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The GSR implications in the human unfamiliar faces recognition

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Abstract—**This paper is focused on showing the implications of GSR reactivity to unfamiliar human faces recognition. The method: The participants were the undergraduate students at the Faculty of Psychology and Educational Sciences, University of Bucharest, both male and female in all three experiments. The instruments: The Lafayette Polygraph 4000 platinum series and three sets of photos as follows: red neutral unfamiliar faces, lamp lighted neutral unfamiliar faces and cap covered neutral unfamiliar faces. The results highlighted that the GSR reactivity to correct and incorrect unfamiliar faces recognition is coordinated by the limbic system. Furthermore, the GSR has implications in the memory task of faces recognition. The conclusions emphasize the fact that the faces seen by the participants are unconsciously memorized and with the help of the GSR, which is coordinated by the limbic system, a signal appears and reveals the incongruity or the false recognition when the subject has mistakenly recognized and when he or she did not recognize the image containing the stimulus (the face) previously seen.**

Keywords-unfamiliar faces recognition, unfamiliar dark lamp lighted faces, unfamiliar red neutral faces.

I. INTRODUCTION

For more than 5 decades researchers have been studying face recognition process in multiple experimental designs [1], [2], [3], [4], [5], [6]. Their findings show that face recognition represents a very important function of the human visual system and it is fundamental for our complex social behaviour. The recognition process uses the entire visual information available from a human face (shape, pixels, colour, and shadows). Many studies concluded that face recognition predominantly relies on holistic information [7].

According to many studies, the recognition of faces can be easily disrupted by variations such as lighting, shadow, viewpoint, facial expression (happy, neutral and angry) [8], [9] external elements, and image quality. In this way, the recognition of unfamiliar faces depends on superficial similarities between face images. [10], [11] state that faces recognition represents a process similar to a picture recognition or image matching rather than to familiar faces recognition. Also, a change in lighting can cause changes in luminance values of the corresponding pixels in the test image. The same authors highlighted the particularities of unfamiliar faces recognition.

Other method used in faces recognition are involving, Evoked Potential, MRI and fMRI in neural imaging studies, polygraph examination based on physiological sensors of the polygraph observing the patterns in the GSR, heart rate and other autonomic nervous system signals.

The most popular method for observing cortical and subcortical activity with a variety of behavioural and psychological states and faces recognition is functional magnetic resonance imaging (fMRI). The method consists in activating the areas in the brain requiring more oxygen than inactive areas. Thus, a disproportionate amount of oxygenated blood flows to areas of cortical and subcortical activity.

Therefore, [12], [13] identified a number of relatively small functional areas lying outside the retinotopic cortex responding more to pictures of faces than other objects in the human brain. Providing evidence that supports the bidirectional interactive face processing model proposed by [12] a number of studies support the idea that the FFA is activated specifically by faces, and not by the low-level stimulus features usually contained in faces, that is, activity in the FFA indicates that the stimuli have been detected as faces. Thus, the FFA shows an increased blood flow in response to a wide variety of face stimuli as front and profile photographs of faces [14] and line drawings of faces [15]. Therefore, many studies using new stimuli and paradigms have questioned the traditional view about the neural systems of face processing focused on top-down face processing. This has been achieved by requiring participants to imagine faces [16], [17]. The authors mentioned found that top-down feed-backward mechanisms play an important role in face processing. Thus, [17], [18] studied the neural system's use of face-relevant knowledge and evidenced expectations that regulate the bottom-up processing of visual stimuli. Further, these studies revealed a distributed cortical network for top-down face processing [19] continuing the bottom-up face processing studies [12], [20], [21]. The findings [17], [18], [19], [21], [22], [23] showed that the neural system for processing faces involves a network of neural regions distributed from occipital to frontal cortices implicated in feed-forward and feed-backward connection.

[24] examined in an fMRI based study the neural correlates of intentionally misidentifying individuals (deception) versus truth telling in a facial identification task. The research was based upon previous results of deception imaging studies and the anticipated cognitive processes involved in deception. The results of the described study indicate that there is not a singular area of activation when an individual responds deceptively to a task involving face

recognition. The authors highlighted that false identification of individuals appears in ‘‘line-ups” and activates a neural network mediated by the prefrontal and parietal lobes. These areas are involved in cognitive processes that incorporate the suppression of truth, working memory, visual-spatial memory, and imagery. The findings show that the neural processes subserving the deceptive responding are no different than those involved in other complex cognitive processes even if the magnitude of activation may differ significantly.

Polygraph still remains the best-known and widely used technique for the detection of *misidentifying individuals versus truth telling* in a variety of studies [25]. Experts revealed in studies which analyzed the emotions that the polygraph is based on contact sensors and heuristic analysis of the resultant signals by experts [26]. The polygraph examination is used to check deception when questioning the truth. Therefore, a premise behind the polygraph consists in that dishonesty and truthfulness reliability is different and could be identifiable by psychophysiological states.

Taking into consideration the limbic system and the unconscious reactivity to stressors [27], [28] highlighted the psychological reactivity controlled by the autonomic nervous system. This physiological response could be considered part of the `fight or flight' syndrome triggered by the autonomic nervous system (limbic system), whereby blood redistributes peripherally towards musculoskeletal tissue [29]. [30] conducted several experiments using a video clip and a photography of the same person taken at different times and under different settings. The target was to create two versions of the same face in different lighting, facial expression, background, and clothing. The authors simulated a real situation where the available images of a suspect are more likely to be taken at different times and contexts.

Previous research done in the Laboratory of Experimental Psychology, University of Bucharest shows that face recognition is statistically different in the tasks focused on agressive emotional expressions recognition than other emotional expression recognition consiting, for example, in lamp lighted dark faces [31] and the recognition freuqency is statistically significant higher for the visual stimuli represented by aggressive human faces than happy faces and visual stimuli represented by neutral human faces [9].

Continuing the previous studies this research describes three experimental studies using the polygraph instrument in order to reveal the unfamiliar faces memory retrieval process. Through these researches we wanted to emphasize the fact that physiological reactions recorded by the polygraph accurately show the recognition or the absence of recognition concerning the unfamiliar human faces when variables such as fear, anxiety and apprehension are kept under control.

II. EXPERIMENT 1

A. The research objective and hypotheses

1) The objective

The objective of the research is focused on highlighting the implication of the GSR in unfamiliar red faces recognition.

2) The Hypotheses

a) General hypothesis

The difference between the physiological reactivity to correct and incorrect answer to unfamiliar red neutral faces recognition is statistically significant.

b) Specific hypothesis

- The difference between the correct and the incorrect answer to unfamiliar red neutral faces recognition measured through the GSR is statistically significant.
- The difference between the correct and the incorrect answer to unfamiliar red neutral faces recognition measured through the heart rate is statistically significant.
- The difference between the correct and the incorrect answer to unfamiliar red neutral faces recognition measured through the blood preasure is statistically significant.
- The difference between the correct and the incorrect answer to unfamiliar red neutral faces recognition measured through the respiration rate is statistically significant.

B. The method

1) The participants

The participants were 53 undergraduate students of the Faculty of Psychology and Educational Sciences, University of Bucharest, aged between 18 and 24 years old (m=20.3, A.S=1.62), both males and females, rural and urban areas.

2) The instruments

a) The Laffayette Polygraph, LX 4000-Platinum Series, with virtual interface, windows program. The polygraph soft and the GSR sensors are generally fixed about two inches apart, either to the top and bottom of the middle finger or on the base of two adjacent fingers.

b) The PPT slide show: For the memorizing task a power point slide show has been created with a set of photos showing 9 unfamiliar red neutral faces of Romanian undergraduate students, the same age. For the faces recognition task, there were selected 5 unfamiliar red neutral faces photos from the previous task and they were mixed with 4 new unfamiliar red neutral faces photos in a second set of photos.

3) The procedure

The participants were tested individually with the Polygraph system. Firstly, the participants had the task to memorize 9 red neutral and unfamiliar faces. The second task consisted in answering “Yes” or “No” to each red neutral unfamiliar face shown from the second set of stimuli.

4) The experimental design

a) The variables

- The independent variables were the visual stimuli: 1) the red neutral unfamiliar faces of the Romanian undergraduate students.

- The dependent variables: the Galvanic Skin Response (GSR) recorded as amplitude and return distance from the highest point to the base line in pixels; the Heart Rate and Blood Volume Pulse (BVP) and respiration (amplitude and return distance).

C. *Results and Disscusions*

The data received from applying the unfamiliarly red neutral faces recognition task (figure 1) were recorded by the polygraph.

Figure 1. Example of two unfamiliarly red neutral faces.

After the data analysis, the following results shown in table I and II were revealed. As it can be observed, table 1 reveals the descriptive statistics of the dependent variables representing the physiological reactions (the correct answers to the stimuli) during the unfamiliarly red neutral faces recognition task.

TABLE I. DESCRIPTIVE STATISTICS

No	The correct answers to the task		
	Variables	***Mean***	***Standard Deviation***
1	GSR Amplitude	3.1 div	1.13
2	GSR return distance in pixels	15.5 sec	3.82
3	Heart rate	80 bpm	15.26
4	Blood volume pulse	34 mmHG	1.64
5	Respiration Amplitude P1	2.9 div	0.71
6	Respiration return P1	4 sec	0.35

Tabel II shows the descriptive statistics of the dependent variables representing the physiological reactions (the incorrect answers to the stimuli) during the unfamiliarly red neutral faces recognition task.

TABLE II. DESCRIPTIVE STATISTICS

No	The incorrect answer to the task		
	Variables	***Mean***	***Standard Deviation***
1	GSR Amplitude	7.12 div	1.92
2	GSR return distance in pixels	17.34 sec	2.61
3	Heart rate	96 bpm	12.82
4	Blood volume pulse	34 mmHG	1.28
5	Respiration Amplitude P1	2.45 div	0.21
6	Respiration return P1	3.77 sec	0.42

Figure 2 reveals the diagrams of the dependent variables recorded by the polygraph for one of the participants in two situations: correct answer and incorrect answer.

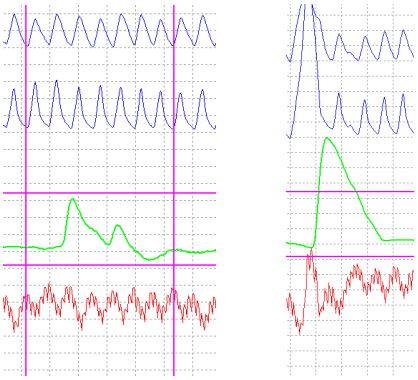

Figure 2. Example of physiological reactivity to the red neutral unfamiliar faces recognition: (a) correct answer, (b) incorrect answer.

Analyzing figure 2 we can observe the GSR high amplitude and the length of the long line until returning to the base line for the incorrect answer. The findings highlight that the GSR reactivity reveals the unconscious response to the task.

The research hypothesis has been tested using the Wilcoxon nonparametric test for dependent groups to differentiate between the correct and incorrect responses to the unfamiliar red neutral faces recognition task.

Thus, the hypothesis "There is a statistically significant difference between the GSR reactivity to correct and incorrect answer concerning the unfamiliar red neutral faces recognition" has been confirmed ($p<0.01$). This finding shows that the autonomic nervous system precisely controls the false recognition or the absence of recognition when seeing the red faces even if these have been unconsciously memorized.

The following three hypotheses haven't been confirmed:

The hypothesis "There is a statistically significant difference between the heart rate reactivity to correct and incorrect answer concerning the unfamiliar red neutral faces recognition" hasn't been confirmed ($p>0.05$);

The hypothesis "There is a statistically significant difference between the blood pressure reactivity to correct and incorrect answer to unfamiliar red neutral faces recognition" has been confirmed ($p>0.05$);

The hypothesis "There is a statistically significant difference between the respiration rate reactivity to correct and incorrect answer to unfamiliar red neutral faces recognition." hasn't been confirmed ($p>0.05$).

These results show that the physiological indicators such as the heart rate, the blood presure and the respiration rate are more stabilized than the GSR and do not respond to the subtle fluctuations controlled by the limbic system.

Compared to the previous study concerning the recognition of red faces versus lamp lighted faces [24], this study highlights the fact that the autonomic nervous system precisely controls the fake sau false recognition or the absence of recognition when seeing the red faces even if these have been unconsciously memorized. Therefore, this study emphasises the effects sau implications of the working memory sau short-term memory when recognizing the neutral faces without being influenced by different emotional expressions of by colour differences. Hence, it can be assumed that the limbic system acts promptly when it comes to false recognition or the absence of recognition at an conscious and unconscious level, because the memory containing the details of the faces seen in the task is involved.

III. EXPERIMENT 2

A. The research objective and hypothesis

The research objective is focused on showing the implication of the GSR in unfamiliar lamp lighted dark faces recognition.

1) The Hypotheses

a) General Hypothesis

There is a statistically significant difference between the physiological reactivity to correct and incorrect answer concerning the unfamiliar lamp lighted dark faces recognition.

b) Specific hypotheses

- There is a statistically significant difference between the GSR reactivity to correct and incorrect answer concerning the unfamiliar lamp lighted dark faces recognition.
- There is a statistically significant difference between the heart rate reactivity to correct and incorrect answer concerning the unfamiliar lamp lighted dark faces recognition.
- There is a statistically significant difference between the blood pressure reactivity to correct and incorrect answer concerning the unfamiliar lamp lighted dark faces recognition.
- There is a statistically significant difference between the respiration rate reactivity to correct and incorrect answer concerning the unfamiliar lamp lighted dark faces recognition.

B. The method

1) The participants

The participants were 47 undergraduate students of the Faculty of Psychology and Educational Sciences, University of Bucharest, aged between 18 and 25 years old (m=20.6, A.S=1.69), both males and females, rural and urban areas.

2) The instruments

a) The Laffayette Polygraph, LX 4000-Platinum Series, with virtual interface, windows program. The polygraph soft and the GSR sensors are generally fixed about two inches apart, either to the top and bottom of the middle finger or on the base of two adjacent fingers.

b) The PPT slide show: For the memorizing task a power point slide show has been created with a set of 9 unfamiliar lamp lighted dark faces photos of Romanian undergraduate students, the same age. For the face faces recognition task, there were selected 5 unfamiliar lamp lighted dark faces photos from the previous task and they were mixed with 4 new unfamiliar lamp lighted dark faces photos in a second set of photos.

3) The procedure

The participants were tested individually with the Polygraph system. Firstly, the participants had the task to memorize the set of 9 unfamiliar lamp lighted dark faces. The second task consisted in answering "Yes" or "No" to each unfamiliar lamp lighted dark face shown from the second set of 9 photos. The participants didn't know that between the stimuli faces presented in the first task there were inserted other 4 new stimuli in the second task.

4) The experimental design

a) The variables

- The independent variables were the visual stimuli: 1) the unfamiliar lamp lighted dark faces of the Romanian undergraduate students.
- The dependent variables: the Galvanic Skin Response (GSR) recorded as amplitude and return distance from the highest point to the base line in pixels; the Heart Rate and the Blood Volume Pulse (BVP) and the respiration (amplitude and return distance).

C. Results and Disscusions

In figure 3 there are shown the unfamiliar lamp lighted dark faces stimuli. The data collected by the polygraph concerning the reactivity to the correct and inccorect answer were processed with the SPSS program version 15.

Figure 3. Example of two unfamiliarly lamp lighted dark faces.

Table III and IV show the descriptive statistics for the dependent variables measured by the polygraph concerning the unfamiliar lamp lighted dark faces recognition task. Also, table III reveals the descriptive statistics for the correct answer to the unfamiliar lamp lighted dark faces recognition task.

TABLE III. DESCRIPTIVE STATISTICS

No	The correct answer to the task		
	Variables	***Mean***	***Standard Deviation***
1	GSR Amplitude	2.1 div	0.94

No	The correct answer to the task		
	Variables	*Mean*	*Standard Deviation*
2	GSR return distance in pixels	10.51 sec	3.48
3	Heart rate	114 bpm	23.18
4	Blood volume pulse	43 mmHG	1.70
5	Respiration Amplitude P1	2.7 div	0.25
6	Respiration return P1	3.3 sec	0.16

Table IV shows the descriptive statistics for the incorrect answer to the unfamiliar lamp lighted dark faces recognition task.

TABLE IV. DESCRIPTIVE STATISTICS

No	The incorrect answer to the task		
	Variables	*Mean*	*Standard Deviation*
1	GSR Amplitude	6.42 div	1.63
2	GSR return distance in pixels	21 sec	4.38
3	Heart rate	96 bpm	11.5
4	Blood volume pulse	43 mmHG	1.12
5	Respiration Amplitude P1	3.1 div	0.27
6	Respiration return P1	3.12 sec	0.31

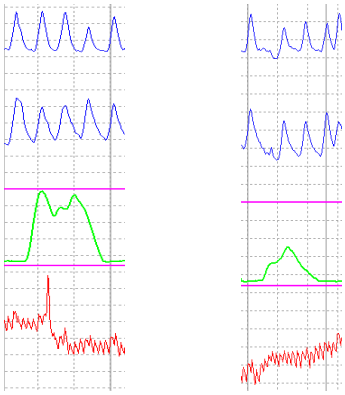

Figure 4. Example of physiological reactivity to unfamiliar lamp lighted dark faces faces recognition: (a) correct answer, (b) incorrect answer.

Analyzing figure 4 we can observe the GSR high amplitude and the length of the long line until returning to the base line for the incorrect answer. The findings in the first experiment are similar with to the findings in the second experiment, highlighting that the GSR reactivity reveals the unconscious response to the task.

The research hypotheses have been tested using the Wilcoxon nonparametric test for dependent groups to differentiate between the correct and incorrect responses during the unfamiliar lamp lighted dark faces recognition task.

The hypothesis "There is a statistically significant difference between the GSR reactivity to correct and incorrect answer concerning the unfamiliar lamp lighted dark faces recognition" has been confirmed ($p<0.01$).

This finding shows that the autonomic nervous system precisely controls the fake/ false recognition or the absence of recognition when seeing the dark lamp lighted faces even if these have been unconsciously memorized.

The other three hypotheses haven't been confirmed as in the first experiment of this study. The explanation consists in the fact that the physiological indicators such as the heart rate, the blood pressure and the respiration rate are more stabilized than the GSR and do not respond to the subtle fluctuations controlled by the limbic system.

By contrast with the previous study concerning the polyghraph physiological response to face recognition, this study is focused only on the correct or incorrect recognition of the dark lamp lighted faces. This fact also emphasises as in the first experiment of the study that the limbic system precisely controls the GSR during the task of the false or incorrect recognition without the subject knowing this consciously.

IV. EXPERIMENT 3

A. The research objective and hypotheses

1) The objective

The research objective is focused on highlighting the implication of the GSR in unfamiliar cap covered faces recognition.

2) The Hypotheses

a) General hypothesis

There is a statistically significant difference between the physiological reactivity to correct and incorrect answer concerning the unfamiliar cap covered faces recognition.

b) Specific hypotheses

- There is a statistically significant difference between the GSR reactivity to correct and incorrect answer concerning the unfamiliar cap covered faces recognition.
- There is a statistically significant difference between the heart rate reactivity to correct and incorrect answer concerning the unfamiliar cap covered faces recognition.
- There is a statistically significant difference between the blood pressure reactivity to correct and incorrect answer concerning the unfamiliar cap covered faces recognition.
- There is a statistically significant difference between the respiration rate reactivity to correct and incorrect answer concerning the unfamiliar cap covered faces recognition.

B. The method

1)The participants

The participants were 58 undergraduate students of the Faculty of Psychology and Educational Sciences, University of Bucharest, aged between 18 and 26 years old (m=21.16, A.S=2.31), both males and females, rural and urban areas.

2) The instruments

a) The Laffayette Polygraph, LX 4000-Platinum Series, with virtual interface, windows program. The polygraph soft and the GSR sensors are generally fixed about two inches

apart, either to the top and bottom of the middle finger or on the base of two adjacent fingers.

b) The PPT slide show: For the memorizing task a power point slide show has been created with a set of 9 unfamiliar cap covered neutral faces photos of Romanian undergraduate students, the same age. For the faces recognition task, there were selected 5 unfamiliar cap covered neutral faces photos from the previous task and they were mixed with 4 new unfamiliar cap covered neutral faces photos in a second set of photos.

3) The procedure

The participants were tested individually with the Polygraph system LX 4000. During the task of the cap covered faces recognition, the reactions to the presentation of the visual stimuli were correctly categorized as being the emotion felt by the participant through measuring only the signals with the polygraph sensors. Firstly, the participants had the task to memorize the 9 unfamiliar cap covered faces. The second task consisted in answering "Yes" or "No" to each unfamiliar cap covered face shown. The participants were not informed that in the second task there were included 4 new cap covered neutral faces stimuli.

4) The experimental design

a) The variables

- The independent variables were the visual stimuli: 1) the unfamiliar cap covered faces of the Romanian undergraduate students. The cap covered 30% from the upper part of the face.
- The dependent variables: the Galvanic Skin Response (GSR) recorded as amplitude and return distance from the highest point to the base line in pixels; the Heart Rate and the Blood Volume Pulse (BVP) and the respiration (amplitude and return distance).

C. Results and Disscusions

The unfamiliar cap covered stimuli are presented in figure 5.

Figure 5. Example of two unfamiliar cap covered faces.

Table V and VI show the descriptive statistics for the dependents variables measured by the polygraph during the unfamiliar cap covered faces recognition task. In order to analyze the data, the descriptive statistics for the correct answer to the unfamiliar cap covered faces recognition task is shown in table V.

TABLE V. DESCRIPTIVE STATISTICS

No	The correct answer to the task		
	Variables	***Mean***	***Standard Deviation***
1	GSR Amplitude	3.21 div	1.08
2	GSR return distance in pixels	24.81 sec	4.62
3	Heart rate	81 bpm	11.16
4	Blood volume pulse	33 mmHG	1.04
5	Respiration Amplitude P1	5.6 div	0.27
6	Respiration return P1	3.6 sec	0.18

Table VI highlights the descriptive statistics for the incorrect answer to the unfamiliar cap covered faces recognition task.

TABLE VI. DESCRIPTIVE STATISTICS

No	The incorrect answer to the task		
	Variables	***Mean***	***Standard Deviation***
1	GSR Amplitude	5.4 div	1.93
2	GSR return distance in pixels	22.7 sec	3.52
3	Heart rate	92 bpm	11.81
4	Blood volume pulse	33 mmHG	1.03
5	Respiration Amplitude P1	5.4 div	0.73
6	Respiration return P1	4.2 sec	0.67

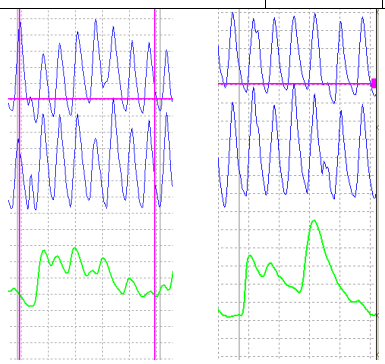

Figure 6. Example of physiological reactivity to the unfamiliar cap covered faces recognition: (a) correct answer, (b) incorrect answer.

Analyzing figure 6 we can observe the GSR high amplitude of the long line until returning to the base line for the incorrect answer. The findings highlight as in the previous experimental studies, that the GSR reactivity reveals the unconscious response to the task.

In order to test the research hypotheses, the Wilcoxon nonparametric test has been applied.

The first hypothesis "There is a statistically significant difference between the GSR reactivity to correct and incorrect answer concerning the unfamiliar cap covered faces recognition" has been confirmed ($p<0.01$).

This finding shows that the autonomic nervous system precisely controls the false recognition or the absence of

recognition when seeing the faces covered up to 30% by a cap even if these have been unconsciously memorized.
The other three hypotheses haven't been confirmed as in the first and second experiments of this study. The explanation consists in the fact that the physiological indicators such as the heart rate, the blood pressure and the respiration rate are more stabilized than the GSR and do not respond to the subtle fluctuations controlled by the limbic system.

V. General Conclusions

As we highlighted in previous experimental studies [8], [9], [31] the GSR reactivity is coordinated by the limbic system. In this way, the emotional signals seem to cause near instant changes in the level of sweat in the glands, and in turn affects the skin conductivity. The findings of the experimental studies presented show that the unconscious memory can be related to the GSR reactivity. For the tasks when the participants mentioned an incorrect answer because they were confused or they forgot the picture showing a certain face (consciousness memory) the GSR reaction had the amplitude statistically significant higher than in the tasks with the correct answers. One of the practical applications for the experimental studies presented is that it could help the justice system in criminal investigation, bank attacks, theft and other actions where the eyewitnesses can be involved in faces recognition tasks. In this way, the eyewitnesses can answer to unfamiliar faces recognition task from crime scenes or theft scenes, and even if they cannot remember exactly all the details of the context and the faces, the GSR reactivity could help them in giving the right answer.
Starting from the research of [24] who emphasized that with the help of the fMRI he could show the presence of the neural reactivation in the cortical areas specific of lie, working memory, spatial memory and imagination during the fake/ false recognition of faces, we wanted to highlight that the polygraph sensors differentiate exactly, precisely and reliably the true and false recognition of the faces seen in the task. One important result of the researches described in this article is that it shows the fact that the faces seen by the participants are unconsciously memorized and with the help of the GSR coordinated by the limbic system a signal of incongruity or of the fake/false recognition appears when the subject has mistakenly recognized or when he or she did not recognize the image containing the stimulus (the face) previously seen. Hence, the function/purpose of the unconscious memory is very important in recognizing unfamiliar faces because the subjects are asked to recognize the face of the person who committed the murder or the theft and do not remember exactly (consciously) because oblivion interferes. On the other hand, another important result of the experiments previously described consists in the fact that the faces shown in different contexts-red, lamp lighted or cap covered are all neutral when recognition takes place so, it is necessary to simulate these situations with the faces of the persons presented or of the suspects found. This particular aspect is scientifically supported by previous researches and by the experiments described in this study as well and it emphasizes that memorizing unfamiliar faces takes place starting from details such as face structure, luminescence, mimic or expressed emotional state [8], [9], [10], [11]. More than that, when applying the strategy for suspect recognition it is needed for a simulation as accurate as possible with all the suspects from the moment the faces were seen because those small details specific to the faces of the aggressors or the thieves can be unconsciously memorized and brought to the surface by eyewitnesses or victims from a conscious or unconscious level.

Taking into consideration the previous studies which emphasized that the fMRI cannot show precisely whether the recognition or the mistaken recognition happened because the cognitive processing specific to memory, attention and imagination activates similar neural networks, [32], [33], [34], [35], [36], [24] we consider the polygraph remains the only instrument which can detect lie/ deception or truthfulness in human faces recognition. Finally, we state that the study will be continued even further by studying the process of memory involving faces belonging to other races and cultures and familiar faces because this study is focused on females from the same race and culture.

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References

[1] V. Bruce, "Changing faces: visual and nonvisual coding in face recognition," British Journal of Psychology, Vol. 73, 1982, pp. 105–116.

[2] I. Gauthier, and M. J. Tarr, M. "Becoming a "Greeble" expert: Exploring the face recognition mechanism," Vision Research, Vol. 37, 1997, pp. 1673–1682.

[3] G. McCarthy, A. Puce, A. Belger, and T. Allison, "Electrophysiological studies of human face perception II: response properties of face specific potentials generated in occipitotemporal cortex," Cerebral Cortex, Vol. 9, 1999, pp. 431–444.

[4] G. Grudin, "On Internal Representation in Face Recognition Systems," Pattern Recognition, vol. 33, 2000, pp. 1161-1177.

[5] F. Song, D. Zhang, D. Mei, Z. Guo, Z, " A multiple maximum scatter difference discriminant criterion for facial feature extraction," IEEE Trans. Syst. Man Cybern. Part B Cybern., Vol., 37, issue 6, 2007, pp. 1599–1606.

[6] M. Chandra Mohan, V. Vijaya Kumar, K.V. Subbaiah, "A New Method of Face Recognition Based on Texture Feature Extraction on Individual Components of Face," International Journal of Signal and Image Processing, Vol.1, Iss.2, 2010, pp. 69-74.

[7] D. Maurer, R. LeGrand, R. and C.J. Mondloch, "The many faces of configural processing," Trends in Cognitive Sciences, Vol. 6, 2002, pp. 255-260.

[8] M. Chraif, M. Anitei, M. Hritcu, and A. Dogar, "The polygraph physiological response to face recognition, " in the Proceedings of The international congres of psychology "Modern research in psychology. Directions and perspectives", Sibiu: Editura Universitara, 22-24 may 2009, pp75-82.

[9] M. Aniței, M. Chraif, A. Dogar, M. Hrițcu, " The effect of wrong faces recognition in physiologic reactivity," The Romanian military psychology at 150 years celebration, Coord. A. Jianu, A. Prisăcaru, Bucharest: The Army technic printing house, june 2009, pp. 9-18.

[10] V. Bruce, and A.W. Young, "Understanding face recognition," British Journal of Psychology, vol.77, 1986, pp. 305–327.

[11] P.J.B. Hancock, V. Bruce, and A.M. Burton, "Recognition of unfamiliar faces," Trends in Cognitive Sciences, vol. 4, 2000, pp. 330–337.

[12] J.V. Haxby, E.A. Hoffman, M.I. Gobbini, "The distributed human neural system for face perception," Trends Cognitive Sciences vol. 4, 2000, pp. 223–233.

[13] M.J. Tarr, and I. Gauthier, "FFA: a flexible fusiform area for subordinate-level visual processing automatized by expertise," Natural Neurosciences, vol. 3, 2000; pp.764–769.

[14] F.Tong, K. Nakayama, M. Moscovitch, O. Weinrib, and N. Kanwisher, "Response properties of the human fusiform face area," Cognitive Neuropsychology, vol. 17, 2000, pp. 257–279.

[15] M. Spiridon, and N. Kanwisher, "How distributed is visual category information in human occipito-temporal cortex? An fMRI study," Neuron, vol.35, 2002, pp.1157–1165.

[16] A. Ishai, L.G., Ungerleider, J.V. Haxby, „Distributed neural systems for the generation of visual images," Neuron, vol. 28, 2000, pp. 979–990.

[17] A. Mechelli, C.J. Price, K.J. Friston, and A. Ishai, "Where bottom-up meets top-down: neuronal interactions during perception and imagery," Cerebral Cortex, vol. 14, 2004, pp.1256–1265.

[18] C. Summerfield, T. Egner, M. Greene, E. Koechlin, J. Mangels, J. Hirsch,''Predictive codes for forthcoming perception in the frontal cortex,'' Science, vol. 314, 2006, 1311–1314.

[19] J. Li, J. Liu, J. Liang, H. Zhang, J. Zhao, D.E. Huber, C.A. Rieth, K. Lee, J. Tian, G. Shi, 2009. "A distributed neural system for top-down face processing," Neuroscience Lett., vol. 451, 2009, pp. 6–10.

[20] A. Ishai, C.F. Schmidt, and P. Boesiger, „Face perception is mediated by a distributed cortical network," Brain Res. Bull., vol. 67, 2005, pp. 87–93.

[21] A. Ishai, "Let's face it: it's a cortical network," Neuroimage vol. 40, 2008, pp. 415–419.

[22] S.L. Fairhall, and A. Ishai, " Effective connectivity within the distributed cortical network for face perception," Cerebral Cortex, vol. 17, 2007, pp. 2400–2406.

[23] J. Li, J. Liu, J. Liang, H. Zhang, J. Zhao, C. A. Rieth, D. E. Huber, W. Li, G. Shi, L. Ai, J. Tian, and K. Lee, "Effective connectivities of cortical regions for top-down face processing: A Dynamic Causal Modeling study," 2010, Elsevier DOI:10.1016/j.brainres.2010.04.044.

[24] S. Bhatt, J. Mbwana, A. Adeyemo, A. Sawyer, A. Hailu, and J. VanMeter, "Lying about facial recognition: An fMRI study," Brain and Cognition, vol. 69, 2009, pp. 382–390, doi:10.1016/j.bandc.2008.08.033

[25] D.A. Pollina, A.B. Dollins, S.M. Senter, D.J. Krapohl, and A.H. Ryan "Comparison of polygraph data obtained from individuals involved in mock crimes and actual criminal investigations," Journal of Applied Psychology*, vol. 89*, issue 6, 2004, pp. 1099–1105.

[26] B. Kleinmuntz, and J.J. Szucko, „Lie detection in ancient and modern times," American Psychologist, vol. 39, issue 7, 1984, pp. 66–76.

[27] P. Davis, "Effects of acoustic stimuli on the waking human brain," Journal of Neurophysiology, vol. 2, 1939, pp. 494–499.

[28] C. Landis, and R. Gullette, "Studies of emotional reactions: III. Systolic blood pressure and inspiration–expiration ratios," Journal of Comparative Psychology, vol. 5, 1925, pp. 221–253.

[29] F. H. Martini, W.C. Ober, C.W. Garrison, K. Welch, and R.T. Hutchings, "Fundamentals of Anatomy and Physiology," 5th edition New Jersey: Prentice Hall, Upper Saddle River, 2001.

[30] C. H. Liu, H. Seetzen, A. "Mike Burton and A. Chaudhuri Face Recognition Is Robust With Incongruent Image Resolution: Relationship to Security Video Images," Journal of Experimental Psychology: Applied, Vol.9, No. 1, 2003, pp.33–41, DOI: 10.1037/1076-898X.9.1.33.