


BACHELOR'S THESIS



CLOSING THE GAP TO  
DECEIT: INFLUENCES OF  
IMPOSED COGNITIVE  
LOAD AND  
MACHIAVELLIANISM ON  
TONIC ELECTRODERMAL  
ACTIVITY

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## Abstract

The aim of the current research project is to provide more insight in the deception management process, exploring influences of imposed cognitive load and Machiavellianism on tonic electrodermal activity while having the intent to deceive and actual deceiving. Hundred seven mostly Social Sciences students from Twente University participated in the experimental study. Ages ranged from 17 till 49, approximately 37 % of participants were male; approximately 63 % were female. In a controlled environment we instructed individuals to answer questions shown on a computer screen either truthfully or deceptive while they had to complete a secondary. A week after the experiment participants were instructed to complete the Mach IV questionnaire from which Machiavellianism data was derived.

We found a significant increase of tonic electrodermal activity when participant were lying compared to when they told the truth ( $p < 0.001$ ). Contrary, we found a significant decrease of tonic electrodermal activity when participants had the intention to lie ( $p = 0.004$ ). Furthermore current research shows individual differences in Machiavellianism to play a distinct role in how tonic electrodermal activity is portrayed.

Both having the intent to lie, thus telling the truth, waiting when to lie and actual lying are part of the deception management process, therefore lying should be comprehended as a continuous social process. Using the tonic, continuous, measure of electrodermal activity, promising results are found for detecting deception in even those showing least signs of deceptive intent.

*Keywords: Deception, Intent to deceive, Imposed cognitive demand, Tonic electrodermal activity, Machiavellianism*

## Samenvatting

Het doel van het huidige onderzoeksproject is meer inzicht te verschaffen in het liegproces door de invloed van *imposed cognitive demand* en Machiavellianisme op tonische electrodermale activiteit te verkennen wanneer een individu liegt of de intentie heeft om te liegen. Honderdenzeven, over het algemeen Gedragswetenschappen studenten van Universiteit Twente hebben deelgenomen aan het experimentele onderzoek. Leeftijd varieerde van 17 tot en met 49 jaar, ongeveer 37 % van de deelnemers was man en ongeveer 63 % van de deelnemers was vrouw. In een gecontroleerde omgeving instrueerden we deelnemers terwijl zij een secundaire taak moesten uitvoeren om vragen die werden getoond op een computerscherm of wel naar waarheid te beantwoorden ofwel hierop te liegen. Een week na het experiment werden deelnemers geïnstrueerd om de Mach IV vragenlijst in te vullen waarvan Machiavellianisme data werd afgeleid.

We vonden een significante toename van de tonische electrodermale activiteit wanneer deelnemers logen in vergelijking tot wanneer ze de waarheid spraken ( $p < 0.001$ ). In tegenstelling vonden we een significante afname van tonische electrodermale activiteit wanneer deelnemers de intentie hadden om te liegen in vergelijking tot wanneer ze de waarheid spraken ( $p = 0.004$ ). Bovendien laat het huidige onderzoek tekenen zien dat individuele verschillen in Machiavellianisme een duidelijke rol zouden kunnen spelen in hoe tonische electrodermale activiteit wordt weergegeven.

Zowel de intentie hebben om te liegen; dus de waarheid spreken, afwachten wanneer te liegen en het daadwerkelijke liegen maken onderdeel uit van het liegproces. Om deze reden moet liegen gezien worden als een continu sociaal proces. Gebruikmakend van de tonische, continue, maat van electrodermale activiteit zijn er veelbelovende resultaten gevonden dat leugens zelfs bij degenen die de minste tekenen van bedrog tonen opgespoord kunnen worden.

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## **Introduction**

Consider the next scenario: A person approaches airport customs after flying from Riyadh to Schiphol airport. Airport security is already on alert, because the man has only booked a single flight. Arriving at the customs authorities, the man is taken aside by a customs officer for a brief interview with the purpose of determining the intentions of his visit to the European Union. After a while, the officer determines the man means no harm and can continue his trip through the EU. However, the officer did not find out his true intention; after arriving in Paris, the man will join a terrorist cell.

People deceive each other in many different ways, in example by intentionally withholding information or by providing false information. Deception detection methods can therefore only be effective when they are based on theory, which can adequately predict what differences occur between lying and truth telling. Nowadays police manuals typically utilize a ‘concern-based lie detection approach’ as a primary detection method (Vrij, Fisher, Man, & Leal, 2008). It assumes that when lying people are more nervous than when telling the truth, resulting in an increased likelihood to display nervous behavior. However this approach is limited, because even when individuals are questioned by the police and tell the truth, they can still be nervous during an interrogation situation. Secondly, and most importantly because currently there is no compelling theoretical explanation as to why people individuals should necessarily nervous and display nervous behaviors when lying to direct questions (Vrij et al., 2008).

Alternatively, based on the cognitive load approach (Vrij et al., 2008) much research has shown that deceiving others is more cognitively demanding than telling the truth (Ekman & Friesen, 1971; Mann, Vrij, & Bull, 2002; Vrij & Mann, 2001) and is therefore and more substantiated indicator of deception than mere “nerves”. This increase of cognitive demand is reflected by changes in skin conductance, or electrodermal activity (Zuckerman, De Paulo,

& Rosenthal, 1981; DePaulo et al., 2003; Vrij, Ennis et al, 2010). Based on sound theory, electrodermal activity (EDA) can therefore be regarded as a rather direct way of measuring deceit. However, several individual differences, such as differences in personality might influence individuals' electrodermal responses while deceiving. Kowalski (2001) mentioned several socially aversive personalities, from which three generated the most empirical attention: Machiavellianism, narcissism and psychopathy. Individuals high in Machiavellianism are assumed to lie more often and experience a lesser increase in cognitive load during deceit than people low in Machiavellianism (Kashy & DePaulo, 1996). Machiavellianism might therefore be an important factor influencing individuals' electrodermal activity when lying. The aim of the current research project is to provide more insight in the deception management process, exploring influences of imposed cognitive load and Machiavellianism on electrodermal activity while deceiving.

### **The cognitive load approach**

We consider lying as a social process (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996); not necessarily applying to a single moment of statement and which is characterized by the intention to lie about certain topics. Management of these processes is supposed to be cognitively demanding and might distinguish between people who are truthful or have the intent to deceive.

Cognitive load can be defined as a multidimensional construct representing the load that performing a particular task imposes on an individual's cognitive system (Paas & Merriënboer, 1994a). Vrij et al (2008) introduced two cognitive load approaches in lie detection. The first approach, *measuring cognitive load*, assumes that the mere act of lying generates observable signs of increase of cognitive load. This approach is the traditional cognitive lie detection approach formulated by Zuckerman et al. (1981). The second approach, *imposing cognitive load*, goes one step further and tries to actively increase the

differences between lying and truth telling by adding a mentally taxing intervention while telling the truth or lying (Vrij et al., 2008). The assumption here is that people require more cognitive resources to produce their statements when they lie than when they tell the truth, and therefore will have fewer cognitive resources left to address these mentally taxing interventions. Adding cognitive demand should therefore make deceit more visible. This second approach was put in to practice by Vrij and Mann (2008), adding cognitive demand during police interviews, by letting subjects tell their story in reversed order. Findings supported the prediction that liars would display more signs of cognitive load than truth tellers, particularly in the reversed order condition. In the current research project we build on this line of inquiry. Since people require more cognitive resources to produce their statements when they lie than when they tell the truth (Vrij et al., 2008), imposing cognitive load would make differences between liars and truth tellers more salient. We therefore hypothesize that *deceiving increases cognitive load compared to when telling the truth* (Hypothesis 1).

Research by Carrion, Keenan and Sebanz (2010) found that even when individuals told the truth but had the intent to deceive, cognitive demand increases. Thus, the mere intention to deceive is sufficient to increase one's cognitive load. In the current research we therefore hypothesize that *the mere intention to deceive will increase cognitive load compared to when telling the truth* (Hypothesis 2). We are specifically interested in this condition because it reflects a real-world scenario as the one opening this paper, where individuals with malicious intent make up -part of- their story in order to deceive others. Furthermore we hypothesize that *the increase in cognitive load when having the intent to deceive will be significantly higher compared to when telling the truth, however this effect is less pronounced compared to when lying* (Hypothesis 3).

## **The Dark Triad: Machiavellianism**

The dark triad represents the most prominent, socially aversive personalities: Machiavellianism, narcissism and psychopathy, and are characterized by a common underlying deficit in empathy (Wai & Tiliopoulos, 2012). As stated before, individuals high in Machiavellianism are assumed to lie more often and experience a lesser increase of cognitive load during deceit than people low in Machiavellianism (Kashy & DePaulo, 1996). Understanding influences of Machiavellianism on individuals' electrodermal activity when lying might therefore be important since a) individuals high in Machiavellianism are assumed to be relatively more highly represented amongst liars than individuals low in Machiavellianism, and b) a lesser increase in cognitive load makes it more difficult to detect deceit. Machiavellianism was first introduced in scientific literature by Christie and Geis (1970) after its originator Niccolo Machiavelli. According to Christie and Geis, Machiavellianism refers to interpersonal strategies that people use when interacting with others for their self-interest, including deceit and manipulation (Jakobwitz and Egan, 2006). Cherulnik, Way, Ames, & Hutto (1981) found that in interview situations people high in Machiavellianism are ambitious and dominating, but they also seem relaxed, talented and confident. Therefore the assumption that individuals are more nervous when lying than when telling the truth – on which the 'concern-based approach' is based – might for this reason, in certain cases, not to be so. We therefore hypothesize that *the increase in cognitive load when lying compared to when telling the truth is moderated by Machiavellianism* (Hypothesis 4). Specifically, we expect that the difference between lying and telling the truth to be largest for individuals scoring low on Machiavellianism and smallest for individuals scoring high on Machiavellianism. Following, we also hypothesize that *the increase in cognitive load when having the intent to deceive compared to when telling the truth is moderated by Machiavellianism* (Hypothesis 5). Specifically, we expect the difference between having the



intention to lie and telling the truth to be largest for individuals scoring low on Machiavellianism and smallest for individuals scoring high on Machiavellianism.

Elaborating on the deception process Sip, Roepstroff, McGregor, and Frith (2008), state that deception is influenced by several social and cognitive processes, which can be classified into three different mechanisms. First, the interpersonal; appearing trustworthy, managing your reputation. Secondly, the intrapersonal; managing information, keeping track of what is told and; finally, strategic choices; determining if deception is worth it and what the possible gains and losses are. Inducing cognitive demand by different additional tasks (cognitive and emotional) might therefore have impact on these mechanisms in a different way. In addition Wai and Tiliopoulos (2012) found that all dark triad personalities were associated with deficits in affective empathy, but showed little evidence of impairment in cognitive empathy. These findings unite in our sixth and seventh hypothesis. Adding an emotional task might impose a higher increase of cognitive load for people scoring high on Machiavellianism. For this reason we hypothesize that *within an emotional task, a larger difference occurs between an easy and difficult task for individuals scoring high on Machiavellianism compared to individuals scoring low on Machiavellianism* (Hypothesis 6). On the other hand, all dark triad personalities showed little evidence of impairment in cognitive empathy. A cognitive task might therefore be easy for individuals scoring high on Machiavellianism, making them experience less increase in cognitive load compared to individuals scoring low on Machiavellianism. We therefore finally hypothesize that *within a cognitive task, a larger difference occurs between an easy and difficult task for individuals scoring low on Machiavellianism compared to individuals scoring high on Machiavellianism* (Hypothesis 7).

## Method

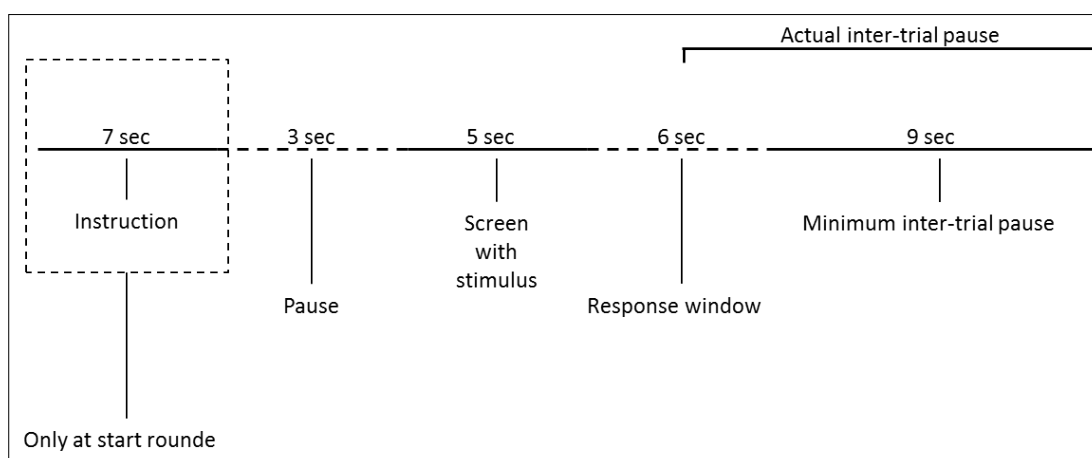
### Participants

Hundred seven, mostly Social Sciences students from Twente University were originally recruited for the experiment. Due to technical failures we removed data of 13 participants, leaving data of 94 participants for statistical analysis, their age ranged from 17 to 49 ( $M = 21.26$ ,  $SD = 3.95$ ). Approximately 37 % of participants were male; approximately 63 % were female, reflecting the approximate demographics of the faculty's subject pool. Participants either participated voluntarily or were given a course credit for the completion of the experiment. Additionally, to boost participant motivation and create a high stake situation, a €100 prize was held in prospect for "the best liar". A €50 was held in prospect for the "second best liar." After the experiment we allotted prize money between participants.

### Experimental design

The study was based on a 2x2x3 mixed factor experimental design. During the experiment all participants had to answer questions truthfully or had to lie while performing a double task in three within-subject conditions. In the truth condition participants had to tell the truth, in the lie condition participants had to lie and in the intent condition participants had to lie on only one question and tell the truth on the remaining questions. The Intent condition should be elaborated more thoroughly. In the Intent condition participant had to answer truthfully on most question and, as stated before had to lie on one question. This was either the 4<sup>th</sup>, 5<sup>th</sup> or 6<sup>th</sup> question and was marked as "the blue question" which meant the actual question was colored blue. We are specifically interested in this condition because it reflects a real-world scenario as the one opening this paper, where individuals with malicious intent make up part of their story in order to deceive others. We also included blue questions in Truth and Lie conditions so response differences on blue questions were not due to recognition. The double task varied between subjects and was either an emotion task, where

participants had to judge an emotional expression, or a cognitive task, where participants had to complete a math task. Furthermore the double task varied in difficulty between participants and was either easy or difficult. In the easy emotion condition participants had to judge the unambiguous emotional expression of a person’s face on a picture; in the difficult emotional condition participants had to judge a more ambiguous emotional expression of a person’s face on a picture. For examples of the actual stimuli see Appendix I, (Note that all appendices are in Dutch since the experiment was conducted on a Dutch university). Ambiguous emotions were created by morphing the picture of the unambiguous emotional expression with a picture of the same person with a neutral expression using Facemorpher Lite (Luxand Development, 2008). In the easy cognitive condition participants had to solve a simple sum problem; in the difficult cognitive condition participants had to solve a difficult multiplication problem. For examples of the actual stimuli see Appendix II. In total the current experiment contained one independent within-subject variable; condition (truth, lie and intent), two independent between-subject variables; task (emotion, cognitive) and task difficulty (easy, difficult) and one dependant variable (electrodermal activity). The truth, lie and intent conditions contained 6 stimuli (trials), each trial lasted for 23 seconds as indicated by Figure 2.1. Together these 6 trials formed one “block” and each block returned 4 times per experiment; however faces and questions differed between blocks of the same condition. The total experiment consisted of 12 blocks; four of each condition.



Figuur 2.1 Trial structure. Thanks to Marije Hoogeboom.

We used counter balancing by to control for boredom and learning effects; hereby creating a total of 12 different versions, depending on task, task difficulty and block. Which experimental version a participant would perform was also set prior to the experiment using a randomization generator (<http://www.randomization.com>).

Electrodermal activity was recorded as skin conductance (SC, in  $\mu$ Siemens) and was registered during the entire experiment as the dependent variable, reflecting cognitive effort. Recording skin conductance response relies on a current across the skin (Dawson, Schnell, and Fillion, 2000), therefore skin conductance sensors were attached to the ring finger and index finger of the non-dominant hand to reduce the risk of data distortion by accidental hand movement. Both tonic skin conductance response, which is the baseline level of skin conductance in the absence of any particular distinct environmental event, and phasic skin conductance response, which are caused by distinct environmental stimuli, were recorded (Dawson et al., 2000). Since we see lying as a social, *continuous* process we chose to only use the tonic, *continuous*, skin conductance response rather than the, event related, phasic skin conductance response.

## **Stimuli**

The stimulus pool consisted of 66 portraits of Dutch people, each demonstrating seven unambiguous emotions (anger, fear, surprise, sadness, disgust, contempt and happiness) and one neutral face. These facial expressions were derived from Ekman's universal emotions (Ekman & Friesen, 1969; Ekman, 1999). Extra features, like earrings, were added to the faces, so different questions could be asked during the experiment. These basic portraits were used as stimuli for the easy emotional condition. As stated before the difficult emotional condition consisted ambiguous emotions which were created by combining one emotion and the neutral

face. For both cognitive tasks the original facial expressions. Freckles were added to the face, with which participant had to calculate an outcome.

### **Instruments**

Skin conductance signals were measured exodermally using Thought Technology skin conductance sensors (Thought Technology Ltd., 2012); signals were amplified using ProCompInfiniti (Thought Technology Ltd., 2012). The actual experiment was carried out on a desktop monitor connected to a laptop using e-Prime (Psychology Software Tools, 2012) to run the experiment. The amplifier did not have a dedicated interface for e-Prime, for this reason analogue experimental markers were created. For each experimental event (e.g. a Truth question), e-Prime produced a signal which was transported via the serial port to the amplifier, which in turn created fluctuations of the VI-channel. Every fluctuation marked an experimental event.

Pre-processing was performed using MATLAB (Mathworks, 2012). For the current study only Continuous Decomposition Analysis (CDA) (Benedek & Kaernbach, 2010) was used to analyze the data. Previous study has shown CDA provided the most sensitive tonic estimate. For further technical information see Utzareth (2012).

Machiavellianism data was collection using the Mach IV questionnaire developed by Christie and Geis (1970) (Appendix IX). The questionnaire was explained as being part of a different survey and conducted one week posterior to the experiment so participants had no idea the questionnaire was part of the original experiment.

### **Procedure**

Pre-experimental procedures included preparing the experimental setting (Appendix III) and starting up the appropriate experimental version. Participants were received in an isolated room of the university's psychology laboratory. After being seated, before the actual experiment took place, participants were asked to sign the informed consent, in which

participants rights were explained (Appendix IV). Hereafter written instructions in accordance with the experimental task (either emotional or cognitive) were given to the participants, including two control questions, to verify if instructions were understood properly (Appendix V and VI).

Instructions were given to stop reading when they reached the heading “Belangrijk” (Important). Participants were connected to the recording equipment when they reached this section. Hereafter they could continue reading and answer the control questions. To increase motivation the experimenter again stressed the participant could win €100 and following this the participants were told an expert in lie detection would observe them via a camera during the entire experiment and analyze whether they were telling the truth or were lying. The camera was positioned next to the desktop monitor such that it was visible but would not distract participants during the experiment (see Appendix III). The camera however was only recording participant’s responses for later analysis. Subsequently the experimenter would shortly leave the room in order to “check if the camera was well positioned.” After returning to the room the experimenter would run a test block with the participant. When there were no more questions it was assumed the participant had mastered the task at hand and the participants were instructed they could start the experiment by pressing spacebar after the experimenter had left the room.

When the experimenter left the room the participant completed 12 blocks corresponding to a total of 72 trials. After 26 minutes the experiment was finished and the experimenter would return to the room and participants were questioned whether they thought they performed well. Following, the experimenter would save the recorded data and disconnect the recording equipment. A final questionnaire was given, evaluating participant’s mental condition and opinion about the experiment (Appendix VII and VIII). Participants were then told they would receive a survey questionnaire from another researcher a week later

and after completion of this questionnaire they would receive their course credit. Finally, participants were thanked for their participation and told they could leave the room.

### **Statistical Analysis**

Statistical analysis was performed using SPSS 20 (IBM SPSS, 2012). For reasons mentioned in the introduction only Tonic CDA data was used for analysis. Since there were six trials per block Tonic CDA data was provided six times for every condition. During the Intent condition participants either had to lie on the 4<sup>th</sup>, 5<sup>th</sup> or 6<sup>th</sup> question so to provide a reliable comparison, dependant variables were extracted by averaging the trial-positions across the first 3 trials per block per condition. This was sufficient because only the overall differences between conditions are of interest in the current study. For analysis of different tasks an overall mean was calculated. All analysis used a significance criterion of  $p < 0.5$ .

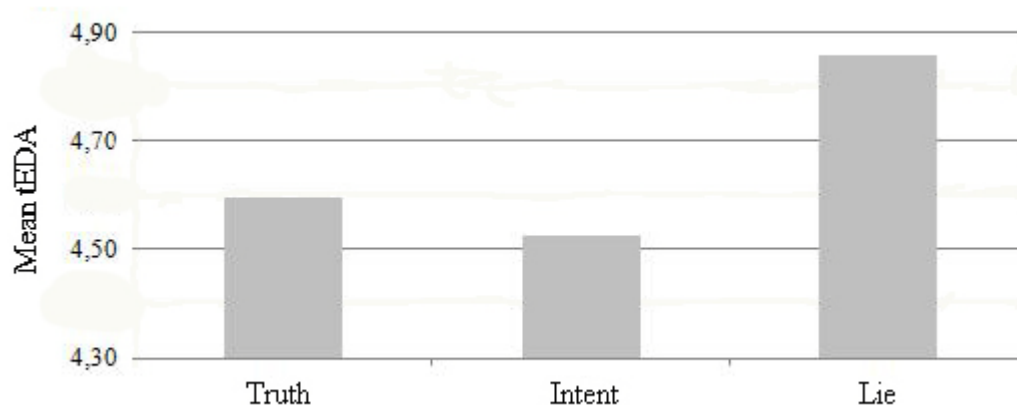
The Mach IV questionnaire consisted 20 statements which were rated on a 5-point Likert scale. Before computing the Mach IV score items 2, 5, 8, 10, 11, 13-15, 17 and 20 were rescaled. Following this the total Mach IV scores was computed by the sum of the separate question scores. To assess reliability of the questionnaire we calculated Cronbach's Alpha. According to literature Cronbach's Alpha should be in the range of .70 and .80, which indicates high reliability (Field, 2005). Cronbach's  $\alpha$  was .68, which is nearly .70 and therefore we assumed good reliability of the questionnaire. By using a median split we created two uniformly distributed groups containing either individuals scoring low or high on the Mach IV questionnaire.

### **Results**

We expected that deceiving would cause an increase in cognitive load compared to when telling the truth. To test this hypothesis we conducted a repeated-measures ANOVA with within-subjects factor Condition (Truth, Intent, Lie) and dependant variable tonic electrodermal activity. Mauchly's test indicated the assumption of sphericity had been

violated  $\chi^2 = 66.09$ ,  $p < 0.001$ . Therefore degrees of freedom were corrected using Greenhouse-Geisser estimate of sphericity. Results show that mean tonic electrodermal activity was significantly affected whether an individual was either telling the truth, had the intention to lie or was lying,  $F(1.33, 126.25) = 44.698$ ,  $p < .001$ ,  $\epsilon^2 = .66$ , as indicated by Figure 3.1. In addition, post hoc test showed that mean tonic electrodermal activity was higher in the Lie compared to the truth condition, respectively  $M = 4.86$ ,  $SD = 0.38$  and  $M = 4.60$ ,  $SD = 0.36$ , this difference was shown to be significant,  $p < .001$ . This result confirms our hypothesis that lying requires higher cognitive effort in comparison to telling the truth. Our second hypothesis predicted that the mere intention to lie requires higher cognitive effort than telling the truth. Contrary to this prediction, post hoc tests found tonic electrodermal activity to be significantly lower when having the intention to lie ( $M = 4.53$ ,  $SD = 3.46$ ), compared to when telling the truth ( $M = 4.60$ ,  $S = 3.50$ ), this difference was also found to be significant,  $p = .004$ . See Figure 3.1

Figure 3.1. Effect of Condition on tonic electrodermal activity (tEDA)



We predicted that cognitive load would be significantly higher when an individual has the intention to lie compared to when one is telling the truth, but that this effect would be less pronounced when compared to when one is lying. Post hoc test found this hypothesis not to be true. Though mean difference between when having the intent to lie and when telling the



truth were found to be less pronounced compared to the mean difference between when lying to lie and when telling the truth, respectively 0.07 and 0.26, we found a significant decrease in tonic electrodermal activity when having the intention to lie compared to when telling the truth, hereby rejecting our hypothesis.

An interaction effect was expected between Condition (Truth, Intent, Lie) and Machiavellianism (High, Low) on tonic electrodermal activity. The increase in tonic electrodermal activity between Truth and Lie condition were expected to be most pronounced for low Machiavellianism (LowMach) individuals and least pronounced for high Machiavellianism (HighMach) individuals. A repeated-measures ANOVA including within-subject factor *Condition* (Truth, Intent, Lie) and between-subjects factor *Machiavellianism* (High, Low) was conducted to analyze this prediction. Again Mauchly's test indicated the assumption of sphericity had been violated  $\chi^2 = 55.89, p < 0.001$ . Therefore degrees of freedom were corrected using Greenhouse-Geisser estimate of sphericity. Post hoc analysis shows mean differences between Truth and Lie condition to be greatest for low Machiavellianism individuals, as shown by Table 3.1. Results however show a non-significant interaction effect between Condition and Machiavellianism,  $F(1.34, 111.10) = 0.21, p = .716, \epsilon^2 = .67$ .

*Table 3.1.* Mean intra-group tEDA differences between Truth and Lie condition.

<b>Lie-Truth</b>	<i>MΔ</i>
<b>LowMach</b>	.288
<b>HighMach</b>	.247

*Note.* *MΔ* = Mean difference

We subsequently hypothesized that an increase in tonic electrodermal activity between Truth and Intent condition was most pronounced for low Machiavellianism individuals and least pronounced for high Machiavellianism individuals. Our primary analysis however found a significant decrease in tonic electrodermal activity in the Intent condition compared to tonic electrodermal activity in the Truth condition. Therefore this hypothesis has to be rejected. However, if we only take differences of tonic electrodermal activity between Intent and Truth condition into account, post hoc analysis again shows differences in tonic electrodermal activity to be most pronounced for high Machiavellianism individuals compared to low Machiavellianism individuals, as shown by Figure 3.3.

*Table 3.2.* Mean intra-group tEDA differences between Truth and Intent condition.

<b>Intent-Truth</b>	<i>MΔ</i>
<b>LowMach</b>	-.075
<b>HighMach</b>	-.065

*Note.*  $M\Delta$  = Mean difference

Comparing tasks we expected intra and intergroup differences of tonic electrodermal activity between high Machiavellianism and low Machiavellianism individuals, while ignoring different conditions. Differences between emotional task difficulty were expected to be more pronounced for high Machiavellianism individuals compared to low Machiavellianism individuals. Contrary, differences between cognitive task difficulty were expected to be more pronounced for low Machiavellianism individuals compared to high Machiavellianism individuals. A two-way ANOVA was conducted with dependant variable *overall mean* (mean tonic electrodermal activity over all conditions) and independent

variables *task* (emotional, cognitive), *difficulty* (easy, difficult) and *Machiavellianism* (high, low).

A statistically non significant three-way interaction of task\*task difficulty\*Machiavellianism was found on tonic electrodermal activity,  $F(1, 77) = 0.23, p = 0.63$ . Both in the emotional and cognitive tasks a non-significant interaction effect between difficulty and Machiavellianism was found, respectively  $F(1, 41) = 2.81, p = .10$  and  $F(1, 36) = 0.27, p = .61$ . In spite of these non significant interaction effects, our hypotheses do not need to be rejected immediately. Post hoc analysis shows differences in tonic electrodermal activity to be more pronounced for high Machiavellianism individuals compared to low Machiavellianism individuals, which is in line with our hypothesis. Furthermore results show tonic electrodermal activity to be higher for low Machiavellianism individuals compared to high Machiavellianism individuals in the easy condition. This effect is the other way around for high Machiavellianism individuals as Figure 3.2 shows. Table 3.3 shows the mean differences of tonic electrodermal activity between the difficult and easy *emotional* condition.

Table 3.3. Mean intra-group tEDA differences within the emotional condition

Emotional $\Delta$	$M\Delta$
LowMach	-.679
HighMach	2.453

Note. Emotional $\Delta$  = Difference between difficult and easy emotional condition;  $M\Delta$  = Mean difference

Table 3.5 shows the mean differences of tonic electrodermal activity between the difficult and easy *cognitive* condition. Post hoc analysis again shows differences in tonic electrodermal activity to be more pronounced for high Machiavellianism individuals

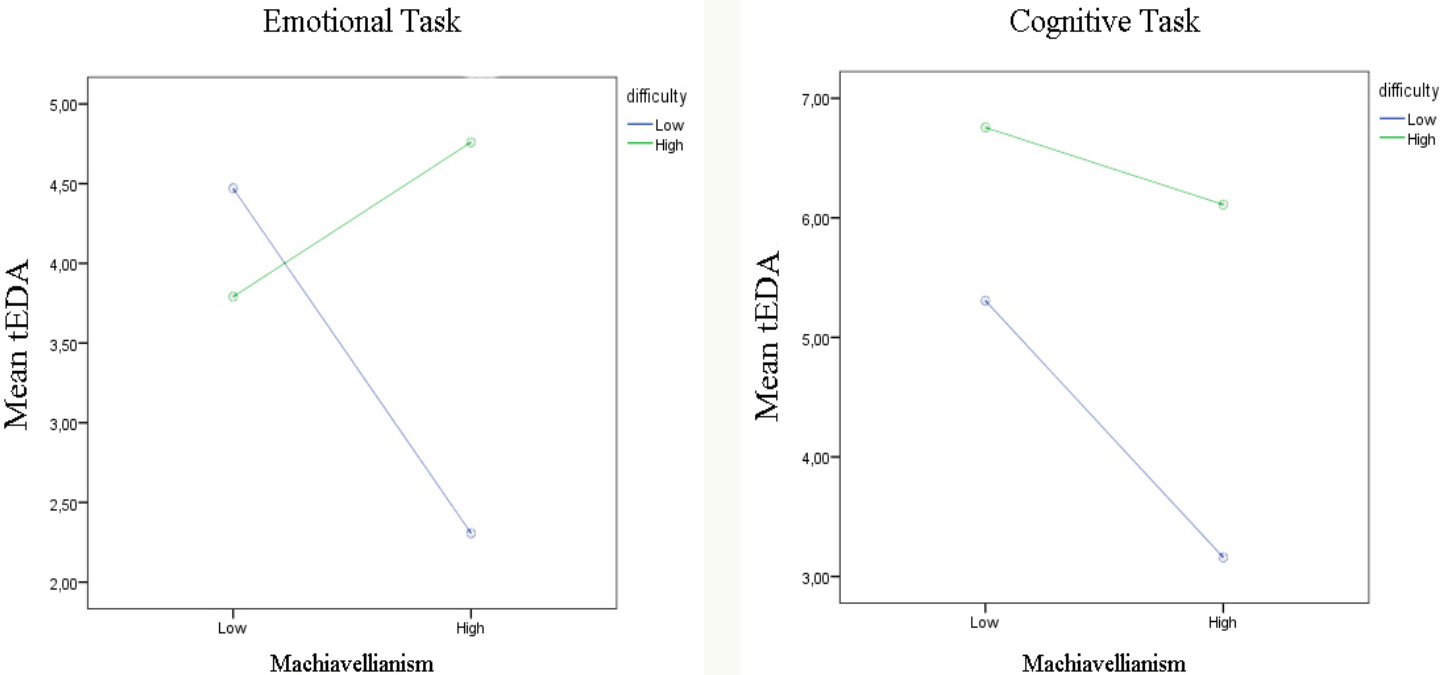
compared to low Machiavellianism individuals. This time the result is contradictory to our hypothesis. Furthermore results show tonic electrodermal activity to be higher for both low Machiavellianism and high Machiavellianism individuals in the difficult condition, as Figure 3.2 shows.

Table 3.4. Mean intra-group tEDA differences within the cognitive condition

Cognitive $\Delta$	$M\Delta$
<b>LowMach</b>	1.448
<b>HighMach</b>	2.952

Note. Cognitive $\Delta$  = Difference between difficult and easy emotional condition;  
 $M\Delta$  = Mean difference

Figure 3.2. Differences in tonic electrodermal activity (tEDA) between task difficulty within low Machiavellianism and high Machiavellianism individuals between tasks



## Discussion

Nowadays we live in a world in which people, through media, are more and more conscious about their own safety. National boundaries fade and by this it gets ever easier to travel from country to country without people paying much attention to where you're from, where you're going or why you're going there. For individuals travelling through Europe to spend the holidays in Spain it is a very pleasant development, however also individuals with malicious intent such as smugglers and terrorist profit from this loss of control by national authorities. September 11<sup>th</sup>, the day on which Al Qaeda terrorists led two American Airlines planes in the World Trade Center, was a low point in the freedom of our world's citizens. Since the attacks on the World Trade Center airport security worldwide is on high alert to prevent unwanted visitors entering our nations.

Research into deception detection can contribute to a more secure world. By better understanding the processes and individual characteristics involved in deception, airport personnel can be better trained, and more advanced detection equipment can be developed to improve chances to catch individuals with a hidden agenda. The aim of the current research project was to provide more insight in the deception management process, exploring influences of induced cognitive load and Machiavellianism on tonic electrodermal activity while deceiving.

General results showed clear differences in tonic electrodermal activity between individuals telling the truth and individuals who were lying. Furthermore we found a clear difference in tonic electrodermal activity during the lying process; whether participants were anticipating when to lie or were actually lying caused an obvious opposite effect on electrodermal activity when compared to when participants were telling the truth. Results furthermore pointed in the direction that individual differences in Machiavellianism might be a distinct cause of differences in electrodermal response.

Previous research on deception detection has shown that deceiving others is more cognitively demanding than telling the truth (Ekman & Friesen, 1971). This increase of cognitive demand is reflected by changes in skin conductance (Zuckerman et al., 1981). We therefore expected an increase in tonic electrodermal activity when an individual was lying compared to when s/he was telling the truth (Hypothesis 1), reflecting an increase in cognitive demand. We found that deception is associated with an increase in tonic electrodermal activity, which confirms our hypothesis. Current research used induced cognitive load to facilitate lie detection. Cognitive load was both induced when an individual had to tell the truth and when an individual had to lie, therefore a difference in tonic electrodermal activity had to be due to either deceptive or truthfully answering of questions; hereby denying critique that increase in tonic electrodermal activity was caused by inducing cognitive load.

Secondly, anticipating the same results as Vrij and Mann (2008) we expected that when an individual had the intent to deceive this would be reflected by an increase in tonic electrodermal activity compared to when an individual told the truth. However, contrary to our expectation, we found a distinct decrease in tonic electrodermal activity when an individual had the intent to deceive compared to when an individual told the truth. Results however are in line with an earlier experiment by Leal, Vrij and Fisher (2008), who found same results in mock crime experiments. During the current experiment participants were instructed to tell the truth during a whole block, lie during a whole block or lie on one question during a whole block. The fact of being instructed when to lie or tell the truth does not reflect a real-time scenario. Anticipating or plan ahead about when to lie in an Intent block was argued to be an important influencer of increased cognitive demand. Instructing participants when to lie might therefore take away an import part of cognitive demand increase during this process. Further analysis could give a definitive answer, whether effect of earlier trials blocks, when participants a not yet accustomed to block length is greater when

compared to later trial blocks. In addition, Leal et al (2008) found that cognitive demand could reduce tonic arousal and suspected that tonic arousal could be reflecting executive functioning. However our experiment does not provide data to either confirm or disclaim this suspicion. Finally, it should be noted that no model is available on how tonic electrodermal activity either increases or decreases during a process defined by deceptive intent, therefore further extensive experiments should be conducted to give answers to these arising questions.

Thirdly it was expected that there would be a distinct increase in cognitive load when an individual had the intent to lie compared to when telling the truth. Specifically, it was expected that this increase was less pronounced compared to the increase in cognitive load between lying and telling the truth. However, we found tonic electrodermal activity to be highest when respectively lying and telling the truth and lowest when having the intention to lie, hereby negating our hypothesis.

Signs of deception however should be considered as a complex combined effect of personal factors, which can be seen by the great variety of tonic electrodermal activity between participants. One such factor we argued to be the extent to which one has a Machiavellianistic personality or not. Elaboration of this assumption produced our next two hypotheses. Both stating personal differences in Machiavellianism would influence an individuals' tonic electrodermal activity when telling the truth, having the intention to lie and actual lying. Specifically it was expected that an increase in tonic electrodermal activity would be greatest for individual scores low on Machiavellianism and smallest for individuals scoring high on Machiavellianism when respectively lying and having the intention to lie. We found non-significant results, however results were in line with our hypotheses. We found tonic electrodermal activity increase between telling the truth and having the intent to lie and Tonic electrodermal activity increase between telling the truth and lying to be greatest for individuals scoring high on Machiavellianism. Our subject pool might be a perpetrator of

these insignificant but promising results. Participant scores' on Machiavellianism ranged from 41 till 69, which are quite average on a scale which can range from a minimum of one till a maximum of hundred. The lack of extreme scores might therefore cause insignificant effects. In addition the lack of extreme scores has led us to use a median split for analysis in this paper in order to provide two uniformly distributed groups despite of the fact it is known to decrease effect size. However, we deliberately used a median split, since otherwise a disproportionate distribution of the two groups was created. Further analysis however should find a better way of differentiating between Machiavellianism in our subject pool.

For further analysis of the combined effect of induced cognitive demand and Machiavellianism on tonic electrodermal activity two final hypotheses were proposed, including the influence of task difficulty and sort of task. Previous research showed high Machiavellistic personalities to have an emotional empathy deficit (Wai and Tiliopoulos, 2012). We therefore hypothesized these personalities would have more difficulty in performing a secondary emotional task compared to low Machiavellistic personalities. For this reason we assumed that an increase in cognitive demand – operationalized by increase in task difficulty – would be characterized by a greater increase in tonic electrodermal activity for high Machiavellistic personalities when compared to low Machiavellistic personalities. Results pointed in the right direction; however differences were non-significant. Furthermore, low Machiavellistic personalities showed a decrease in tonic electrodermal activity when comparing high and low task difficulty. We assumed more ambiguous emotions would be more difficult to assess than unambiguous emotions because it would be less clear what emotional expression someone has. However using more ambiguous emotions might have had a different than anticipated effect on recognition of facial expressions. Precisely because emotions are more ambiguous, it might be that low Machiavellistic individuals also put less effort in identifying different emotions, thereby decreasing cognitive demand. The increase of



tonic electrodermal activity for high Machiavellistic individuals might be explained by the deficit in emotional empathy, where ambiguous emotions put an even greater strain on cognitive functioning. Further analysis of data might give a conclusive answer. Furthermore it could be argued whether or not participants were able to identify the primary emotions at all. It was chosen not to name used emotions in experimental instruction for the reason it would make the task of assessing emotions a recognition task. However data should be analyzed to confirm or reject the notion participants were able to name all different emotions used or were more inclined to name basic corresponding emotions such as anger, sadness and happiness.

Wai and Tiliopoulos' (2012) research also showed no significant impairment of cognitive empathy. Therefore it was assumed that adding a secondary cognitive task would have the opposite effect than the emotional task. It was hypothesized that low Machiavellistic personalities would have more difficulty in performing a secondary cognitive task when compared to high Machiavellistic personalities. For this reason it was assumed that an increase in cognitive demand – operationalized by increase in task difficulty – would be characterized by a greater increase of tonic electrodermal activity for low Machiavellistic personalities when compared to high Machiavellistic personalities. We found this hypothesis not to be true. High Machiavellistic personalities again showed the greatest increase in tonic electrodermal activity between task difficulties. Difference between cognitive task difficulty was operationalized by either summing (easy) or multiplying (difficult). Cherulnik et al. (1981) found individuals high in Machiavellianism to be ambitious, dominating, relaxed, talented and confident. A greater increase of tonic electrodermal activity for high Machiavellistic personalities might therefore be caused by a greater ambition or motivation to successfully complete the task at hand compared to low Machiavellistic personalities. However Cherulnik et al. (1981) made no such distinction, but data provides the means to analyze this assumption. Preparatory analysis shows participants responding correctly,

incorrectly or withholding response due to not knowing the correct answer in the given time. Analysis could provide some insight in differences, if any, in response effort by high and low Machiavellistic individuals.

### **Implications of current findings**

Much research has shown that deceiving others is more cognitively demanding than telling the truth and can be detected by means of recording electrodermal activity. Current findings confirm the notion that deception can be detected by means of increase in tonic electrodermal activity. However, as results show, further elaborative studies should be done in order to gain more insight in the complete deception management process. Results showed – both compared to when telling the truth- a distinct *decrease* of tonic electrodermal activity when having the intent to lie and a significant *increase* in tonic electrodermal activity when lying. Both having the intent to lie, thus telling the truth, awaiting when to lie, actual lying are part of the deception management process as a whole, therefore a model based on the comparison of this distinct decrease and increase of tonic electrodermal activity during the lying process might make the deceptive answer more salient. More research however has to be done on this topic.

Current research shows individual differences in Machiavellianism to play an obvious role in how tonic electrodermal activity is portrayed. Using the tonic, continuous, measure of electrodermal activity, promising results are found for detecting deception in even those showing least signs of deceptive intent. Finally, despite the fact that results were non-significant, results show promising possibilities by using different additional tasks, to elicit deception even for the most cold-blooded liars.

## **Acknowledgements**

I would like to thank Marije Hoogeboom with how I conducted the experiment. Furthermore I would like to thank Sabine Ströfer, Elze Ufkes, Matthijs Noordzij and Ellen Giebels for their confidence, patience and guiding throughout the process of writing my Bachelor Thesis.

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## Appendices

### Appendix A. Examples of the emotional condition

#### Easy emotional condition



Antwoord op de vraag:

Emotie:

**Difficult emotional condition**

Heeft deze persoon een getinte huidskleur?



Antwoord op de vraag:

Emotie:

## Appendix B. Examples of the cognitive condition

### Easy cognitive condition

Heeft deze persoon een getinte huidskleur?



Aantal sproeten  
+ 3

Antwoord op de vraag:

Uitkomst sproeten:



**Difficult cognitive condition**

Heeft deze persoon een getinte huidskleur?

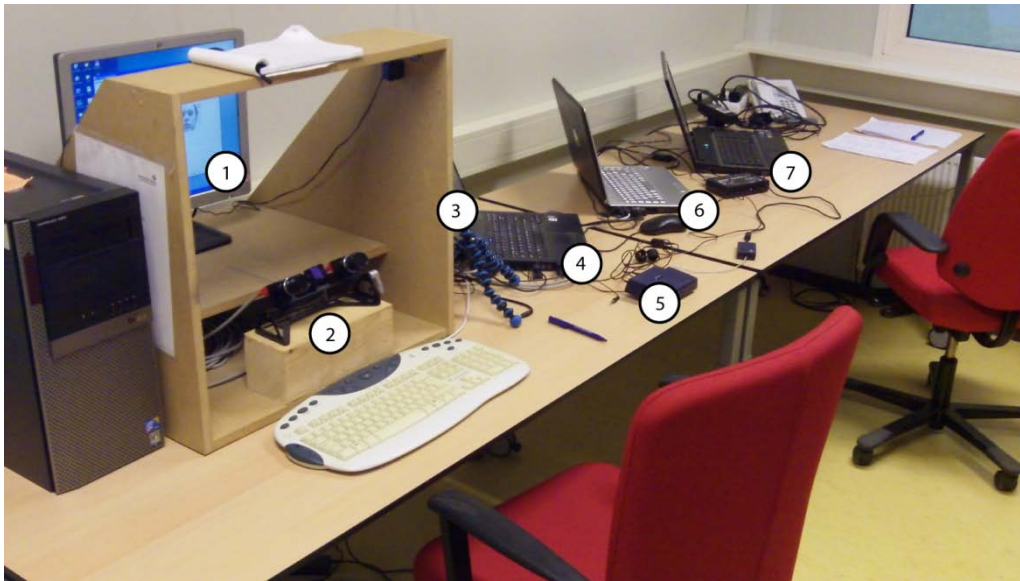


Aantal sproeten  
x 27

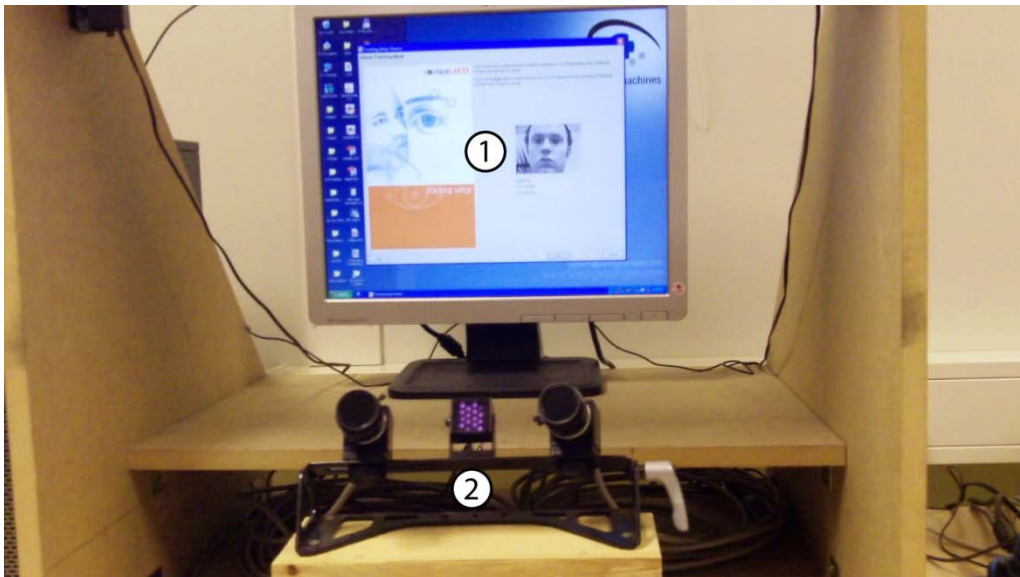
Antwoord op de vraag:

Uitkomst sproeten:

## Appendix C. Experimental setting



- 1) Monitor showing stimuli
- 2) Eye-tracker
- 3) Camera position
- 4) Laptop running faceLAB (recording eye-tracker data)
- 5) Skin conductance sensors
- 6) Laptop running e-Prime
- 7) Laptop running BioInfinity (recording EDA data)



## Appendix D. Informed consent

### GEÏNFORMEERDE TOESTEMMING

GW.07.130

Ik, ..... (naam proefpersoon)

Stem toe mee te doen aan een onderzoek dat uitgevoerd wordt door

Tom Jansen

Ik ben me ervan bewust dat deelname aan dit onderzoek geheel vrijwillig is. Ik kan mijn medewerking op elk tijdstip stopzetten en de gegevens verkregen uit dit onderzoek terugkrijgen, laten verwijderen uit de database, of laten vernietigen.

*De volgende punten zijn aan mij uitgelegd:*

1. Het doel van dit onderzoek is deceptie detectie  
Deelname aan dit onderzoek zal meer inzicht geven omtrent hoe mensen omgaan met deceptie
2. Er zal mij gevraagd worden aan een experiment mee te werken en achteraf een vragenlijst in te vullen. Het hele onderzoek zal ongeveer 45 minuten duren.
3. Er behoort geen stress of ongemak voort te vloeien uit deelname aan dit onderzoek.
4. De gegevens verkregen uit dit onderzoek zullen anoniem verwerkt worden en kunnen daarom niet bekend gemaakt worden op een individueel identificeerbare manier.
5. De onderzoeker zal alle verdere vragen over dit onderzoek beantwoorden, nu of gedurende het verdere verloop van het onderzoek.

Handtekening onderzoeker: .....

Datum: .....

Handtekening proefpersoon: .....

Datum: .....

## **Appendix E. Emotional task instructions**

### **OVER DIT ONDERZOEK**

In dit onderzoek ga je vragen beantwoorden over foto's van personen. Hierbij vertel je op sommige momenten de waarheid, en op sommige momenten ga je liegen. Je opdracht is om zo geloofwaardig mogelijk over te komen. Hoe geloofwaardiger je bent, hoe groter je kans op de eerste prijs van €100,- of de tweede prijs van €50,- die we voor dit onderzoek beschikbaar hebben. Mocht je een prijs winnen, dan nemen we via e-mail contact met je op. Vul daarom hieronder je naam en emailadres in.

Respondentnummer (datum en tijd): \_\_\_\_\_

Email-adres: \_\_\_\_\_

Lees de instructies hieronder aandachtig door. Je zult hierdoor beter in staat zijn goed te presteren. Bovendien levert het onderzoek ons meer op naarmate de deelnemers een beter begrip hebben van de taak. Aarzel dus niet om vragen te stellen als iets onduidelijk is.

## OPDRACHTEN

Voordat we ingaan op de opdracht willen we benadrukken dat het belangrijk is dat je zo geloofwaardig mogelijk overkomt. Zo vergroot je immers de kans op de prijzen van €100,- en €50,-.

### *Rondes*

Je krijgt straks een aantal rondes waarin je elke ronde 6 vragen krijgt. De vragen gaan over persoonskenmerken, bijvoorbeeld haarkleur of geslacht. Na elke vraag krijg je een foto van een gezicht te zien, waarover je de vraag moet beantwoorden. Voorafgaand aan de rondes krijg je een opdracht. Dit kan zijn dat je moet liegen op alle vragen, lieg op geen enkele vraag (spreek dus in dat geval op alle vragen de waarheid) of dat je op slechts 1 vraag, de blauwgekleurde vraag, in de ronde liegt. Je krijgt iedere opdracht een aantal keer.

### *Emotie*

Daarnaast krijg je een aanvullende opdracht, bestaande uit twee delen. Ten eerste moet je inschatten welke emotie iemand laat zien. Lieg in geen van de gevallen over de uitkomst hiervan.

### *Blauwe vraag*

Verder krijg je bij de lieg- en de waarheidsopdracht ook de opdracht "blauw" te zeggen zodra je een blauwgekleurde vraag ziet. Je moet dan zo snel mogelijk "blauw" zeggen en hoeft hier dus niet te wachten op het antwoordscherm.

### *Antwoord*

In een andere ruimte zit een leugen-expert met je mee te kijken. Hij maakt bij ieder antwoord de inschatting of je liegt of de waarheid spreekt. Het is daarom belangrijk dat je het antwoord op de vraag hardop uitspreekt. Ook moet je de vraag in je antwoord herhalen. Als de vraag dus bijvoorbeeld is: "Heeft deze persoon een bril?", dan antwoord je als volgt: "Ja, deze persoon heeft een bril", of "Nee, deze persoon heeft geen bril". Het antwoord kun je geven als je het antwoordscherm te zien krijgt.

### *Proefronde*

Je gaat nu samen met de proefleider een proefronde spelen.

## BELANGRIJK

Zometeen gaat het echte experiment van start, het zal in totaal ongeveer 30 minuten duren. Neem je rol serieus en probeer de instructies die je hebt gekregen zo goed mogelijk op te volgen. Je kans op de eerste prijs van €100,- of de tweede prijs van €50,- is in eerste instantie afhankelijk van hoe geloofwaardig je overkomt op de leugen-expert daarnaast wordt ook gekeken hoe goed je presteert op de aanvullende opdracht.

**Zou je bij het beantwoorden van de volgende vragen niet meer terug willen bladeren? Omcirkel steeds het juiste antwoord.**

**1. Op welke opdracht moet je soms liegen**

- a. De emotie
- b. De vragen over de kenmerken van de personen (bijvoorbeeld haarkleur)

**2. In hoeverre wil je**

- |                               |   |   |   |   |   |
|-------------------------------|---|---|---|---|---|
| a. Geloofwaardig overkomen    | 1 | 2 | 3 | 4 | 5 |
| b. De emoties goed inschatten | 1 | 2 | 3 | 4 | 5 |

## Appendix F. Cognitive task instructions

### OVER DIT ONDERZOEK

In dit onderzoek ga je vragen beantwoorden over foto's van personen. Hierbij vertel je op sommige momenten de waarheid, en op sommige momenten ga je liegen. Je opdracht is om zo geloofwaardig mogelijk over te komen. Hoe geloofwaardiger je bent, hoe groter je kans op de eerste prijs van €100,- of de tweede prijs van €50,- die we voor dit onderzoek beschikbaar hebben. Mocht je een prijs winnen, dan nemen we via e-mail contact met je op. Vul daarom hieronder je naam en emailadres in.

Respondentnummer (datum en tijd): \_\_\_\_\_

Email-adres: \_\_\_\_\_

Lees de instructies hieronder aandachtig door. Je zult hierdoor beter in staat zijn goed te presteren. Bovendien levert het onderzoek ons meer op naarmate de deelnemers een beter begrip hebben van de taak. Aarzel dus niet om vragen te stellen als iets onduidelijk is.

## OPDRACHTEN

Voordat we ingaan op de opdracht willen we benadrukken dat het belangrijk is dat je zo geloofwaardig mogelijk overkomt. Zo vergroot je immers de kans op de prijzen van €100,- en €50,-.

### *Rondes*

Je krijgt straks een aantal rondes waarin je elke ronde 6 vragen krijgt. De vragen gaan over persoonskenmerken, bijvoorbeeld haarkleur of geslacht. Na elke vraag krijg je een foto van een gezicht te zien, waarover je de vraag moet beantwoorden. Voorafgaand aan de rondes krijg je een opdracht. Dit kan zijn dat je moet liegen op alle vragen, lieg op geen enkele vraag (spreek dus in dat geval op alle vragen de waarheid) of dat je op slechts 1 vraag, de blauwgekleurde vraag, in de ronde liegt. Je krijgt iedere opdracht een aantal keer.

### *Rekensom*

Daarnaast krijg je een aanvullende opdracht, bestaande uit twee delen. Ten eerste krijg je tegelijk met de foto een rekensom aangeboden. De personen hebben allemaal sproeten, waarmee je de rekensom uit moet voeren. Lieg in geen van de gevallen over de uitkomst van de rekensom.

### *Blauwe vraag*

Daarnaast krijg je bij de lieg- en de waarheidsopdracht ook de opdracht "blauw" te zeggen zodra je een blauwgekleurde vraag ziet. Je moet dan zo snel mogelijk "blauw" zeggen en hoeft hier dus niet te wachten op het antwoordscherm.

### *Antwoord*

In een andere ruimte zit een leugen-expert met je mee te kijken. Hij maakt bij ieder antwoord de inschatting of je liegt of de waarheid spreekt. Het is daarom belangrijk dat je het antwoord op de vraag hardop uitspreekt. Ook moet je de vraag in je antwoord herhalen. Als de vraag dus bijvoorbeeld is: "Heeft deze persoon een bril?", dan antwoord je als volgt: "Ja, deze persoon heeft een bril", of "Nee, deze persoon heeft geen bril". Het antwoord kun je geven als je het antwoordscherm te zien krijgt.

### *Proefronde*

Je gaat nu samen met de proefleider een proefronde spelen.

## BELANGRIJK

Zometeen gaat het echte experiment van start, het zal in totaal ongeveer 30 minuten duren. Neem je rol serieus en probeer de instructies die je hebt gekregen zo goed mogelijk op te volgen. Je kans op de eerste prijs van €100,- of de tweede prijs van €50,-



is in eerste instantie afhankelijk van hoe geloofwaardig je overkomt op de leugen-expert daarnaast wordt ook gekeken hoe goed je presteert op de aanvullende opdracht.

**Zou je bij het beantwoorden van de volgende vragen niet meer terug willen bladeren? Omcirkel steeds het juiste antwoord.**

**3. Op welke opdracht moet je soms liegen**

- a. De rekensom
- b. De vragen over de kenmerken van de personen (bijvoorbeeld haarkleur)

**4. In hoeverre wil je**

- |                              |   |   |   |   |   |
|------------------------------|---|---|---|---|---|
| c. Geloofwaardig overkomen   | 1 | 2 | 3 | 4 | 5 |
| d. De rekensommen goed maken | 1 | 2 | 3 | 4 | 5 |

## **Appendix G. Post-experiment questionnaire in the emotion condition**

Beste deelnemer,

Het grootste gedeelte van dit onderzoek zit erop. We willen je vragen onderstaande stellingen in te vullen. Het zijn vragen die ingaan op hoe je het onderzoek ervaren hebt.

Je kunt op de stellingen steeds aangeven in hoeverre je het met de betreffende uitspraak eens bent. Lees de vragen goed door, maar aarzel niet te lang met antwoorden, de eerste ingevulling is vaak de juiste. Er zijn geen goede of foute antwoorden, wij zijn geïnteresseerd in jouw beleving. Daarom willen we je vragen de lijst zelfstandig en volledig in te vullen en daarbij zo eerlijk mogelijk te zijn. Het invullen kost ongeveer 5 minuten.

Tot slot willen we benadrukken dat de door jou ingevulde gegevens vertrouwelijk worden behandeld, de gegevens anoniem worden verwerkt en de resultaten uitsluitend op algemeen niveau worden gerapporteerd.

Alvast bedankt voor je deelname!

Geef aan in hoeverre onderstaande stellingen beschrijven hoe je je **nu, op dit moment** voelt. Ga op je eerste ingeving af en gebruik bij je antwoorden de volgende schaal:

1	2	3	4	5	6	7
helemaal niet	nauwelijks	een beetje	neutraal	best wel	behoorlijk	heel erg

1. Ik voel me mentaal uitgeput. \_\_\_\_\_
2. Op dit ogenblik zou het me veel inspanning kosten me ergens op te concentreren. \_\_\_\_\_
3. Ik heb iets prettigs nodig om me beter te voelen. \_\_\_\_\_
4. Ik voel me gemotiveerd. \_\_\_\_\_
5. Als ik nu een moeilijke opdracht zou krijgen, zou ik makkelijk opgeven. \_\_\_\_\_
6. Ik voel me leeg. \_\_\_\_\_
7. Ik heb veel energie. \_\_\_\_\_
8. Ik voel me uitgeput. \_\_\_\_\_
9. Als ik nu ergens door verleid zou worden, zou weerstand bieden erg moeilijk zijn. \_\_\_\_\_
10. Ik zou met elke moeilijke taak die ik zou krijgen willen stoppen. \_\_\_\_\_
11. Ik voel me rustig en rationeel. \_\_\_\_\_
12. Ik kan geen informatie meer opnemen. \_\_\_\_\_
13. Ik ben in een luie bui. \_\_\_\_\_
14. Op dit moment zou ik het moeilijk vinden om vooruit te plannen. \_\_\_\_\_
15. Ik voel me scherp en geconcentreerd. \_\_\_\_\_
16. Ik wil opgeven. \_\_\_\_\_
17. Dit zou een goed moment voor mij zijn om een belangrijke beslissing te nemen. \_\_\_\_\_
18. Ik heb het gevoel dat mijn wilskracht verdwenen is. \_\_\_\_\_
19. Ik heb mijn gedachten nu niet helemaal op een rijtje. \_\_\_\_\_
20. Ik kan me op dit moment goed concentreren. \_\_\_\_\_
21. Ik heb bijna geen mentale energie meer. \_\_\_\_\_
22. Een nieuwe uitdaging zou me op dit moment aanspreken. \_\_\_\_\_
23. Ik zou willen dat ik me even kon ontspannen. \_\_\_\_\_
24. Ik heb moeite mijn verlangens te bedwingen. \_\_\_\_\_
25. Ik voel me ontmoedigd. \_\_\_\_\_
26. Ik vond het inschatten van de emoties moeilijk \_\_\_\_\_

Nu willen je graag nog wat vragen stellen over jouw stemming op dit moment. Kruis bij ieder woord aan in hoeverre het beschreven gevoel overeenkomt met hoe jij je nu voelt. Denk niet te lang na over je antwoord.

	Helemaal niet	Een beetje	Enzigszins	Nogal	Heel erg
Geïnteresseerd					
Ontdaan					
Opgewonden					
Overstuur					
Sterk					
Schuldig					
Angstig					
Vijandig					
Enthousiast					
Trots					
Geïrriteerd					
Alert					
Beschaamd					
Geïnspireerd					
Zenuwachtig					
Vastbesloten					
Oplettend					
Nerveus					
Actief					
Bang					

Geef aan in hoeverre je het eens/ oneens bent met de volgende stellingen:

	Helemaal niet				Helemaal wel
1. Ik had het gevoel dat ik bekeken werd	1	2	3	4	5
2. Ik vond het moeilijk om te liegen	1	2	3	4	5
3. Ik vond het moeilijk om de waarheid te spreken	1	2	3	4	5
3. Ik denk dat ik een goede leugenaar ben	1	2	3	4	5
4. Ik voel me schuldig over het liegen	1	2	3	4	5
5. Ik vond het inschatten van emoties lastig	1	2	3	4	5
6. Ik denk dat ik geloofwaardig overkwam toen ik loog	1	2	3	4	5
7. Ik was gemotiveerd om geloofwaardig over te komen	1	2	3	4	5

## **Appendix H. Post-experiment questionnaire in the cognitive condition**

Beste deelnemer,

Het grootste gedeelte van dit onderzoek zit erop. We willen je vragen onderstaande stellingen in te vullen. Het zijn vragen die ingaan op hoe je het onderzoek ervaren hebt.

Je kunt op de stellingen steeds aangeven in hoeverre je het met de betreffende uitspraak eens bent. Lees de vragen goed door, maar aarzel niet te lang met antwoorden, de eerste ingeving is vaak de juiste. Er zijn geen goede of foute antwoorden, wij zijn geïnteresseerd in jouw beleving. Daarom willen we je vragen de lijst zelfstandig en volledig in te vullen en daarbij zo eerlijk mogelijk te zijn. Het invullen kost ongeveer 5 minuten.

Tot slot willen we benadrukken dat de door jou ingevulde gegevens vertrouwelijk worden behandeld, de gegevens anoniem worden verwerkt en de resultaten uitsluitend op algemeen niveau worden gerapporteerd.

Alvast bedankt voor je deelname!

Geef aan in hoeverre onderstaande stellingen beschrijven hoe je je **nu, op dit moment** voelt. Ga op je eerste ingeving af en gebruik bij je antwoorden de volgende schaal:

1	2	3	4	5	6	7
helemaal niet	nauwelijks	een beetje	neutraal	best wel	behoorlijk	heel erg

1. Ik voel me mentaal uitgeput. \_\_\_\_\_
2. Op dit ogenblik zou het me veel inspanning kosten me ergens op te concentreren. \_\_\_\_\_
3. Ik heb iets prettigs nodig om me beter te voelen. \_\_\_\_\_
4. Ik voel me gemotiveerd. \_\_\_\_\_
5. Als ik nu een moeilijke opdracht zou krijgen, zou ik makkelijk opgeven. \_\_\_\_\_
6. Ik voel me leeg. \_\_\_\_\_
7. Ik heb veel energie. \_\_\_\_\_
8. Ik voel me uitgeput. \_\_\_\_\_
9. Als ik nu ergens door verleid zou worden, zou weerstand bieden erg moeilijk zijn. \_\_\_\_\_
10. Ik zou met elke moeilijke taak die ik zou krijgen willen stoppen. \_\_\_\_\_
11. Ik voel me rustig en rationeel. \_\_\_\_\_
12. Ik kan geen informatie meer opnemen. \_\_\_\_\_
13. Ik ben in een luie bui. \_\_\_\_\_
14. Op dit moment zou ik het moeilijk vinden om vooruit te plannen. \_\_\_\_\_
15. Ik voel me scherp en geconcentreerd. \_\_\_\_\_
16. Ik wil opgeven. \_\_\_\_\_
17. Dit zou een goed moment voor mij zijn om een belangrijke beslissing te nemen. \_\_\_\_\_
18. Ik heb het gevoel dat mijn wilskracht verdwenen is. \_\_\_\_\_
19. Ik heb mijn gedachten nu niet helemaal op een rijtje. \_\_\_\_\_
20. Ik kan me op dit moment goed concentreren. \_\_\_\_\_
21. Ik heb bijna geen mentale energie meer. \_\_\_\_\_
22. Een nieuwe uitdaging zou me op dit moment aanspreken. \_\_\_\_\_
23. Ik zou willen dat ik me even kon ontspannen. \_\_\_\_\_
24. Ik heb moeite mijn verlangens te bedwingen. \_\_\_\_\_
25. Ik voel me ontmoedigd. \_\_\_\_\_
26. Ik vond de rekensommen moeilijk \_\_\_\_\_

Nu willen je graag nog wat vragen stellen over jouw stemming op dit moment. Kruis bij ieder woord aan in hoeverre het beschreven gevoel overeenkomt met hoe jij je nu voelt. Denk niet te lang na over je antwoord.

	Helemaal niet	Een beetje	Enzigszins	Nogal	Heel erg
Geïnteresseerd					
Ontdaan					
Opgewonden					
Overstuur					
Sterk					
Schuldig					
Angstig					
Vijandig					
Enthousiast					
Trots					
Geïrriteerd					
Alert					
Beschaamd					
Geïnspireerd					
Zenuwachtig					
Vastbesloten					
Oplettend					
Nerveus					
Actief					
Bang					

Geef aan in hoeverre je het eens/ oneens bent met de volgende stellingen:

	Helemaal niet				Helemaal wel
1. Ik had het gevoel dat ik bekeken werd	1	2	3	4	5
2. Ik vond het moeilijk om te liegen	1	2	3	4	5
3. Ik vond het moeilijk om de waarheid te spreken	1	2	3	4	5
3. Ik denk dat ik een goede leugenaar ben	1	2	3	4	5
4. Ik voel me schuldig over het liegen	1	2	3	4	5
5. Ik vond de rekensommen lastig	1	2	3	4	5
6. Ik denk dat ik geloofwaardig overkwam toen ik loog	1	2	3	4	5
7. Ik was gemotiveerd om geloofwaardig over te komen	1	2	3	4	5

## Appendix I. Machiavellianism Questionnaire (MACH IV)

### VRAGENLIJST

Geef aan in hoeverre je het eens / oneens bent met onderstaande stellingen.

	Helemaal mee eens	1	2	3	4	Helemaal mee oneens	5
1. De beste manier om met mensen om te gaan is ze te zeggen wat ze willen horen		1	2	3	4		5
2. Als je wil dat iemand iets voor je doet kun je het beste de echte redenen geven, in plaats van redenen die overtuigender zijn		1	2	3	4		5
3. Iemand die een ander volledig vertrouwd vraagt om problemen		1	2	3	4		5
4. Het is moeilijk om verder in het leven te komen zonder anderen wel eens de pas af te snijden		1	2	3	4		5
5. Eerlijkheid is altijd het beste		1	2	3	4		5
6. Je kunt er het beste vanuit gaan dat iedereen je een vuile strek levert als ze de kans krijgen		1	2	3	4		5
7. Vertel nooit iemand de echte reden waarom je iets deed, tenzij het je voordeel op kan leveren		1	2	3	4		5
8. Doe alleen iets als je het moreel juist acht		1	2	3	4		5
9. Het is verstandig om belangrijke mensen te vleien		1	2	3	4		5
10. Over het algemeen is het beter om bescheiden en eerlijk te zijn dan belangrijk en oneerlijk		1	2	3	4		5
11. Iedere minuut wordt er wel ergens een sukkel geboren		1	2	3	4		5
12. Mensen die ongeneeslijk ziek zijn moeten de kans krijgen om pijnloos om het leven gebracht te worden		1	2	3	4		5
13. Het is mogelijk om in alle opzichten goed te zijn		1	2	3	4		5
14. De meeste mensen zijn over het algemeen goed en		1	2	3	4		5



vriendelijk

15. Er is geen excuus dat een leugen kan rechtvaardigen	1	2	3	4	5
16. De meeste mensen verwerken de dood van hun ouders makkelijker dan het verlies van hun bezit	1	2	3	4	5
17. De meeste mensen die vooruit komen in het leven laten zich leiden door juiste en rechtvaardige principes	1	2	3	4	5
18. Over het algemeen werken mensen niet hard, tenzij ze daartoe worden gedwongen	1	2	3	4	5
19. Het grootste verschil tussen criminelen en gewone mensen is dat criminelen zo dom zijn om gepakt te worden	1	2	3	4	5
20. De meeste mensen zijn moedig	1	2	3	4	5

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