correlation Matrix Structure		AR(1)

Case Processing Summary

	N	Percent
Included	2113	58,0%
Excluded	1529	42,0%
Total	3642	100,0%

Correlated Data Summary

Number of Levels	Subject Effect	Participants	15
	Within-Subject Effect	Sentence_code	246
		Order	4
Number of Subjects			15
Number of Measurements per Subject	Minimum		50
	Maximum		246
Correlation Matrix Dimension			826

Categorical Variable Information

			N	Percent
Factor	Deception	Truth	1082	51,2%
		Lie	1031	48,8%
		Total	2113	100,0%
	Relatability	Personal	973	46,0%
		Impersonal	1140	54,0%
		Total	2113	100,0%
	Emotionality	Low	1056	50,0%
		High	1057	50,0%
		Total	2113	100,0%
	Order	Block 1	601	28,4%
		Block 2	532	25,2%
		Block 3	462	21,9%
		Block 4	518	24,5%
		Total	2113	100,0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	Amplitude_Scaled	2113	,032986	21,079215	1,72361571	2,191819910

Goodness of Fit[a]

	Value
Quasi Likelihood under Independence Model Criterion (QIC)[b]	2130,530
Corrected Quasi Likelihood under Independence Model Criterion (QICC)[b]	2016,804

Dependent Variable: Amplitude_Scaled

Model: (Intercept), Order, Deception, Relatability, Emotionality, Deception * Relatability, Deception * Emotionality, Relatability * Emotionality

a. Information criteria are in small-is-better form.

b. Computed using the full log quasi-likelihood function.

Tests of Model Effects

Source	Type III		
	Wald Chi-Square	df	Sig.
(Intercept)	18,325	1	,000
Order	17,761	3	,000
Deception	,824	1	,364
Relatability	1,476	1	,224
Emotionality	,035	1	,852
Deception * Relatability	1,932	1	,165
Deception * Emotionality	1,071	1	,301
Relatability * Emotionality	,100	1	,752

Dependent Variable: Amplitude_Scaled

Model: (Intercept), Order, Deception, Relatability, Emotionality, Deception * Relatability, Deception * Emotionality, Relatability * Emotionality

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	,709	,1788	,358	1,059	15,702	1	,000
[Order=1]	,028	,1264	-,220	,275	,048	1	,827
[Order=2]	-,169	,1382	-,440	,102	1,500	1	,221
[Order=3]	-,308	,1248	-,553	-,064	6,105	1	,013
[Order=4]	0[a]	.	.	.	.	.	.
[Deception=1]	-,206	,1175	-,436	,024	3,075	1	,080
[Deception=2]	0[a]	.	.	.	.	.	.
[Relatability=1]	,020	,0923	-,161	,201	,049	1	,825
[Relatability=2]	0[a]	.	.	.	.	.	.
[Emotionality=1]	-,046	,1257	-,292	,201	,132	1	,716
[Emotionality=2]	0[a]	.	.	.	.	.	.
[Deception=1] * [Relatability=1]	,117	,0844	-,048	,283	1,932	1	,165
[Deception=1] * [Relatability=2]	0[a]	.	.	.	.	.	.
[Deception=2] * [Relatability=1]	0[a]	.	.	.	.	.	.
[Deception=2] * [Relatability=2]	0[a]	.	.	.	.	.	.
[Deception=1] * [Emotionality=1]	,126	,1215	-,112	,364	1,071	1	,301
[Deception=1] * [Emotionality=2]	0[a]	.	.	.	.	.	.
[Deception=2] * [Emotionality=1]	0[a]	.	.	.	.	.	.
[Deception=2] * [Emotionality=2]	0[a]	.	.	.	.	.	.
[Relatability=1] * [Emotionality=1]	-,050	,1595	-,363	,262	,100	1	,752
[Relatability=1] * [Emotionality=2]	0[a]	.	.	.	.	.	.
[Relatability=2] * [Emotionality=1]	0[a]	.	.	.	.	.	.
[Relatability=2] * [Emotionality=2]	0[a]	.	.	.	.	.	.
(Scale)	1,600						