Emotional Consequence of Telling a Lie

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Abstract: Generally, arousal increases when telling a lie, as indicated in psychophysiological studies about lie detection. But the emotional valence induced by lying is unknown, though intuition indicates that it may be negative. Indeed, the EDA (electrodermal activity), used in such studies, only shows arousal changes during an emotional response. In this study, we used two tasks in order to examine the emotional valence induced by lying. At the beginning, in the deceptive task, participants answered “no” to every question regarding the nature of displayed playing cards. Therefore, they told a lie about specific cards. Their EDA was recorded all along the task. Secondly, in the figure estimation task, they assessed pictures positively or negatively after looking at playing cards visibly or subliminally as prime stimuli. We expected them to tend to estimate figures negatively when cards relevant to deception had been previously shown. This would mean that an affective priming effect due to telling a lie actually occurred. All in all, this effect was found only when prime stimuli had been displayed visibly. This result suggests that lying per se induces negative emotions even without motivation or punishment due to lying. Furthermore, we found that such effect was all the more obvious in participants whose EDA changes were salient while lying.

Key words: Lie detection, emotion, affective priming.

1. Introduction

As the Japanese proverb says, “lying and stealing live next door to each other, he that will lie will steal”, we tend to think that lying is a bad thing to do. Thus, it may be expected that we feel negative emotion when we are lying even if it is a white lie and has no malignant intention. However, there seemed to be no studies that directly examined this assumption (that is, even a white lie evokes a negative feeling within a lying person).

Due to its obvious practical importance there have been many studies that examined various aspects of lying with physiological measures. Most of those studies have used various physiological responses that accompany when one tells a lie. Especially, EDA (electrodermal activity), which is an index of peripheral sympathetic nervous system activity, has been recorded in the majority of those studies. EDA measures the electrical conductivity of the skin. It is highly sensitive to emotional arousal. It has been shown that a larger EDA response is obtained when participants are lying rather than when they tell a truth [1-5]. EDA has also been used in emotion studies extensively. EDA changes occur whenever arousal level goes up irrespective of valence of the stimulus that evokes arousal (i.e., whether the evoked emotion is positive or negative) [6, 7]. Therefore, in order to know that lying is a bad thing we have to use some measure in addition to EDA that reflects the emotional valence of those who tell a lie.

For this purpose we utilized an affective priming method [8-16]. Affective priming refers to the phenomenon where a previous presentation of an emotional stimulus (a prime) biases subsequent evaluation of a neutral stimulus (a target) in the direction of emotional valence of the prime. In this study, one such method called affective misattribution [17] was used. With this method the participants were asked to evaluate the valence of a target stimulus (usually neutral words or pictures) as “pleasant/like” or “unpleasant/dislike”. Stimuli with either positive or negative valence were used as primes and neutral
stimuli were used as targets. Participants’ judgements of these targets were influenced by the valence of the prime due to their misattributing the emotion evoked by the latter to that caused by the former.

In this study, we aimed at examining the emotional valence induced by lying with the misattribution paradigm. Two tasks were conducted to obtain participants’ physiological data both in telling a lie and telling a truth and behavioural data to stimuli both relevant and irrelevant to their lies. In task 1, the deception task, participants were asked to tell a lie to some of the cards, while telling truth to other cards. Participants’ EDA was recorded during the task to examine whether arousal change was greater when telling a lie than when telling a truth. In task 2 the participants made preference judgements of neutral geometric figures, which were judged to be neutral in emotional likeness in a preliminary check. These neutral figures followed the presentation of the card used in task 1. It was expected that the participants were influenced by the card and tended to judge these figures as “dislikes” when the card was one of those used in task 1 as deception cards. We also expected that this affective priming effect would be more salient when the prime stimuli were presented “invisibly” (for a short duration with a mask), as was suggested in the previous studies [8, 9, 11-13].

2. Materials and Methods

Fifty three healthy university students (of these 24 were women) with a mean age of 22.6 years old (ranging from 18 to 33) participated in the experiment. All were right-handed and had normal or corrected to normal vision. All of the participants provided written informed consent after they were explained about the procedure of the present experiment. The participants were divided into two groups, either HS (Heart-Spade) or CD (Club-Diamond) group prior to task 1 (the deceptive task). They performed two tasks and finally answered some questionnaires. They had a short break between the two tasks. During task 1, EDA of the participants was recorded by attaching TSD203 electrodes connected to GSR100B bio-electric amplifier (MP-100-CE, BIOPAC System Inc.) to their left hand. EDA data was recorded at 200 samples/s and processed and stored in a notebook computer used for the recording device.

2.1 The Deception Task: Task 1

The participants were instructed to say “no” to every question regarding the nature of displayed playing cards (visual image stimuli) on the computer screen. Therefore, they had to tell a lie to specific cards. In the HS (Heart-Spade) group, which consisted of 15 men and 12 women, they were always asked the question of “What you see is the card of Heart?”. Therefore, their answer of saying “No” to such a question meant that they told a lie about the card “Heart”. In this condition only two kinds of mark were used, A-10 of Heart and Spade. There were twenty cards, ten for each mark, of which half were heart (i.e., lie) cards. We obtained both honest and deceptive responses in this way. In the CD (club-diamond) group, which consisted of 14 men and 12 women, the participants were always asked “What you see is the card of club?”. Thus, for this group the Club cards were lie cards, while Diamond cards were truth cards. These two conditions were employed to reject the possibility that obtained results would be a result of some particular influence of stimulus colour (red/black) or type of the card. In both of the groups the participants responded by saying no to twenty cards consisting of ten black mark cards and ten red mark cards. For detailed information about the sequence of stimulus presentations on the computer screen of task 1, (Fig. 1). During this task, two kinds of EDA of the participants were recorded. The first EDA (EDA1) is related to perception and decision made by the participants on their forthcoming response they would make to the card and the second EDA (EDA2) is related to the actual response of telling a lie or truth.
Fig. 1 The time sequence of presentations on the computer screen of a trial in task 1. The recording period of EDA1 which is related to detection of stimuli is framed by a green line, and EDA2 which is related to verbal response is framed by an orange line.

Peaks of EDA1 amplitude were determined during 5 s period starting from onset of the presentation of a card in each trial and the averages of the peaks were calculated for each truth condition. EDA2 peaks were found during 6 s period from the onset of verbal response cue. Fifty samples of EDA data that were recorded just after the start of each trial were averaged and the mean thus obtained was used as baseline for each trial, which was assigned the value of 100. All EDA data were standardized using these baselines. The EDA data were then log transformed to reduce the range of EDA responses. All the statistical analyses were conducted on these standardized data.

2.2 The Preference Judgment Task: Task 2

After a break, the participants were asked to judge their preference of the geometric figures. The task was explained to them as for obtaining their intuitive preference of the figures. We used this fake instruction because we did not want them to notice true purpose of the present study, lest they should intentionally try to fulfill our expectations. For this reason, electrodes were attached to their hands, though we did not record EDA. The participants evaluated the neutral figures that followed one of the playing cards by pressing one of two keys that were assigned to either “like” or “dislike”. We also told the participants that the card that preceded the geometric figure was used for timing signal of recording of EDA, so that they should ignore them. Prior to this experiment the geometric figures used for this task were judged by a group of participants who did not serve in this experiment and were found to be neutral in preference (Fig. 2). All 20 playing cards the participants had seen in task 1 were used as the prime stimuli. There were 40 trials consisting of two conditions regarding presentation of prime stimuli, which is a short or long (visibly or subliminally) presentation condition. Hence, all cards were presented twice in random order. The prime was presented for 30 ms in the SP (short presentation) condition, for 200 ms in the LP (long presentation) condition. As a check of visibility of the card, 10 participants were tested with the SP condition before the main experiment in order to check whether they could discriminate the color of the cards. It was found that no one could tell the color of the card better than chance level. Hence, stimulus presentation of the SP condition may be assumed to be subliminal in this task.

RTs (reaction times) for the judgment of and the choices they made to the figures were recorded. Based on the number of “like” responses the preference percentages were calculated for each prime duration condition (SP vs. LP) and the prime state of the cards (truth or lie cards). It was expected that the participants

Fig. 2 Some examples of neutral figures used in task2.
would judge those figures that followed the lie cards as “dislike” more often than those that followed the truth cards. Furthermore, this bias may be especially strong in the SP (short presentation) condition, as expected by the results of the previous studies. Detailed information about the presentation sequence of the task 2 is presented (Fig. 3).

2.3 Questionnaires

The participants filled in two kinds of questionnaires after they completed two tasks: Neuroticism-Extraversion-Openness Five-Fact Inventory (NEO-FFI [18]) and a scale for subjective well-being (used in Ref. [19]). NEO-FFI is made of 60 question items and can assess five factors of personality (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness). Subjective well-being scale used by Forest can assess life satisfaction and happiness of the participants. First set of questions is designed to measure overall life satisfaction in terms of the participant’s level of satisfaction with each of the 5 item (his/her city or place of residence, non-working activities, friendships, family life, and health and physical condition) using a 7-point scale that ranges from 7 “a great deal” to 1 “none”. Second question is for assessing happiness of the participants by reporting single item with 3-point scale, 1 “not so happy” or 2 “happy” or 3 “very happy.”

Finally, their personal preferences for playing cards presented in task 1 were also assessed using a 5-point scale ranging from 5 (“I like this card”) to 1 (“I dislike this card”) to check whether there was any explicit preference in the cards (Club/Diamond, Heart/Spade).

3. Results

3.1 Physiological Response (Lie vs. Truth)

We calculated the mean peak amplitude of EDA1 and EDA2 for lie and truth condition and for both SP and CD conditions, and performed 3-way ANOVA (group: SP vs. CD condition, response: Lie vs. Truth, recording phase: EDA1 vs. EDA2) on these EDA data. As a result, both main effects of response and recording phase were significant (F (1, 51) = 77.851, (F (1, 51) = 78.07, P < 0.001, respectively, see Fig. 4). These results revealed that EDA in lie condition was larger than EDA in truth condition, and EDA2 was larger than EDA1. This means that the participants showed greater EDA response by telling a lie rather than telling a truth, and EDA for verbal response was greater than that.

Fig. 3  The time sequence of presentations on the computer screen of a trial in task 2. The participants had to answer within 5s as soon as a fixation appeared after the figure disappeared.
for watching response.

3.2 Affective Priming Effect (SP vs. LP Condition)

The results of both mean percentage of “like” to figures in SP condition and LP condition are presented in Fig. 5. We performed 2-way ANOVA (group: HS vs. CD condition, prime card: lie vs. truth) on the data obtained in each condition (SP/LP condition). As a result, main effect of prime card is significant only in LP condition \( (F(1, 51) = 4.144, P < 0.05, \text{see Fig. 6}) \). Further comparison revealed that the participants evaluated figures more negatively when the playing card used for lying was presented as a prime. Thus, the participants seemed to have associated negative emotion with the cards to which they had to tell a lie, although the act itself was rather innocent one in nature.

3.3 Reaction Time

RTs data were subjected to 4-way ANOVA (presentation condition: SP vs. LP, group: HS vs. CD condition, prime card: lie vs. truth, response: like vs. dislike). There was a significant main effect of prime card \( (F(1, 51) = 4.739, P < 0.05, \text{see Fig. 6}) \). Group x prime card interaction was also significant. \( (F(1, 51) = 15.682, P < 0.001, \text{see Fig. 7}) \). To further analyze
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Fig. 6 The mean RT (reaction time) until response to figures after watching either playing card related to truth or lie as a prime in both SP and LP condition (*: $P < 0.05$).

Fig. 7 The mean RT until response to figures after watching either playing card related to truth or lie as a prime of both HS and CD condition (*: $P < 0.05$).

the interaction, simple main effects were tested for each card group separately. They showed a significant main effect of prime card in HS condition ($F(1, 51) = 18.831, P < 0.001$). These results show that the participants responded slower in their evaluative judgment when the prime card was related to lie than when it was the truth card and that this was only found with HS condition where Heart was the lie card.

3.4 Individual Traits Related to Affective Priming Effect

We obtained several individual scores through questionnaires. We calculated EDA differences (EDA1 and EDA2) between in lie condition and truth condition, and defined as deceptive responses (deceptive response1, 2). Also, we calculated “like” percentage differences (when the participants evaluated figures by “like”) between in lie prime condition (when playing card related to their lie was presented as a prime) and truth prime condition, and defined as affective priming effective dose.

Among these data (several scores of individual traits, deceptive response, affective priming effective dose), we performed correlation analysis. The results showed that positive correlation between happiness and affective priming effective dose was near significant ($r = 0.26, P = 0.061$). The positive correlation between deceptive response 2 (calculated
by EDA2) and affective priming effective dose also approached conventional level of significance ($r = 0.23, P = 0.096$).

3.5 The Assessment of Playing Cards Observed in Task 1

The mean scores of the participants’ assessment of personal preferences for playing cards presented in task 1 were calculated. We performed one-way ANOVA (card mark: Heart vs. Spade vs. Club vs. Diamond) on these data. The results showed no main effect. It means that there was no explicit bias in the preference of the cards used in this experiment. Thus, it may be suggested that the preference bias found in task 2 was a result of implicit association of the negative emotion the participants would have felt toward the cards to which they had to tell a lie in task 1.

4. Discussion

The participants showed greater EDA response to the card to which they had to lie than to the true card in task 1. Hence, it was confirmed that they experienced greater emotional arousal when lying than when telling a truth. Moreover, EDA that occurred during verbal response (EDA2) was larger than that found in the perceptual phase (EDA1). This may be due to the fact that verbal response required vocalization for answering the question, whereas cognitive load was minimal when the card was clearly discernible and judgment of the type of the card was easy.

These results suggest that most people are essentially honest and thus feel guilty with negative emotion in telling a lie even if the lie is rather innocuous and has no consequences (incurring no penalty or without motivation to conceal their true knowledge). These results might be affected by how they have been educated from their family or from teachers and by their belief on honesty. The present study employed Japanese university students who have received a good education in the culture where honesty is believed to be the best policy. Consequently, it may be possible that the negative affective priming associated with lying be found only among those who have grown up in the circumstances like those of the present participants.

The RTs obtained for preference judgment in task 2 showed that the participants responded slower when the geometric figure followed the lie card in both SP and LP conditions. Interestingly this finding is consistent with those found in previous lie detection studies where researchers explored behavioral indices related to deception [20-24]. These studies have shown that people produce their responses slower when they have to lie than when they can tell a truth. In our study, the participants did not tell a lie in task 2, but they just judged preference of neutral figures. However, they were affected by the stimuli involved in their previous lying and may have associated negative emotion with them. Else, their judgment was interfered with the memory spontaneously remembered by the emotionally laden card, which made them respond more slowly to the neutral figures. A third possibility may be that it is simply take more time to make a dislike response toward a stimulus, irrespective of previous history of some negative experience associated with it.

Though this RT difference was salient in HS condition, opposite tendency, albeit statistically non-significant, that the participants responded faster when a stimulus relevant to their lie was presented as a prime than the one related to their truth was found in CD condition. We have no appropriate explanation of this latter result, but it may be suggested that as people often encounter in their daily life with heart mark they are most familiar with the card among four marks of the cards. It may be possible that more familiar shapes are quicker to acquire inhibitory effect associated with negative emotion when it is used as a stimulus for lying. Of course there is also a possibility that this RT difference was just obtained incidentally due to the
particular stimulus (i.e., heart mark) selected as a lie card here. Further research concerning on this point may be necessary to elucidate this point.

In conclusion, the present study revealed that emotional valence caused by telling a lie was really negative as expected when it was assessed implicitly with the affective priming, rather than using conventional explicit evaluation by subjective assessment. This effect was strong with individuals who showed larger physiological deceptive verbal response or with higher life satisfaction. Moreover, RT was affected by the kind of prime card (truth or lie), especially when the heart mark was associated with lying and space was associated with telling a truth. The present study found that the emotional valence associated with an innocuous lie is really negative. This finding opens a gate for the development of an implicit method of detecting emotion associated with lying.

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