MEASUREMENTS OF GALVANIC SKIN RESPONSE ON SUBJECTS AFFECTED BY STRESS

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Abstract: *The aim of the present paper is to study the Galvanic Skin Response (GSR) level on subjects affected by stress. The device that we have used, connects to the people by finger electrodes to record GSR. The purpose was to find statistical differences between the activities (mental task, walking, sitting and to fill out a survey about their lives) and their stress level. During the experiment, it was found that the survey caused the source of high stress and increasing skin conductance was caused by sweat secretion (mental, physical activity). Is needed to work of collecting data from more subjects because GSR is depended on human behaviour, is variable upon many factors (their eating habits, their emotional state, their gender, their relationship with family, etc) and we need to build a substantial data set for a valid research.*

1. Introduction

The objective of the present article is to study the Galvanic Skin Response level on subjects affected by stress. Stress monitoring in daily life is important to reduce the negative emotions and to improve the health for human society. Working on research we can resolve a lot of problems such as: cardiovascular diseases, gastro intestinal diseases, psychological diseases and other issues generated by stress. Therefore, monitoring psychological stress level is important for better life and to improve performance at work.

2. Literature review

The founding researcher in field of stress, Hans Selye define the stress as a perception over a situation negative or positive from our lives [1].

Our skin is an open book and one of the most sensitive measures for emotional incentive is Galvanic Skin Response. Emotional experiences trigger changes in our body: the pulse rises, hands become sweaty, the heart beats faster [2].

The GSR signal consists of SCL – skin conductance level and SCR – skin conductance response [3].

Lots of the researches have studied about how to measure human psychological stress using the GSR data and they were discovered that an emotional reaction under stressed condition is making the skin more conductive in the palms of the hands [4].

As regards GSR, there exist different studies which propose different methods of detecting stress levels: EEG [5], epilepsy [6], SC [7], diagnosis of diabetes [8] and so one.

3. Methodology

In this work, we focus on the problem of detecting changes in the stress level from the GSR sensor data. GSR activity is measured in "micro-Mho (μM)" or "micro-Siemens (μS)" [9].

The experiments are done under stress and no-stress conditions (mental task -math, walking, sitting and to fill out a survey about their lives) on 30 subjects (18 persons were female, and 12 persons were male) in the age group of 25 to 58 years old.

In terms of age, out of total number of participants, are the following 4 persons aged 25 to 30, 5 persons aged 31 to 36, 9 persons aged 40 to 45, 6 persons aged 47 – 50, 4 persons aged 55 and 2 persons aged 58. Each participant in the case study was exposed to a protocol containing four 4 activities and the time of measurement was divided as per figure 1:

- mental task (math exercise) -5 minutes
- walking – 2 minutes
- sitting – 2 minutes
- to fill out a survey about their lives (10 questions) – 8 minutes

Fig.1. GSR activities and the time of measurement

Therefore, during the mental tasks the respondents were asked to add at the final answer five digits number (17946) and then to multiply this sum with the last 3 numbers of Personal Numerical Code (CNP). The research took place between the months of January 2019 and the respondents were employees of the economics company from Romania.

Main focus is on the use of GSR data and the observation of stress requires basic equipment.

We proposed 10 questions for the interview which are presented below:
1) Describe a situation time when you struggled to build a relationship with someone important.
2) Tell me about your schedule time regarding the last job.
3) Give me an example of a time you faced a conflict at work. How did you handle that?
4) Talk about the time when you manage to resolve a family problem.
5) Explain a stressful situation when you work in team.
6) You set a goal for yourself. How did you do to meet your objective?
7) How do you go about prioritizing your friends, parents or family needs?
8) Describe one day with difficult moments.
9) How often do you eat health food?
10) When you have a reunion with the manager how do you handle the stress?

The steps to applying it correctly can be found below:
- Place two electrodes on body locations and make sure that the sensors are properly attached to the fingers
- Set up the device to "on" and configured correctly
- Check the wireless for data transmission with the computer
- Apply a constant low voltage and check that the electrode cables are properly plugged into the correct sockets of your GSR device.
- Measure the electrical current between the two electrodes
- Report the associated skin conductance

4. Experimental results

Table 1 summarizes the results of the GSR data measured on 30 persons.

Table 1. GSR data results

Nr	Gender	Mental tasks	Walking	Sitting	Survey
1	F	1.51	1.1	0.6	2.89
2	F	2.77	0.97	0.51	3.91
3	F	2.44	1	0.73	3.13
4	F	2.97	1.7	1.1	4.19
5	F	3.35	1.3	0.9	5.11
6	F	3.89	2.1	1.1	5.27
7	F	2.62	1.8	0.9	4.95
8	F	3.74	2.3	1.1	5.61
9	F	3.99	2.8	1.6	5.83
10	F	2.59	1.1	0.82	3.94
11	F	1.55	0.93	0.59	3.11
12	F	1.99	1.2	0.71	3.61
13	F	2.24	1.5	0.85	4.2
14	F	1.71	1	0.79	2.99
15	F	3.72	2	1.4	5.27
16	F	4.44	2.87	0.98	6.11
17	F	4.17	2.99	0.92	5.97
18	F	2.19	1.4	0.78	3.98
19	M	3.51	1.9	0.93	4.96
20	M	3.91	2.2	0.99	5.39
21	M	3.15	1.74	1	5.51
22	M	4.37	2.6	1.1	6.21
23	M	4.28	2.5	0.98	6.16
24	M	4.79	2.94	1.2	6.42
25	M	4.11	2.6	1.1	6
26	M	2.19	1.7	0.88	3.94
27	M	2.21	1.6	0.79	3.91
28	M	4.1	2.79	1.2	5.81
29	M	4.39	2.97	1.6	5.92
30	M	4.33	2.48	0.99	5.86

The data below (figure 2) shows the GSR signal during a 10 minutes screening. Respondents were seated in front of the monitor with GSR sensors attached to the index and middle finger of the hand.
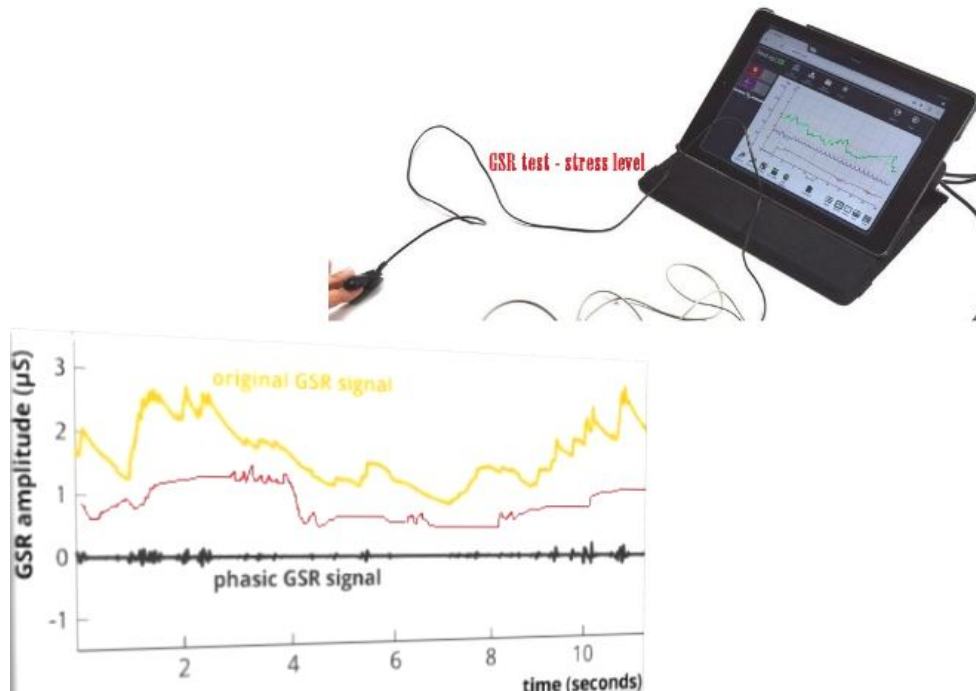

Fig.2. GSR signal

The GSR collect by placing two electrodes on the fingers, the data and, the device can determine the persons stress level. The results of the experiments are shown in figure 3. As can be seen from GSR level showed very low variation as per activities walking and sitting when the subject related to GSR software.
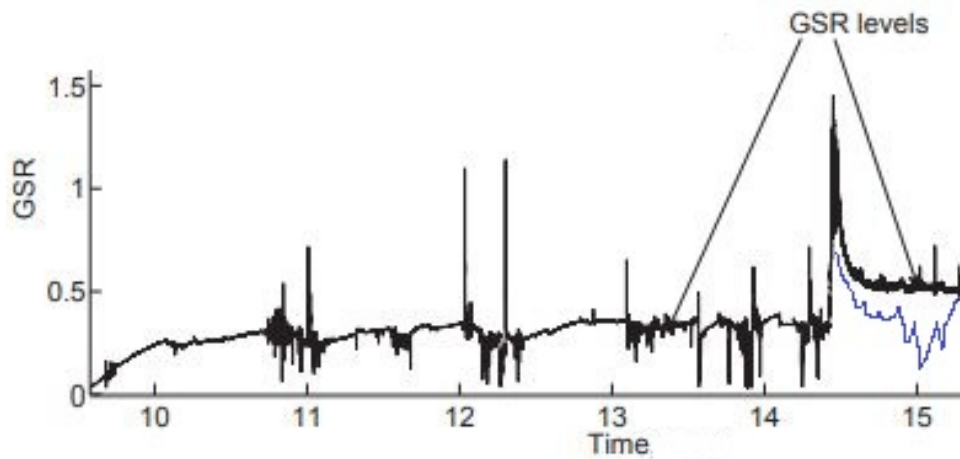
Fig.3. GSR levels

At the same time, with the interviews (10 questions), two electrodes were placed on the body and connected with the software to see the oscillogram. It was result that the survey was the source of high stress level as per figure 4.
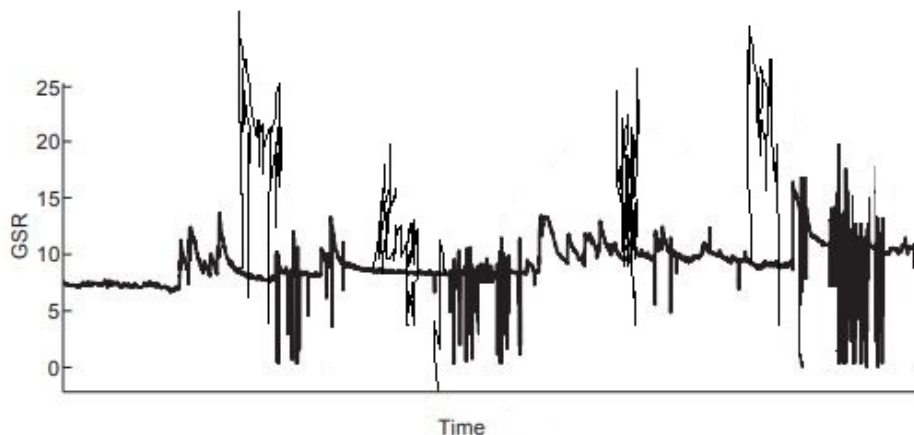
Fig.4. GSR – high stress level for survey activity

5. Conclusions

The main part of this study involved the measurement of GSR device which can detect stress level in different situations.

As per above graphics, we can see that the survey was the source of high stress. The mental task (math exercise) showed medium variation as per table 1. The rest of activities: walking and sitting showed very low variation.

However, significant results were not obtained, but we can do again the test for a high number of subjects.

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