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SCIENTIFIC REPORT ON TESTING PROTECTIVE INFLUENCE ON HUMAN ORGANISM AGAINST MOBILE PHONE RADIATION

FOR THE PRODUCT

smartDOT

Customer

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1 INTRODUCTION

1.1 GENERAL

A fundamental research area at the BION Institute represents measuring the effects/influences of physically as yet undefined and unrecognized (subtle) field(s). Conventional measuring devices cannot measure these fields. However, in the majority of cases, even various unconventional devices, purportedly measuring the subtle field, are not yet capable of measuring this kind of field (influences) reliably enough, although the technology is steadily improving. Mostly, these fields and their effects cannot be explained by commonly accepted theoretical interpretations, even though some scientists have offered possible explanations that span from the quantum vacuum to dark matter.

In more than 20 years of research and testing, the BION Institute developed an alternative path that enables us to use the *human organism* as a reliable detector of such weak or subtle influences. We learned how to express these detections via easily measurable general physiological effects monitored through physiological measurements. Hence, we can reasonably assess the alleged biological influence or non-influence of devices based on a subtle fields' impact. The latter may represent a stimulating factor or a protective shield against supposedly harmful radiation from the environment. If we find the effects of the supposed emission statistically significant, we issue the appropriate certificate.

1.2 SPECIFIC

The company Global EMF Solutions LTD ordered testing of an alleged protective influence on human organism against different types of harmful non-ionizing radiation for the product smartDOT (Figure 1). The customer claims this frequency technology disc named smartDOT has a protective influence against radiation during active calling with a mobile phone and wanted these claims to be validated. By using methodology grounded on clinical research conditions, we verified the supposed protective influence of the disc by exposing volunteers to the radiation during active calling with a mobile phone. We monitored various physiological parameters (heart rate, muscle tension, skin conductance, respiration rate and finger temperature) by physiological measurements.

Figure 1: smartDOT frequency technology disc used in testing.

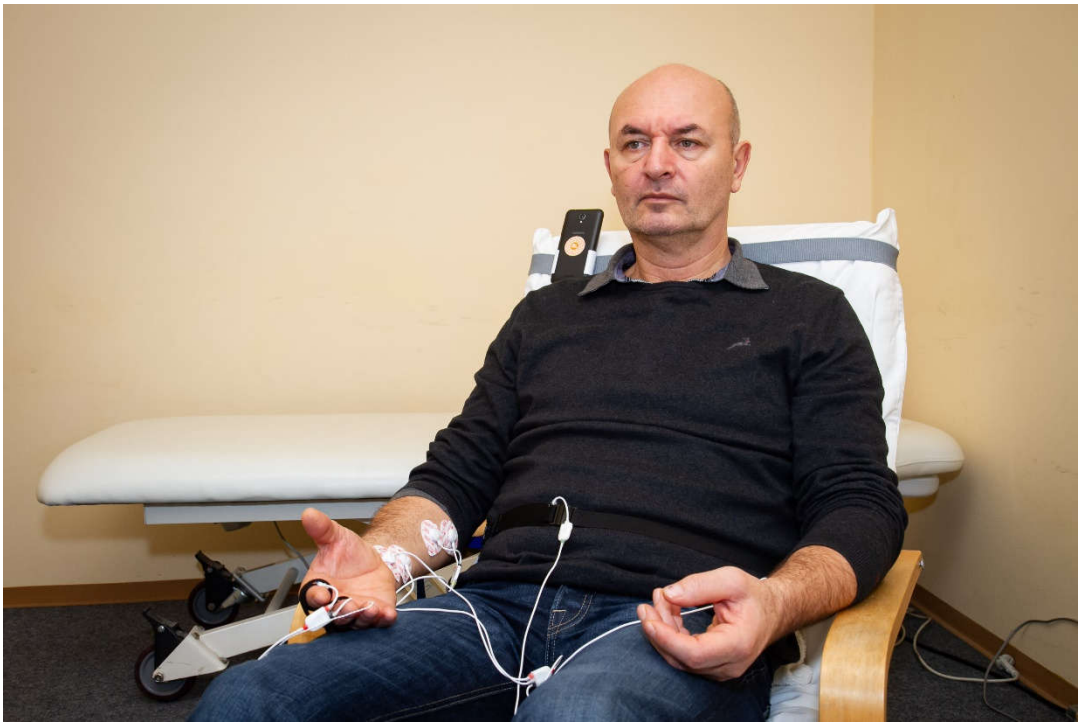

Figure 2: Test setup during testing the supposed protective influence of the smartDOT on the human organism. After all the electrodes were attached to a volunteer, he/she sat for 45 minutes while physiological parameters were measured.

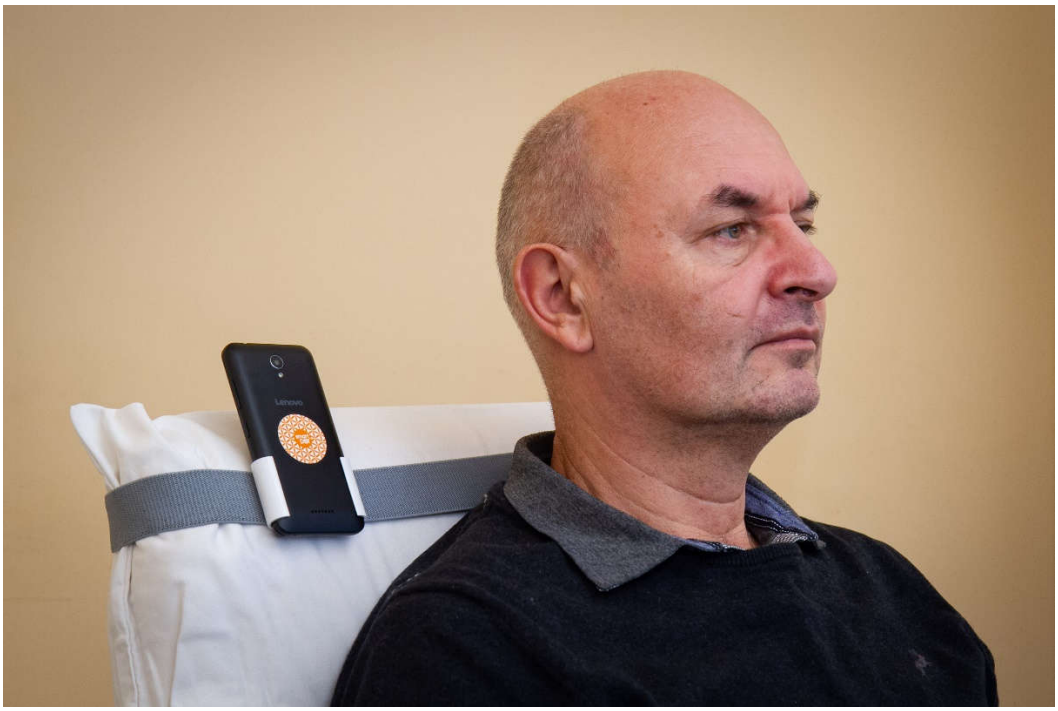

Figure 3: SmartDOT attached to the back of the mobile phone. Mobile phone is located 10 cm from the volunteer's head through the measurement.

Volunteers were arranged into **two testing situations**. The first situation represented the protective influence group with a *working* smartDOT (Figure 1) attached to the mobile phone. The second situation represented the *control* with a sham-working smartDOT attached to the mobile phone. The sham-working smartDOT was identical and indistinguishable from the working smartDOT. Its purpose was to show regular dynamics in the measured physiological parameters. A comparison to the control testing situation was used to disclose a protective influence against radiation during active calling with a mobile phone of the smartDOT on the human organism. We tested each volunteer in both situations, but neither volunteers nor the test assistant knew whether a truly working smartDOT or a sham-working one was used (a double-blind test methodology).

2 MATERIALS AND METHODS

2.1 TEST DESIGN

Manufacturer's claims were validated by a scientific test including 12 volunteers based on principles of clinical testing. This means that the tests were:

- **prospective** (general criteria for the efficiency of the device's tension were determined in advance);
- **with placebo effect ruled out** (volunteers didn't know whether they were exposed to the device's influence or not);
- **double-blind** (even the test assistant didn't know whether the working or sham-working smartDOT was used);
- **randomized** (the decisions about the order of different situations were made randomly).

We tested the protective influence of the smartDOT on the physiological parameters of volunteers. Volunteers were subjected to two different experimental situations in random order:

- **smartDOT situation**: the mobile phone we performed tests with had a working smartDOT attached to its back side.
- **Control situation**: the mobile phone we performed tests with had a sham-working smartDOT attached to its back side.

Tests were conducted from the 12th to 15th of January 2021 at the BION Institute with 12 volunteers aged 30 to 71 (seven females and five males). Before the tests, we instructed the volunteers not to eat a big meal at least one hour before the test and not to drink coffee, alcohol, or energy drinks at least three hours before the test. We tested each person twice on two different days, every time at the same time of the day. This ruled out the effects of other factors as much as possible (e.g., the volunteer could be tired after many hours of work, but is expected to be more or less at the same level of fatigue at the same time of day). Random order of both situations was applied to every volunteer (the principle of randomization). Volunteers sat for 45 minutes in a comfortable wooden chair. During this time heart rate, muscle tension, skin conductance, respiration rate, and finger temperature were measured as presented in Figure 2. An 8 channel Biosignalsplux device was used to measure the aforementioned physiological parameters. Both, the working smartDOT and the sham-working one looked the same so that neither volunteers nor the test assistant could tell one from the other. Either the working or the sham-working smartDOT was attached to the back side of the mobile phone (see the position in Figure 3). The phone was placed next to the volunteer's head (see Figure 3). Then the physiological measurements started. After 20 minutes the test assistant called the mobile phone with another mobile phone and left it ringing for 5 minutes by redialing as needed. Volunteers were not aware when the calls occurred. After that the physiological measurements continued for another 20 minutes. The vast majority of volunteers have long-term testing experiences involving various devices and tend to be quite indifferent regarding different testing situations. When measurements started, the test assistant left volunteers alone in the room.

2.2 MEASUREMENT OF PHYSIOLOGICAL PARAMETERS

Measurements of physiological parameters by physiological methods enable us to monitor dynamic responses to any influencing agent working on the human organism in real-time. We measure the following parameters: heart rate, muscle tension, skin conductance, finger temperature, and respiration.

- **Heart rate** (frequency of heartbeat, HR) is calculated from the electrocardiogram (ECG).
- **Muscle tension** (electromyogram, EMG) is measured on the right forearm. The EMG shows us any artefacts that could appear on the ECG due to arm movements.
- **Skin conductance** (SC) is measured on the fingertips of the right hand, where skin conductance varies the most. Skin conductance measurements are part of lie detectors because both, sweating as well as the blood flow affect skin conductance and are regulated by the parasympathetic nervous system. The latter is a part of the autonomic nervous system that is not controlled by our consciousness, so we cannot regulate it just by simple intention. In general, skin conductance is higher when a person is under stress (more sweating, higher blood flow), but sometimes the response may be much more complex.
- **Respiration rate** (RR) is calculated from thorax expansion (TE) that is measured with a special extendable elastic belt.
- **Finger temperature** (TEMP) is measured on the tip of the middle finger on the right hand.

3 DATA ANALYSIS

After the measurements, the raw data with the sampling frequency of 1000 samples per second were imported into *Matlab*. Within *Matlab*, the electrocardiogram (ECG) data were analysed with the Pan-Tompkins algorithm from which the inter-beat interval (IBI) data was obtained. Heart rate was derived from IBI data. Analysis of the thorax expansion data gave us the respiration rate (RR). All data were then resampled to one-second intervals by averaging the inter-second data points. The first five minutes of the measurements were cut to account for the time needed for the volunteer to calm down at the beginning of the measurements. Then a geometric median of all volunteers was calculated for each measured physiological parameter. Three time groups, each 10 minutes in length, were selected. The first one represents the time before the call (5 min – 15 min time window), the second one represents the calling time and five minutes after (25 min – 35 min time window) and the third one represents the time after the call (35 min – 45 min time window). Geometric medians were then resampled so that each 10 min time window got represented in 15 steps. Afterward, the data were renormalized to an average of the first five minutes. This means the whole session was divided into two three parts and statistically evaluated for every parameter and each part separately. The first part is named **Part A**, the second one **Part B** and the third one **Part C**.

To check for the difference between both test situations we used the Wilcoxon signed-rank test. The results of all statistical tests were corrected with the Holm-Bonferroni correction for multiple comparisons.

4 RESULTS WITH DISCUSSION

An overview of the Wilcoxon signed-rank test results demonstrates that there are statistically significant differences between the two experimental situations for finger temperature parameter (TEMP) in all parts of the measurement. There are statistically significant differences in the Part A and Part B of the measurements for the skin conductance (SC) and respiration rate (RR) and statistically significant differences in the Part B and Part C of the measurements for the muscle tension parameter (EMG) (see Table 1).

Table 1: Summary of Wilcoxon signed-rank test corrected with Holm-Bonferroni correction for multiple comparisons. Values shaded in green represent statistically significant differences between two experimental situations ($p < 0.05$). Marks: HR – heart rate, EMG – muscle tension, SC – skin conductance, RR – respiration rate and TEMP – finger temperature.

	HR	EMG	SC	RR	TEMP
Part A	0.2708	0.3186	0.0009	0.0302	0.0037
Part B	0.3616	0.0128	0.0470	0.0302	0.0009
Part C	0.3330	0.0128	0.3616	0.1534	0.0009

In the following, we represent bar graphs for each measured parameter, belonging to both situations and all three measurement's parts. The height of bars represents normalized averages (to the first five minutes) so that all parameter measurements can be compared.

In Figure 4, all three parts of the heart rate measurements show an insignificant drop when working smartDOT is attached. It may be interpreted as a modest calming effect. Although statistically insignificant, its effective size (D, Table 2) waxes from -0.62 (Part A) to -0.99 (Part C). The last connotes a large difference (see also a description in the Legend of Tabel 3.

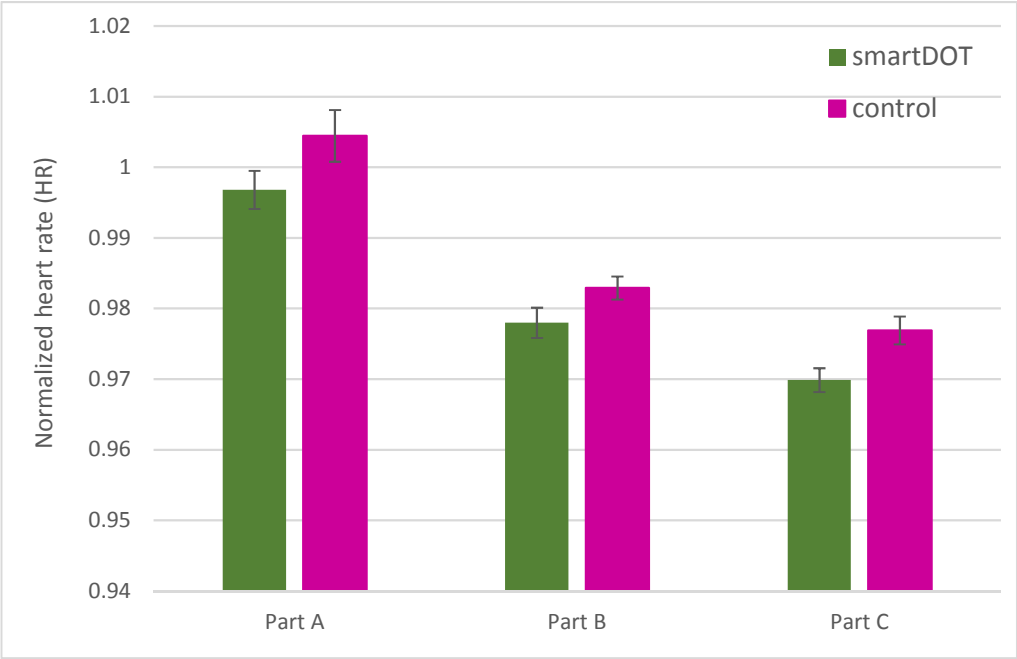

Figure 4: Normalized heart rate (HR) from twelve volunteers during two parts of measurements for two test situations (*smartDOT*: a working smartDOT attached to the back of the mobile phone, *control*: sham-working smartDOT attached to the back of the mobile phone). Mean values ± standard error (N = 12) are shown.

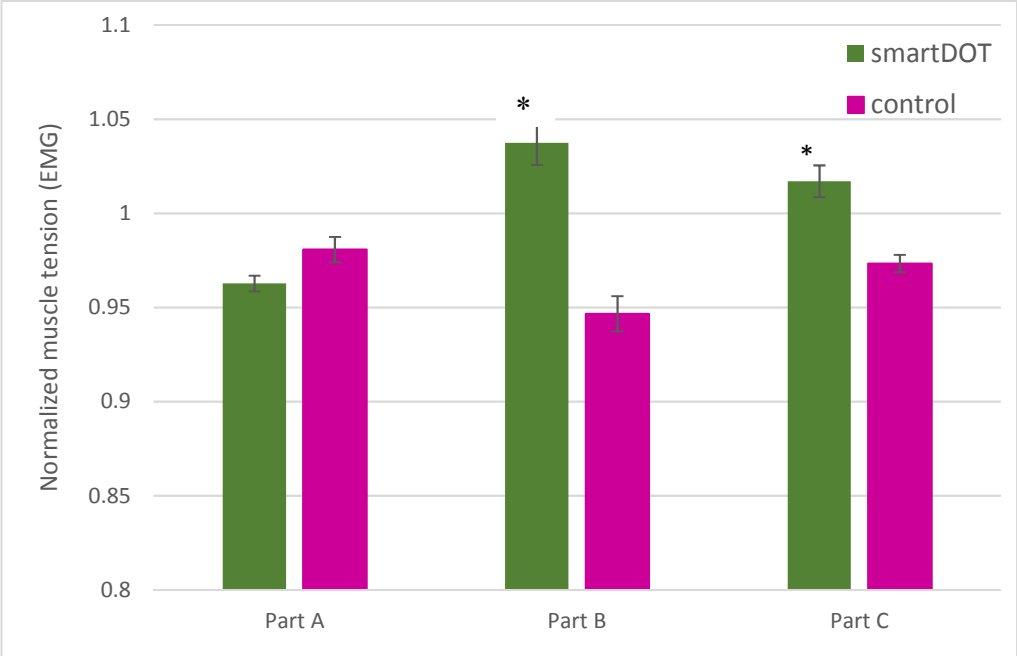

Figure 5: Normalized muscle tension (EMG) from twelve volunteers during two parts of measurements for two test situations (*smartDOT*: a working smartDOT attached to the back of the mobile phone, *control*: sham-working smartDOT attached to the back of the mobile phone). Mean values ± standard error (N = 12) are shown. A single asterisk (*) represents a statistically significant difference between two situations with $p < 0.05$.

In Figure 5, we may see that the muscle tension shows a big effective size (D = 2.22; Table 2) and statistically significant difference (see also Table 1 Part B row and EMG column). This difference lowers in Part C (D = 1.66) but still retains statistical significance. It can be interpreted in the sense that the smartDOT impact shows itself the most when the radiation burden due to the calling was the highest.

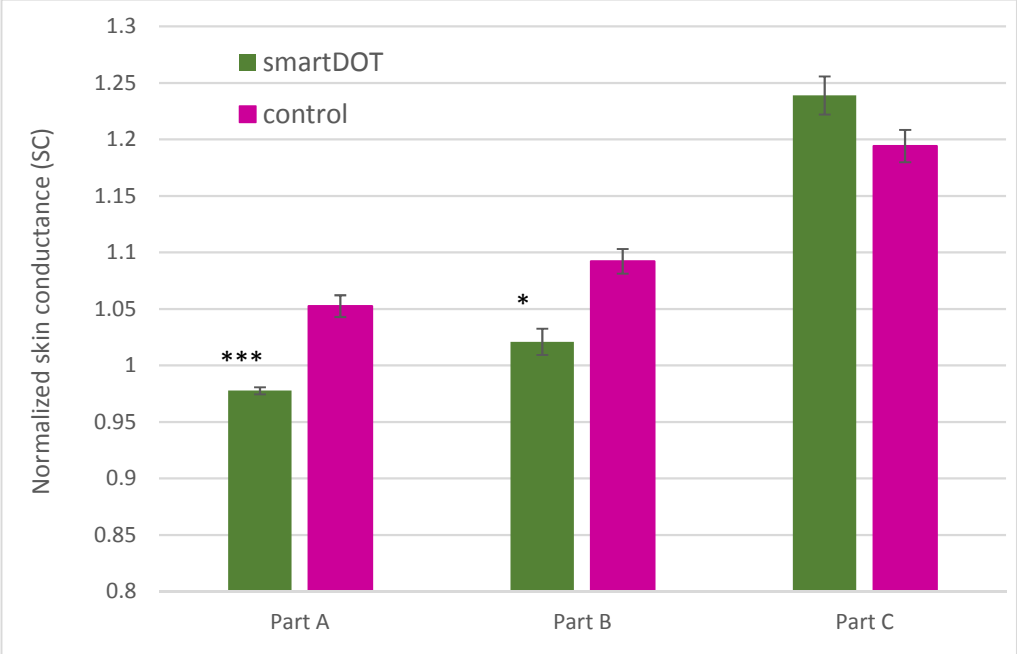

Figure 6: Normalized skin conductance (SC) from twelve volunteers during two parts of measurements for two test situations (*smartDOT*: a working smartDOT attached to the back of the mobile phone, *control*: sham-working smartDOT attached to the back of the mobile phone). Mean values ± standard error (N = 12) are shown. A single asterisk (*) represents a statistically significant difference between two situations with $p < 0.05$ and a triple asterisk (***) represents a very high statistical significance with $p < 0.001$.

In Figure 6, a highly significant difference in the sense of calming is revealed. In Part A its D amounts to -2.7, which connotes a huge difference. This effect attenuates through time (Parts B and C).

Analogous to the parameter SC, in Figure 7 the smartDOT exposed situation demonstrated a calming effect. It is the biggest in Part A (D = -1.6) and retains this difference through time, although it is no more significant in Part C.

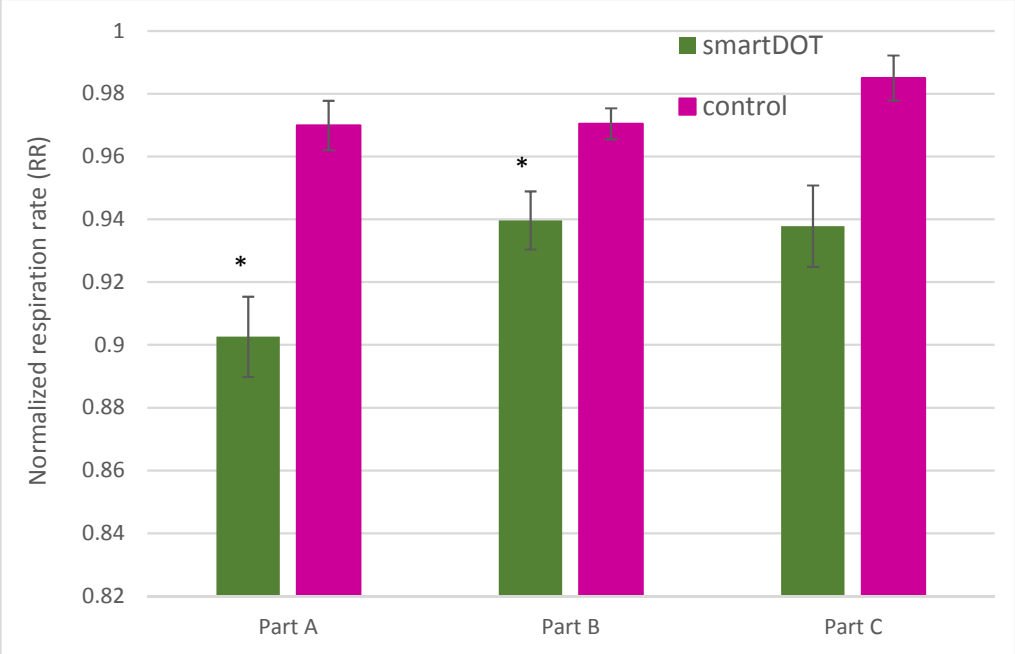

Figure 7: Normalized respiration rate (RR) from twelve volunteers during two parts of measurements for two test situations (*smartDOT*: a working smartDOT attached to the back of the mobile phone, *control*: sham-working smartDOT attached to the back of the mobile phone). Mean values ± standard error (N = 12) are shown. A single asterisk (*) represents a statistically significant difference between two situations with $p < 0.05$.

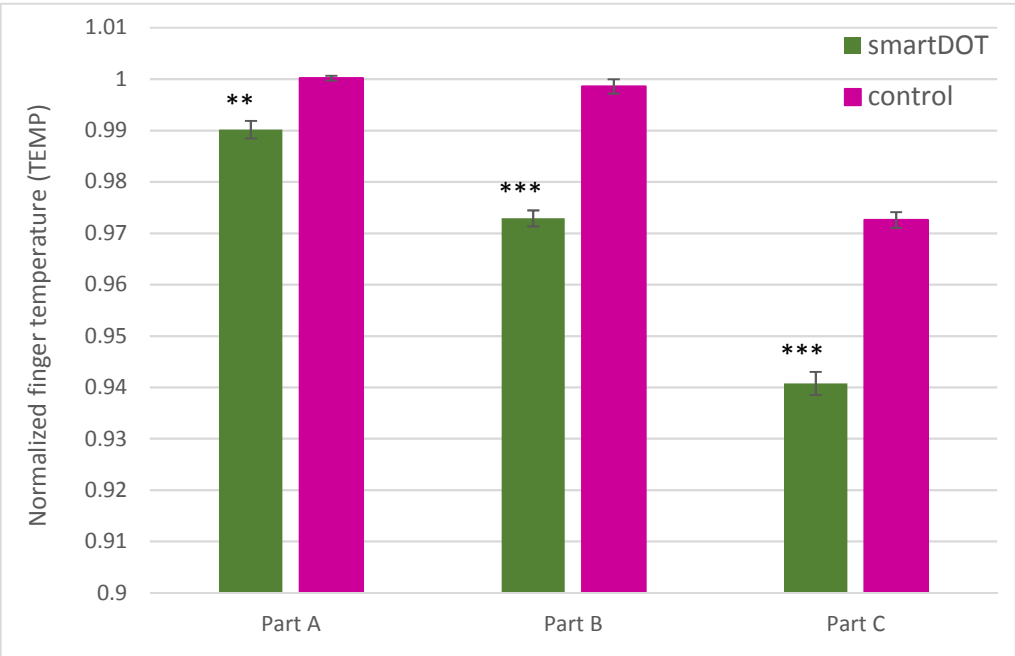

Figure 8: Normalized finger temperature (TEMP) from twelve volunteers during two parts of measurements for two test situations (*smartDOT*: a working smartDOT attached to the back of the mobile phone, *control*: sham-working smartDOT attached to the back of the mobile phone). Mean values ± standard error (N = 12) are shown. A single asterisk (*) represents a statistically significant difference between two situations with $p < 0.05$ and a triple asterisk (***) represents a very high statistical significance with $p < 0.001$.

In Figure 8, we may observe that the TEMP significantly drops in the exposed situation (vs. control) in all three parts; in all of them, it is also highly statistically significant in all three parts. Considering a concomitant decrease in SC, the drop in peripheral temperature indicates a calming effect.

As already said, besides statistical differences, we also calculated the standardized effect size, which speaks about the magnitude and the sign (direction) of the influence. To calculate the standardized effect size, we used Cohen's D with color-coding for the intensity and the direction of influence. The values are presented in Table 2 below.

Table 2: Overview of the Cohen's D effect size on different physiological parameters. Three different comparisons between two test situations are presented. Negative values (blue color) signify that the first situation decreased the parameter compared to the second situation, while the positive values (red color) signify an increase of the parameter. Values with an underlined black font signify parameters yielding a statistically significant difference between two chosen situations, other values are not statistically significant, at least after the Holm-Bonferroni correction. The intensity of the background color signifies the difference magnitude (an absolute value less than 0.2 indicates a *small difference*, an absolute value between 0.2 and 0.8 indicates a *medium difference*, an absolute value between 0.8 and 2 indicates a *large difference* and an absolute value above 2 indicates a *huge difference*). Marks: HR – heart rate, EMG – muscle tension, SC – skin conductance, RR – respiration rate and TEMP – finger temperature.

	HR	EMG	SC	RR	TEMP
Part A	-0.615	**-0.831**	-2.704	-1.636	**-2.061**
Part B	-0.670	**2.217**	**-1.637**	**-1.073**	**-4.476**
Part C	-0.989	1.663	**0.742**	**-1.164**	**-4.254**

Table 3: Effects in parts. The nature of the effect of the exposed situation as compared to the control one. *Red*: a difference in the direction of stimulation, *blue*: a difference in the direction of calming, relaxing.

	HR	EMG	SC	RR	TEMP
Part A					
Part B					
Part C					

As may be observed from Table 3, all colored parameters connected with the vegetative system point in the direction of a calming effect. The EMG parameter, representing the somatic system (muscles) indicates an increase in tone.

5 CONCLUSION

As seen in various graphs and tables and particularly in Table 3, the overall influence of the product *smartDOT* as monitored by physiological testing demonstrates a significant difference between the two tested situations in the direction of calming the vegetative system (stress-reducing). The effects may be seen in all parts of testing, with the majority slightly fading away through time (from Part A to Part C). Simultaneously, as evidenced by the muscle tone parameter (EMG), the somatic system is strengthened.

From the results, we may also infer that the calling with its higher radiation burden does not invoke a much higher difference; the calming effect is also seen almost on equal footing in Part A. In this sense, Part B is somewhat weaker; maybe the organism has already adapted to the new situation.

Based on sufficient statistically significant differences between smartDOT situation and Control situation, as well as a clear indication of the stress-reducing impact demonstrated in the testing of the protective influence of the product *smartDOT*, we acknowledge that the product meets all the criteria required to obtain the *Certificate of Protective Influence on Human Organism against mobile phone radiation* No. 0601, which is announced on webpage http://bion.si/en/testing-certificates.

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