Nonverbal Cues to Deception

The Effects of Cognitive Load and Repetition on Cues to Deception

Rebecca van Beek (914359)
Supervisor: Anna van 't Veer

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Abstract

The research presented in this paper examined the differences between truth tellers and liars in their non-verbal behavior. The non-verbal behavior was captured by coding videotapes in two studies. In study 1 cognitive load was manipulated by three rules the participants had to follow. Students had to go through all three conditions, namely: tell the truth, lie, or lie according to rules (constrained lie). The last condition caused the student to experience the most cognitive load. Results showed that liars shrug their shoulders symmetrically more than truth-tellers, and more than liars with extra cognitive load F (2,12) = 3.91, $p < 0.05$. This effect is higher for women than for men F (2,12) = 5.68, $p = 0.02$. The other cues were not significant different between liars and truth tellers. In study 2 videotapes were coded as in the previous study. Only here the students on the tapes were instructed to tell the truth and lie, about the day before. Students had to go through both conditions twice. Results showed liars bite their lips marginally less than truth tellers F (3,40) = 2.36, $p = 0.09$. Liars also shrug their shoulder on one side more than truth tellers F (3,40) = 5.54, $p < 0.00$. This was the highest for telling a lie the second time and the lowest for telling the truth the first time. This effect was higher for women than for men F (3,40) = 4.05, $p < 0.01$. Implications for further research on lie-detection are discussed.

Nonverbal Cues to Deception

On average, students lie twice a day (DePaulo, Kashy, Kirkendol, Wyer & Epstein, 1996). Lying is therefore a daily activity (DePaulo, et al., 1996). However we do not notice people lying that often. In real life it is impossible to detect lies by just watching people; people are bad lie detectors (Vrij, Mann, Fisher, Leal, Milne & Bull, 2008). Still many researchers try to investigate which behavior is typical for liars. This research will focus on the nonverbal behavior of a liar.

Research shows there are several nonverbal cues to lying. This research examines existing cues to confirm these nonverbal cues of lying behavior, and shows in what amount they exist. Furthermore more clarity between contradictions in the literature will be given. Liars will often use self-manipulation to prevent others from seeing through them (Vrij et al., 2008). This causes the liar to experience more cognitive load than when the liar is telling the truth (Vrij et al., 2008). The more cognitive load a lie causes the more nonverbal lying cues the liar will show. This research will examine if in videotapes where cognitive load was manipulated, more cues are shown.

This research contains of two studies. Study 1 has three conditions – telling the truth, lying, and lying according rules (constrained lie). Every student had to pass all three conditions. In each condition every student had to describe a drawing to a confederate. Study 2 has two conditions – telling the truth, and lie about what the student did the previous day. Every student had to go pass both conditions twice. By coding the nonverbal behaviors of the students, the differences in nonverbal behavior of liars and non-liars, and the differences between lying with or without cognitive load will be investigated.

This research is relevant because it examines, besides agreements, disagreements in literature about nonverbal lying behavior. Also the addition of the manipulation of cognitive load is not done often before. To understand the research properly, some definitions are given below.

According to www.dictionary.com 'to lie' means: "To speak falsely or utter untruth knowingly, as with the intent to deceive" (2012). DePaulo, Lindsay, Malone, Muhlenbruck, Charlton, and Cooper (2003) use the following definition: "A deliberate attempt to mislead others." The important aspect of both definitions of lying is the intention of not telling the truth. If someone is telling a lie unintended he or she would not show lying behavior associated with the lie, which is irrelevant for our current purposes.

Liars cannot control every aspect of their behavior because lying makes you think a lot (DePaulo et al., 2003). This inability to control every aspect causes some leakages in liars' nonverbal behavior, which does not agree with their verbal behavior. This research is about the nonverbal cues to lying, also called cues to deception, verbal cues to lying are not taken into account. Nonverbal behavior is an important part of lie detection. Ekman (2000) showed already that behavior betrays the liar. For example, one of these behaviors Ekman mention is that liars look down because they feel guilty about their lie.

People believe different things about typical lie behavior. In general, people think nervous behaviors – like more movements with arms and legs, more body movements, more looking away – are cues of lying (Vrij & Semin, 1996). But many of the beliefs people have are false beliefs about indicators of lying (Strömwall, Granhag & Hartwig, 2004). These false beliefs are, more movements with the arms and legs, more smiling, and more pauses in their speech (Vrij, 2000). However these are mostly indicators of nervousness as well. In fact, nervousness is not always a cue to deception (Vrij & Semin, 1996). There are a lot of general

beliefs but not every belief is true. This research will try to find more clarity about which cues really are cues to deception and which not.

Below the concepts cognitive load and self-manipulation are described. Subsequently, a description of nonverbal cues of lying is given, derived from the literature.

Cognitive load

As stated above, lying causes cognitive load to the liar (Vrij et al., 2008). The liar has to make up a lie, and telling the lie in a way nobody notices him or her lying. Besides that, the liar needs to remember the lie and keep the lie in every story the same. At the same time the liar has to remember him or herself of having told a lie. Finally, the liar needs to suppress the truth while telling a lie. To take care of all these steps, the liar has to think a lot which causes the liar cognitive load (Vrij, Granhag, Mann & Leal, 2011). Under cognitive load, liars supposedly 'leak' more cues of deception. Research shows liars show more cues while following assignments. For example liars show more cues when telling a story in reversed order (Vrij et al., 2008) or looking the interviewer in the eyes the whole time (Vrij, Mann, Leal, & Fisher, 2010) compared to liars without those tasks. This is because those assignments causes more cognitive load. In case someone has to lie, these assignments cause extra load on top of making up a lie. This makes it more difficult to control the nonverbal behavior.

Self-manipulation

Although it is difficult for liars to control their nonverbal behavior, they nonetheless try to do so. Controlling of behavior is called self-manipulation (DePaulo et al., 2003). This causes, just like making up a lie, cognitive load. Liars use self-manipulation because they are not sure of their own credibility. The pitfall is that liars manipulate their behavior according to what they think liars would do while lying. However laypeople do not think (all) the right

things about lie behavior (Strömwall et. al., 2004). Being busy covering lying behavior can lead to be caught in a lie (DePaulo & Friedman, 1998). In situations of self-manipulation, liars behave less spontaneous than truth tellers (DePaulo, 2003). The behavior becomes unnatural because it is controlled. The posture of the liar becomes more rigid (Vrij & Mann, 2001). Besides that it is impossible to control every behavior. So even with self-manipulation leakages of lies and inconsistencies between verbal and nonverbal behavior come into existence.

Vrij (2000) agrees with the above statements by his 'Attempted Behavioral Control Approach'. This approach states we try to control our behavior while lying. Vrij (2000) also shows the difference between the amount of self-manipulation between offenders and students. Offenders use less self-manipulation than students. The conclusion Vrij makes is; people who are used to lying have to work less hard to behave veracious. They are trained to lie. Granhag and Strömlach (2002) confirm this idea. Their research shows people use less self-manipulation after having the same conversation several times.

A sign of self-manipulation is a reduction of illustrative talking (Vrij et al., 2011). This means less gestures and less expressivity. Another sign is that liars touch their own body less during self-manipulation and they have less body movements. Trained liars show these behaviors the other way around because they know the theories about self-manipulation. In this research touching the body, body movements, and posture shifts are further taken into account.

Cues

Current research focuses on cues of the body and facial cues for lying behavior Not all the facial cues will be coded because they are not properly visible in the videotapes.

Otherwise reliability of the results is not guaranteed. This research first focuses on the whole body, hand and arm movements, and finally on the facial cues.

First the cues of the body, disagreements exist if liars behave nervous or not while telling a lie. In general, people tend to think a liar behaves nervous (DePaulo et al., 2003). However, Vrij, Mann, Leal and Fisher (2010) show liars behave less nervous while telling a lie. In both researches nervous behavior is defined as: body movements which do not help with illustrating what is told. These are posture shifts, body movements, movements with the hands and fingers, and movements with legs and feet.

Second, researches show liars make fewer movements with fingers or hands than truth tellers (Vrij & Semin, 1996; DePaulo et al., 2003). Other research partly disagrees with them (Caso, Maricchiolo, Bonaiuto, Vrij & Mann, 2006).They agree on the part that liars use less deictic gestures than truth tellers. Deictic gestures are pointing gestures to designate. However, in contradiction to DePaulo et al. (2003), Caso et al. (2006) say liars use more metaphoric gestures than truth tellers. Metaphoric gestures are gestures that illustrate abstract ideas. It is like making a drawing in the air. Metaphoric gestures are especially used while performing difficult cognitive tasks (Hadar, Wenkert-Olenik, Kruass, & Soroker, 1998). We use these gestures to explain difficult things but also when it is difficult to explain easy things, like when we are lying about it. Lying is a cognitive task, so it is not surprising liars use more metaphoric gestures than truth tellers. Other research agrees on this, it shows liars use easy controlling gestures less than truth tellers (Hocking & Leathers, 2009). In this research pointing gestures are coded as non-illustrative gestures because they do not support the spoken language. Metaphoric gestures are coded as illustrative gestures.

The body movements the literature agrees on is shrugging the shoulders while lying. Research of Ekman (2006) showed only liars use shrug gestures. However this only was

applicable to 33 percent of his participants. Someone who does not shrug, does not have to be telling the truth, but in case someone shrugs his or her shoulders, there is a high chance the person is telling a lie. Shrugging the shoulder one or two sides is defined by Givens (2008) as a response on someone else's statement or question, or the physical appearance of someone's uncertainties. In the last explanation this could be a cue to deception. When someone is lying he or she feels uncertain. Especially because liars think others see when they are lying (DePaulo et al., 2003). Therefore it is taken into account in this research. Concluding, there is disagreement on body-movements as a cue of lying, but an agreement about shrugging the shoulders.

Finally the facial cues to lying, research from Vrij and Semin (1996) shows laypeople think movements with the head are a cue of lying but in actuality it is not. However that research takes movements of the head as one general cue. Other researches who separate specific movements of the head prove there are cues of movements with the head. O'Hair, Cody and McLaughlin (2006) are more specific on head cues and disagree on Vrij and Semin (1996). According to the research of O'Hair et al. (2006) liars nod more than truth tellers. To make it complete in this research also head shakes are taken into account. However DePaulo et al. (2003) show no significant result, head movements are taken together as well to confirm the results of DePaulo.

Another cue is the raising of the chin. Depaulo et al. (2003) show liars raise their chin more than truth tellers. Zivin (1982) calls this the plus face, a sign of security. Liars are probably busy to appear more confident, because they think others do not take this for granted.

Laypeople think gaze aversion is a cue to lying (Strömwall et. al., 2004). According to DePaulo et al. (2003) gaze aversion is not a cue to lying. However, Ekman (2000) showed

liars look down because they feel guilty about their lie. Doherty-Sneddon and Phelps (2005) show people have more gaze aversion when they experience more cognitive load. In that case we expect case aversion would be higher when someone lies and the more when the liar experiences extra cognitive load.

There are also cues of the mouth. DePaulo et al. (2003) show liars press their lips more than truth tellers. Liars also smile less than truth tellers according to O'Hair, Cody and McLaughlin (2006). Taylor and Hick (2007) show liars swallow more than truth tellers. Research of Porter and ten Brinke (2011) shows the eyes are lie betrayers by blinking less and moving more. Unfortunately this research is not capable of examining the cues about blinking and the movements of the eye because no measurement of this has been done, and for coders this is an impossible job.

Present research

This research investigates the relation between lying and the appearance of several nonverbal cues, moderated by the amount of cognitive load the liar experiences (see fig. 1).

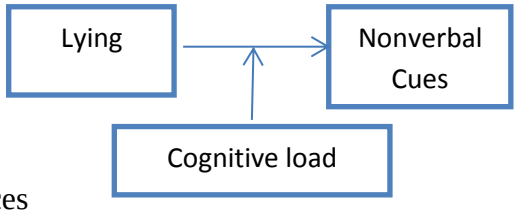

Fig. 1: Research model

To be sure that the cognitive load condition is de condition were the participants experience the highest cognitive load, a pretest was done. A different set of participants had to value the amount of cognitive load they thought the participant of every videotape would have had. Repeated measures ANOVA showed that the participants at the videotapes were judged to think the hardest in the cognitive load condition (M = 60.41, SD = 16.41) condition, less in the lie condition (M = 49.24, SD = 19.20) and the lowest in the truth telling condition (M = 40.23, SD = 17.06) F (2,285) = 46.12, p < 0.00.

The pretest showed in the cognitive load condition, participants had to think the hardest, the expectations are the participant will have more trouble with lying and controlling lying behavior. Therefore the first hypothesis will be*: H1: Cognitive load positively moderates the effect of lying on cues to deception.* At study 2 there is not a specific cognitive load condition. Research (Vrij, 2000; Granhag & Strömlach, 2002) shows liars show less self-manipulators when they are used to lie and/or repeat the lie. Therefore the expectation is that at study 2 when lying the second time, the cognitive load will be less and therefore less cues will be shown compared to lying the first time.

Overall lying will cause lying behavior. These behaviors can be separated in different types and directions of visible non-verbal cues. First there are two cues which contain of a few other signs. First of all self-manipulation is one of the behaviors liars will express. Therefore *H2: Liars show more signs of self-manipulation than truth tellers.* This means liars will behave less spontaneous, more controlled, use less gestures, touch their own body less and have less body movements.

Liars know they show off lying behavior. In order to control themselves liars show less nervous behavior. Therefore *H3: Liars will behave less nervous*. Nervousness can also be shown by other cues, it means more wiggling. This is followed by the next hypothesis *H4: Liars make less movements with hands and fingers.*

When someone explains something, he or she will use gestures. Because liars are controlling themselves they try to move less therefore show less non-illustrative gestures than truth tellers. Nevertheless they probably show more illustrative gestures because they want to be specific about what they tell to the other, in order to come across as more truthful. Besides non-illustrative gestures are easier to control than illustrative gestures (Givens, 2008). This

gives the next hypothesis: *H5: Liars use more illustrative gestures and less non-illustrative gestures than truth tellers.*

Shrugging the shoulder on one or both sides is the physical appearance of uncertainties (Givens, 2008). Liars are insecure about if others belief their lie and feel uncertain. Therefore next hypothesis is *H6: Liars shrug their shoulder (one or both sides) more than truth tellers.*

When someone is lying it is more unclear if someone believes you. The liar thinks he or she comes across as less reliable. Therefore, when the person, which the liar is talking to, continues in the conversation with accepting the lie, the liar will nod more because the liar is happy the lie will be taken as the truth. Nevertheless this will not be the case for headshakes because that will not be an advantage for your lie. Raising the chin will be done more as well because it will give the liar more self-esteem. Therefore the hypotheses are *H7: Liars nod more than truth tellers, while there is no difference between liars and truth tellers in the amount of headshakes. H8: Liars raise their chin more and are more gaze aversive than truth tellers.*

Liars also show lying behavior with their lips. The same as most cues in order to control the behavior and not be showing off as a liar, the liar will show less smiles, but instead press the lips and swallow more than truth tellers. *H9: Liars smile less than truth tellers, and liars press their lips and swallow more than truth tellers.*

Study 1

Method

Participants

Six students from Tilburg University – two women, four male – participated in the recording of the video material. They were assigned to three conditions in random order: truth, lie and constrained lie. Students were paid three euros as participation fee. Besides that a price of thirty euros was given to the best liar. This was a reinforcer to motivate the students to lie as good as they can, without showing they are lying. This was a simulation of a real case situation, in which you do not want to be busted either.

Materials and Procedure

The students had to follow every condition in random order to prevent an order effect. Also the coding of the videotapes was in random order so the coders were not biased about the cues they needed to code.

All the students were recorded by videotapes with at each time a different instruction. The first instruction, the truth condition, the students had to tell the truth. The second instruction, the lie condition, they had to lie the way they wanted. The third instruction, the constrained lie condition, the students had to follow three rules. The first rule was to add one to the amount of things they saw, when there were less than three on the drawing. For example, when there were two trees on the picture, the students said to the confederate there were three of them. The second rule was to subtract the amount with one, when there were three or more of them on the drawing. For example, when there were three clouds on the picture, the student told the confederate there were two clouds. The third rule was to inverse the left and right. The things left on the drawing needed to be described on the right and the other way around.

The students were welcomed in the first room where they got an instruction. They were explained they could gain a bonus of thirty euros if they were the best liar. Next the students were instructed to memorize one of three drawings (see appendix 1) that was presented to them randomly for sixty seconds. After this they were randomly assigned to the three conditions – telling the truth, lie, or constrained lie – to describe the three different drawings. After this they went to a second room to tell a confederate what they saw on the picture. The confederate did not knew the students and was trying to duplicate the drawing from the description the student was giving him. In this room there were two cameras to record the non-verbal behavior of the student.

Dependent variables

The videotapes were coded according to a coding scheme (see appendix 2). This coding scheme is a list of cues of lying behavior, constructed according to the findings in the literature. These cues are the dependent variables of the study and can be divided into different subareas. First, general data and cues were coded. These are: gender, the start and end time of speech (in seconds), the start position (from -3 closed till 3 open), nervousness (from -3 relaxed till 3 nervous) and spontaneity (from -3 rigid till 3 spontaneous). The last three were coded with a 7-point likert scale. The total amount of time was measured by stopwatch because the time span underneath the videotapes was not the same as the second of the stopwatch. Second, cues visible in the face of the student were coded. These are viewing direction (in seconds), nods (amount), holding head high (in seconds), smiling (in seconds and amount), head shake (amount), cues of the lips (amount) – bite, press, and lick lips – and swallowing (amount). Third, cues of body posture were coded. These are posture shifts (amount), self-manipulators (amount), shrug shoulders on both sides (amount) or one side (amount), and moving the elbows on both sides (amount) or one side (amount). These elbow movements were added because small shrugs with the shoulder can be caused by movements

of the elbows. The fourth and last subarea were the limbs. At this section the gestures (in seconds and amount) – illustrative and non-illustrative - and leg and hand movements (in seconds and amount) were coded. In order to guarantee the inter-rater reliability, three persons coded the videotapes independently. The first coder was female, the second coder was male, the third coder was female, all three were 22 years old. All effects are controlled for gender.

Results

Data characteristics

Reliability analyses between the three coders were taken to look to the absolute agreement of the data from the coders. The interclass correlation needed to be above 0.70 (Pallant, 2007). In case the reliability was not high enough the cue is not considered anymore. In case two coders were reliable and the other not, the average of the two coders was taken.

The inter-rater reliability of the following cues was lower than 0.70 and excluded from further analyzes. These cues were: nervousness (.647), spontaneity (.273), holding head high (.227), swallowing (-.041), touching the wrist (.603), and the counting of the non-illustrative gestures (.663). The cues touching neck (.649), touching torso (.585), and moving the elbows symmetric (.666) did not have an inter-rater reliability high enough between three coders but did between coder 1 and 2. The inter-rater reliability between coder 1 and 2 for the cues were respectively, touching neck (.908), touching torso (.790), and moving the elbows symmetric (.725). For these cases the average of coder 1 and 2 were taken.

The data was prepared for further analyzes by taking the average of the three coders. After that the average scores of the cues were divided by the total amount of time of the videotape. In this way the length of the videotape did not have such an amount of influence on the results. Also some cues were combined to analyze a class of non-verbal behaviors. New variables were: cues of the lips – combination of biting, pressing, and licking the lips –, self-

manipulators – combination of all the cues that measure the amount of touching the own body –, total cues – all the cues together.

The data was analyzed by univariate ANOVAs between the conditions and the cue of interest. Gender was added as control variable. Also the interaction of gender and the conditions was measured on the cue of interest.

Data analysis

For most cues the hypothesis was that liars show more cues than truth tellers and this effect would be higher when the liar experience cognitive load, as they did in the constrained lie condition. In Table 1 the means are shown of the cues as seen in the different types of videos.

Table 1

Means conditions Study 1 for every cue

Cue	Truth condition	Lie condition	Constrained lie condition
Start position	-,667	-,444	-,556
Viewing direction (D)	17.81	16.71	23.27
Viewing direction (C)	10.28	8.52	9.48
Nod (C)	0,98	2.59	1.62
Smile (D)	5.21	5.94	5.82
Smile (C)	1.49	1.21	1.60
Headshake (C)	0.39	0.81	0.34
Bite lips (C)	0.31	0.22	0.26
Press lips (C)	2.57	2.31	2.28

Lick lips (C)	0,61	0,63	0.39
Cues of the lips (C)	3.49	3.16	2.93
Posture shift (C)	0.14	0.49	0.70
Body movement (D)	0.08	0.03	0.02
Self-manipulator hair (C)	0.19	0.23	0.20
Self-manipulator head (C)	0.02	0.31	0.29
Self-manipulator mouth (C)	0.06	0.08	0.12
Self-manipulator legs (C)	0.19	0.19	0.16
Self-manipulator nose (C)	0.29	0.20	0.36
Self-manipulator neck (C)	0.06	0.14	0.18
Self-manipulator torso (C)	0.03	0.00	0.06
Self-manipulators total (C)	0.85	1.15	1.37
Shrug shoulders symmetric (C)	0.12	0.33	0.30
Elbow movement symmetric (C)	0.12	0.30	0.30
Shrug shoulders single (C)	0.34	0.58	0.28
Elbow movement single (C)	1.36	1.66	0.99
Illustrative gestures (D)	13.09	12.84	10.93
Illustrative gestures (C)	4.65	3.35	3.06
Non-illustrative gestures (D)	1.01	0.65	1.79
Hand movements (D)	18.77	18.07	21.16
Hand movements (C)	6.27	5.13	6.17
Leg movements (D)	15.31	11.10	12.06
Leg movements (C)	5.90	5.44	5.02
Movements (D)	34.16	29.19	33.25

Movements (C)	12.31	11.06	11.88
All cues	107.68	100.04	108.99

Note. Means are presented in the amount of times or seconds per minute the cue is shown. C means amount of times the cue is shown, D means the duration the cue is show

An univariate ANOVA of the different conditions and gender on shrugging the shoulders symmetrically shows there is significant difference between the conditions in the amount of shrugging the shoulder symmetrically F (2,12) = 3.91, $p < 0.05$. Telling a lie without extra cognitive load shows the most symmetric shrugs of the shoulders. The amount of symmetric shrugs of the shoulders are slightly higher for telling the truth than for telling a lie with cognitive load. Means and standard deviations (between brackets) are shown in table 2. Furthermore, men shrug their shoulder symmetrically less (M = 0.10, SD = 0.21) than women (M = 0.34, SD =0.36) F (1,12) = 5.64, p = 0.04. A 3 (conditions: truth, lie, constrained lie) x 2 (gender: male vs. female) ANOVA with shrugging the shoulder on one side as dependent variable, shows a significant interaction effect F (2,12) = 5.68, p = 0.02. When lying, women show more symmetric shrugs of the shoulders than to men. When telling the truth it is the other way around, men show more symmetric shrugs than women. Means and standard deviations (between brackets) are shown in table 2.

Table 2

Means conditions study 1 for shrugging the shoulders symmetrically

Condition	Men	Women	Average
Truth	0.17 (0.34)	0.12 (0.18)	0.16 (0.28)
Lie	0.06 (0.11)	0.79 (0.06)	0.30 (0.39)
Constrained lie	0.07 (0.14)	0.12 (0.17)	0.08 (0.13)

Note. Means and standard deviations (between brackets) are presented in the amount of times per minute the cue is shown.

Univariate ANOVAs show significant differences between men and women in showing the different cues. Women smile longer F (1,12) = 23.84, $p < 0.00$ and more often than men F (1,12) = 14.94, $p = 0.02$. Women show significant more self-manipulators than men F (1,12) = 9.45, $p < 0.01$. This means, women touch themselves more than men do. Specific for every self-manipulator, women touch their hair F (1,12) = 207.57, $p < 0.00$, neck F (1,12) = 16.78, $p < 0.00$, and torso F (1,12) = 4.87, $p < 0.05$ significantly more than men. Furthermore, women move their elbows symmetrically F (1,12) = 15.45, $p < 0.00$ and on one side more than men F (1,12) = 35.37, $p < 0.00$. Women also shrug their shoulders on one side more than men F(1,12) = 4.94, $p < 0.05$. The means of these gender differences are shown in table 3.

Table 3

Means men and women study 1 for significant differences of the cues between gender

Cue	Men	Women
Smile (D)	3.46 (1.45)	10.04 (3.84)
Smile (C)	1.14 (0.49)	2.02 (0.38)
Self-manipulators (C)	0.64 (0.60)	2.08 (1.24)
Self-manipulator to the hair (C)	0 (0)	0.63 (0.15)
Self-manipulator to the neck (C)	0 (0)	0.38 (0.33)
Self-manipulator to the torso (C)	0 (0)	0.09 (0.15)
Elbow movement symmetrically (C)	0.08 (0.20)	0.60 (0.37)
Elbow movement on one side (C)	0.15 (0.17)	3.70 (2.06)
Shrugging the shoulder on one side (C)	0.19 (0.49)	0.81 (0.61)

Note. Means and standard deviation (between brackets) are presented in the amount of times or seconds per minute the cue is shown. C means amount of times the cue is shown, D means the duration the cue is show

An univariate ANOVA of the condition on the duration of the conversation shows there is no significant difference between the conditions in the time used to explain the picture F (2,15) = 1.13, p = 0.35.

In short, liars only shrug their shoulders more than truth tellers and liars with extra cognitive load. This effect is higher for women than for men. All other nonverbal cues do not show significant differences between truth tellers and liars.

Study 2

Method

Participants

Twelve students from Tilburg University - five women, eight men - participated in the recording of the videotapes. They were randomly assigned to two conditions: truth or lie. Each condition they had to do twice. In this way the differences between the students are the same in every condition, and there is an order effect in telling the truth twice and lying twice after each other to the same person about the same thing. This order effect is the goal of this study. There is not an order effect in telling the truth first and lying next, or the other way around. Also at this study students were paid three euros as participation fee. Besides that a price of thirty euros was given to the best liar. This is a reinforcer to motivate the students to lie as good as they can, without showing they are lying. This is a simulation of a real case situation, in which you do not want to be busted either.

Materials and Procedure

All students were recorded with at each condition different instructions. At the truth telling condition the students had to tell the truth about what they did the day before. After telling the truth once they had to tell it again. The lying conditions was the same as the truth telling condition, however they had to lie this time about what they had done the day before. The second time they had to lie is the cognitive load manipulation. That time they have to think less, because they have practiced already. In that case the students experience less cognitive load. However it could be that they have to think more because they need to tell the exact same again. After the instruction they had to go to the second room to tell about the day before to the confederate. The students were videotaped during each condition, recorded by two cameras in the second room. Afterwards the videotapes were coded by the same coders as in study 1 according to the coding scheme (appendix 2).

Dependent variables

The dependent variables and the coding scheme is the same as in study 1. At study 2 there is controlled for gender differences.

Results

Data characteristics

The procedure for the data analysis is the same in study 2 as it was in study 1, described above. The inter-rater reliability of the following cues was below 0.70 and excluded from further analyzes: nervousness (.080), spontaneity (.300), swallow (.197), touching hair (-.033), mouth (-.033) and wrist (.401), and shrugging shoulders symmetrically (.651). Also holding head high, and touching neck and torso were excluded because these cues did not happen at all. The cue bite lips (0.669) had not a high enough inter-rater reliability between the three coders but did between coder 1 and 2 (.813). The cue nod (0.603) had a high enough

inter-rater reliability between coder 2 and 3 (.774). The cue body movements (0.605) had good reliability between coder 1 and 3 (.796). The cues counting (.574) and duration of illustrative gestures (.547), had not an inter-rater reliability which was high enough. However when the cues duration illustrative gestures and duration non-illustrative gestures were combined the inter-rater reliability was good between the three coders, for duration of gestures (0.956) and the counting of gestures (0.916). This is because the differences at these videotapes between non-illustrative and illustrative gestures were hard to notice, the same was for the counting of the illustrative and non-illustrative gestures. The analyzes at this study were done in the same way as at study 1.

Data analysis

For most cues the hypothesis was that liars show more cues than truth tellers and this effect would be higher when the liar experience cognitive load. The cognitive load condition was the first time lying compared to the second time lying which caused less cognitive load. The second time telling the truth would not be harder or easier than telling the truth the first time, and therefore both should score the same on the cues. In table 4 the means are shown of the cues as seen in the different types of videos.

Table 4

Means conditions Study 2 for every cue

Cue	Telling the truth first time	Telling the truth second time	Lying first time	Lying second time
Start position	-,778	-,889	-,611	-,861
Viewing direction (D)	24.82	23.52	21.57	19.70
Viewing direction (C)	10.05	10.90	10.09	10.76

Nod (C)	2.28	1.33	1.45	2.69
Smile (D)	4.64	7.84	6.09	5.32
Smile (C)	2.04	2.07	2.41	1.77
Headshake (C)	2.11	2.66	3.16	3.58
Bite lips (C)	0.54	0.29	0.05	0.08
Press lips (C)	1.59	0.86	1.51	1.30
Lick lips (C)	0.44	0.49	0.31	0.40
Cues of the lips (C)	2.41	1.62	1.86	1.77
Posture shift (C)	0.19	0.11	0.30	0.02
Body movement (C)	1.11	0.59	0.61	0.04
Self-manipulator head (C)	0.10	0.13	0.15	0.16
Self-manipulator legs (C)	0.04	0.21	0.20	0.38
Self-manipulator nose (C)	0.00	0.36	0.20	0.16
Self-manipulators total (C)	0.14	0.70	0.55	0.69
Elbow movement symmetric (C)	1.21	0.55	0.37	0.66
Shrug shoulders single (C)	0.62	1.18	1.29	1.94
Elbow movement single (C)	2.58	2.31	4.97	4.19
Gestures (D)	2.45	3.85	3.68	3.17
Gestures (C)	2.07	2.53	2.58	2.40
Hand movements (D)	25.33	34.31	24.15	30.54
Hand movements (C)	7.05	7.43	7.40	7.91
Leg movements (D)	16.28	20.62	18.91	19.62
Leg movements (C)	6.20	7.79	6.20	6.70

Movements total (D)	42.71	55.51	43.67	50.20
Movements total (C)	13.44	15.33	13.90	14.62
All cues	113.74	131.92	117.66	123.47

Note. Means are presented in the amount of times or seconds per minute the cue is shown. C means amount of times the cue is shown, D means the duration the cue is show

An univariate ANOVA of the different conditions and gender on biting the lips shows there is a marginally significant difference between the conditions in the amount of times the student bite his or her lips F (3,40) = 2.36, p = 0.09. This is the highest for telling the truth and the lowest for lying. Means and standard deviations (between brackets) are shown in table 5. There is no significant difference between men (M = 0.31, SD = 0.61) and women (M = 0.15, SD = 0.39) in the amount of biting the lips F (1,40) = 1.14, p = 0.29. An 3 (conditions: truth, lie, constrained lie) x 2 (gender: male vs. female) ANOVA with biting the lips as dependent variable shows no significant interaction effect F (3,40) = 0.68, p = 0.57. Table 5 shows the means and standard deviations (between brackets) of the amount of biting the lips for men and women.

Table 5

Means conditions Study 2 for biting the lips

Condition	Men	Women	Average
Truth first time	0.50 (0.71)	0.59 (0.64)	0.54 (0.65)
Truth second time	0.50 (0.96)	0 (0)	0.29 (0.75)
Lying the first time	0.09 (0.16)	0 (0)	0.05 (0.12)
Lying the second time	0.14 (0.26)	0 (0)	0.08 (0.20)

Note. Means and standard deviations (between brackets) are presented in the amount of times per minute the cue is shown.

An univariate ANOVA of the different conditions and gender on shrugging the shoulder on one side shows there is a significant difference between the conditions in the amount of times the student shrugs his or her shoulder on one side F (3,40) = 5.54, $p < 0.00$. This is the lowest for telling the truth the first time, followed by telling the truth the second time, lying the first time, and the highest for lying the second time. Means and standard deviations (between brackets) are shown in table 6. Overall women shrug their shoulder on one side significant more (M = 2.42, SD = 1.49) than men (M = 0.43, SD = 0.62) F (1,40) = 57.52, $p < 0.00$. An 3 (conditions: truth, lie, constrained lie) x 2 (gender: male vs. female) ANOVA with shrugging the shoulder on one side as dependent variable shows a significant interaction effect F (3,40) = 4.05, $p < 0.01$. When someone is lying, the person shows more shrugs with one shoulder, the second time lying, the student shrugs the shoulder even more than the first time. This relation is overall higher for women than for men. Table 6 shows the means and standard deviations (between brackets) of the amount of shrugging the shoulder on one side for men and women in the different conditions.

Table 6

Means conditions Study 2 for shrugging the shoulder on one side

Condition	Men	Women	Average
Truth first time	0.39 (0.47)	0.94 (0.42)	0.62 (0.51)
Truth second time	0.06 (0.11)	2.74 (1.47)	1.18 (1.64)
Lying the first time	0.52 (0.62)	2.38 (1.16)	1.29 (1.27)
Lying the second time	0.73 (0.93)	3.62 (1.46)	1.94 (1.86)

Note. Means and standard deviations (between brackets) are presented in the amount of seconds per minute the cue is shown.

Univariate ANOVAs show significant differences between men and women in showing the different cues. Men show a more open posture at the start of the conversation compared to women F (1,40) = 16.96, $p < 0.00$. Furthermore, women smile longer F (1,40) = 17.40, $p < 0.00$ and more often than men F (1,40) = 32.83, $p < 0.00$. Women show more symmetric elbow movements F (1,40) = 4.27, $p < 0.05$ and more elbow movements on one side than men F (1,40) = 11.53, $p < 0.00$. The means and standard deviations (between brackets) are shown in table 7.

Table 7

Means men and women Study 2 for significant differences of the cues between gender

Cue	Men	Women
Start position	-0.29 (0.18)	-1.48 (0.21)
Smile (D)	2.14 (1.39)	11.34 (1.64)
Smile (C)	1.03 (0.27)	3.54 (0.32)
Elbow movement symmetrically (C)	0.23 (0.35)	1.35 (0.41)
Elbow movement on one side (C)	1.48 (0.95)	6.35 (1.13)

Note. Means and standard deviations (between brackets) are presented in the amount of times or seconds per minute the cue is shown. C means amount of times the cue is shown, D means the duration the cue is show

An univeriate ANOVA of the condition on the duration of the conversation shows there is no significant difference between the conditions in the time used to explain the day before F (3,44) = 0.45, $p = 0.72$.

General results

An univariate ANOVA of study on duration of the conversation shows the students use significant more time in seconds in study 1 (M = 131.50, SD = 30.12) than in study 2 (M = 59.81, SD = 34.26) to explain the picture or tell about the day before F (1,64) = 60.99, $p <$ 0.00.

In short liars bite their lips more than truth tellers. Liars also shrug their shoulder on one side more than truth tellers. This relation is moderated by gender, and higher for women than for men. Other nonverbal cues are not different between liars and truth tellers.

Discussion

This research examined the differences in the amount of non-verbal cues between liars and truth tellers, and the influence of cognitive load on nonverbal behaviour. In this study few differences were found between liars and truth tellers. It also seemed that the manipulations for cognitive load (e.g. describing a drawing according to rules or telling a story for the second time) did not influence the amount of nonverbal cues that appear in the literature on deception detection. The control variable, gender, shows several significant results. Further research could focus on the interaction of gender more.

H1: Cognitive load positively moderates the effect of lying on cues to deception. Overall this hypothesis is not confirmed. At study 1 with shrugging the shoulders symmetrically difference is found between the lying with and without cognitive load. However it is in the other direction than supposed by this hypothesis. Liars show more shrugs with the shoulders than truth tellers. According to the hypothesis during the cognitive load condition this should be even more. However results showed liars with cognitive load show less shrugs with the shoulder than liars without cognitive load.

At study 2 difference is found between liars with and liars without extra cognitive load in shrugging the shoulder on one side. Liars with cognitive load – first time lying – show fewer shrugs with one shoulder than liars without cognitive load – second time lying. This is the other way around than the hypothesis states. Perhaps this is caused because lying the second time causes more cognitive load, because you have to think more to tell the same lie again than to tell a random lie. However earlier research (Vrij, 2000; Granhag & Strömlach, 2002) show people show less self-manipulators when they are used to lie and/or repeat the lie. Although this is another cue you should expect it would count for every cue. Further research could examine this for more cues by letting people lie a couple times and examine if they

show more cues of deception. Not only the cue of self-manipulators or shrugging the shoulders but also other cues of deception. All in all, the other cues show no difference between cognitive load and lie condition, therefore hypothesis 1 is disconfirmed.

H2: Liars show more signs of self-manipulation than truth tellers. This hypothesis is disconfirmed. There is no difference between liars and truth tellers in showing of self-manipulation, which means touching the own body, body movements, and posture shifts. According to DePaulo et al. (2003) liars show self-manipulations because they are insecure about their own credibility. Although the students at this research are reinforced by getting an extra amount of money if they lied the best, they did not have an major problem when someone should catch him or her lying. The students were probably not really insecure, and therefore did not show more signs of self-manipulation than truth tellers.

H3: Liars will behave less nervous. *H4: Liars make less movements with hands and fingers. H5: Liars use more illustrative gestures and less non-illustrative gestures than truth tellers.* These hypotheses are not supported. There was no difference between liars and truth tellers in showing of nervousness, movements with hands and fingers, and gestures. A plausible reason would be the same as mentioned above. The students were not that nervous if the other would catch him or her lying.

H6: Liars shrug their shoulder (one or both sides) more than truth tellers. This hypothesis is partly confirmed. At study 1 liars without cognitive load show shrug their shoulder symmetrically more truth tellers. This effect is higher for women than for men. However there is no difference between telling the truth or lying with cognitive load. Therefore this study partly confirms the hypothesis that liars shrug their shoulder on both sides more than truth tellers.

Study 2 shows shrugging the shoulder on one side happens more often when telling a lie compared to telling the truth. This is linear difference between the conditions, more shrugs are shown when the truth is told the second time, followed by lying the first time, and the most shrugs are shown when lying the second time. This effect is higher for women than for men. Future research could examine the distinction between one and two sides more, also the moderating effect of gender is interesting to examine further.

H7: Liars nod more than truth tellers, while there is no difference between them in the amount of headshakes. H8: Liars raise their chin more and are more gaze aversive than truth tellers. These hypotheses are disconfirmed. There is no difference between liars and truth tellers in nodding, raising the chin, and gaze aversion. There also is no difference in the amount of headshakes which partly confirms hypothesis 7.

H9: Liars press their lips and swallow more than truth tellers, and liars smile less than truth tellers. This hypothesis is not confirmed. Liars do not press their lips or swallow more. Nor smile liars less than truth tellers. Overall are the cues of the lips not significantly different between liars and truth tellers. However liars bite their lips less than truth tellers. Further research could examine this relation more because no earlier research found this relationship.

All in all you can say shrugging the shoulder (one or both sides) and biting the lips are a cue of deception. The other cues are not confirmed to be a cue of deception. Both studies do add value to the research topic by showing differences and similarities with previous research. Besides that about shrugging the shoulders, one or both sides, is not many research available. The same counts for biting the lips. This research gives more prove that both are a cue of deception.

However there are some remarks to be made about the present studies. First some a practical issue, the lengths of the videotapes. Study 1 shows longer videotapes than study 2. This can cause inaccuracy because some behaviour happens more at the beginning of the story. When this is the case, short videotapes show more of this behaviour than longer videotapes. For instance, biting the lips is not shown as cue by study 1 while it is at study 2. This can be caused by the time used by the students. Biting the lips while telling the truth can happen more at the beginning of the conversation than in the end. This can cause the differences between study 1 and study 2. Further research could make differences between time slices and the visibility of cues.

Little evidence is found for the effect of cognitive load on showing cues. However pre-test has shown at study 1 other people think at the constrained lie condition, the students had to thought the most while telling the story, this is not proven by the students themselves. Participants could fill in a questionnaire, before and after the conversation about the difficulty of telling the truth or lying. Afterwards they could also fill in questions about how conscious they were in how they came across. In this way there is more knowledge about how much cognitive load a participant experience and therefore you are better able to compare the amount of cognitive load with the visibility of cues. Next, you also know more about how liars think. Are they really conscious about how they come across or do they automatically adapt their behaviour to show less lying behaviour.

A plausible reason why most cues do not show differences between truth tellers and liars is that the students did not feel to lie that hard. In real life situations, you try to lie the best you can. Although there was a reinforcer of thirty euros the students could win when they should lie the best, they are not really harmed when someone catch them lying.

To better know what liars try to be not caught by listeners, future research could ask liars, after lying, what they did to leak the least cues to lying. This also controls if the person actively or not tried to cover him or her lying. Differences could occur between liars who actively try to and liars who do not.

Although it is not the main focus of this research, a couple cues show differences between men and women in showing cues. Women, smile more, and more often, they touch themselves more, move their elbows and shoulders more than men. This shows women show more non-verbal behaviour than men do. Another difference between men and women is the start position, women have a more closed start position than men do. This can be caused by crossing the legs. Most women cross their legs while it is not so often done by men. Further research should focus more on the moderating effect of gender in showing non-verbal behaviour. At this research it seemed to be an important control variable.

All in all, this study shows many cues of deceptions are not really, or at least not all the time, a cue to deception. Therefore, even by taking close look to the nonverbal behaviour, no one is sure that somebody is lying.

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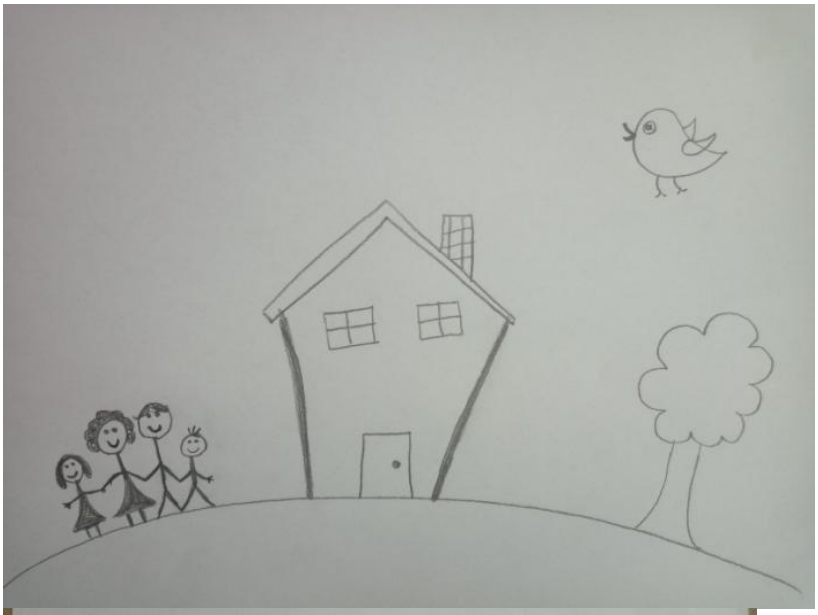
Appendix A: Drawings of study 1



Appendix B: Coding schedule

Video number: _____ C = Count, D = Start and end time, total time in seconds
Coder: _____
Sex: M/F Start time speech: _____ End time speech:_____

Short description of student:

General
Initial posture (right after the student sat on the chair):

Closed -3 – -2 – -1 – 0 – 1 – 2 – 3 Open

+1 posture backward, -1 posture forward, +1 legs outwards/sit straight, -1 crossed legs, +1 arms outwards or on the legs, -1 arms crossed/within the contours of the body.

Nervousness: Relaxed -3 – -2 – -1 – 0 – 1 – 2 – 3 Nervous
Spontaneity: Controlled/Rigid -3 – -2 – -1 – 0 – 1 – 2 – 3 spontaneous

Head	Looking away - D							
	Nod - C							
	Raise head - D							
	Swallow - C							
	Smile - D							
	Head shake – C							
	Lips (bite, press, lick, swallow) – C							

Body posture	Posture shift –C						
	Body movements (at the same time as the head)- D						
	Self-manipulators; (scratching/pedding head, mouth, wrist, legs etc. Including touching nose) – Count and name place (e.g. N1 = 1 time touching nose)	H M W L N Other namely:					

	Shrug (both shoulders) - C	
	Moving both elbows – C	
	Shrug (1-side) – C	
	Moving one elbow – C	

Limbs	Gestures (illustrative) - D Functional hand and arm movements designed to modify and/or supplement speech						
	Hand or finger movements (Without arm movements, non-illustrative, not functional) – D						
	Legs and feet movements (non-illustrative) – D						
	Other movements						
	Noticed:						