

**POSITIVE EFFECT OF EVERYDAY VIRRY VR BREAKS ON OFFICE
EMPLOYEES**

**LONGITUDINAL STUDY CONDUCTED BY FOUNTAIN DIGITAL LABS
(LONDON, UK)
IN THE TOP ONLINE RECRUITMENT COMPANY HEADHUNTER
GROUP (HH.RU)**

Research dates 27.08.2019 - 29.09.2019

MATERIALS AND RESEARCH METHODS

ABOUT VIRRY

The Virry platform offers interactive immersive video-experiences of natural thematics, allowing the viewer to experience contact with nature and wild animals that is not possible in everyday life. Virry experiences immerse the viewer in the world of the African savanna without the use of computer-generated images for periods of 2 to 6 minutes. Among the Virry experiences available are an interaction with an elephant that runs up to the viewer, an interaction with a lioness fed meat by the viewer and a trip down the river. All experiences are described in Appendix 1.

1. Background of the Study

The negative impact of a prolonged state of psycho-emotional stress negatively affects not only the efficiency of an employee, but also health and wellbeing. In addition to purely psychological methods for assessing the level of psycho-emotional stress and its negative effects on humans, there is an array of studies of psychophysiological markers related to heart rate variability (HRV).

The term "biological stress" is not purely negative or positive, for this reason, we introduce in our study two concepts of distress and eustress. The first concept reflects negative stress, which increases the fatigue of the body and its long-term effect leads to the development of body dysfunction, which can cause even death. The most obvious manifestations of distress in the HRV paradigm are usually attributed to a decrease in the activity of the parasympathetic nervous system in the regulation of the body's activity, including during the recovery period, and a general decrease in the power of the spectrum during frequency analysis.

We conducted a study of the effectiveness of Virry technology for a short conscious break in the headquarters of HeadHunter Group (HH.ru). In previous studies of the effectiveness of a conscious break for staff using Virry.Life VR technology in the top senior care home in Russia, the head office of Sberbank and in the IT company Loyalty Factory, data was obtained on the positive impact of the technology on the psycho-emotional state of employees, which showed increasing performance associated with mood and state of mind, as well as a decrease in the level of depression and the coefficient of emotional burnout.

2. Study Hypothesis

- 1) Indicators of heart rate variability after a single conscious break in the virtual savannah will demonstrate a significant increase in the activation of the parasympathetic link of the autonomic nervous system.
- 2) The influence of systematic conscious breaks on the psycho-emotional state of employees is positive and will decrease the activity of the sympathetic link of the nervous system.

- 3) The subjective assessment of one's own condition after each visit to the virtual savannah over a long-term period changes in a positive direction.

3. Summary conclusions

The results of a study at HeadHunter Headquarters show the positive effect of the conscious breaks on the psycho-emotional state of employees, as indicated by the following psychophysiological markers: heart rate decreases statistically significantly after a single visit to the virtual savannah when measured in a calm position, the HRV frequency indicators show an increase in the activity of the parasympathetic system after a single conscious break.

An increase in pNN50 after a single VR experiment reflects a greater activation of the parasympathetic nervous system. However, it should be noted that the balance of the distribution of the frequency analysis indicates the predominance of the sympathetic division in the regulation of the work of the autonomic nervous system (ANS) of participants, which indicates the presence of chronic stress in the research participants during the study period. Throughout the longitudinal period, the positive dynamics of subjective assessments of their own psycho-emotional state by employees is reflected after each conscious break in the virtual savannah with Virry.Life. At the psychophysiological level, there is a significant decrease in the frequency activity indicators in the low-frequency and ultra-low-frequency spectrum.

Thus, the results reflect the positive impact of conscious breaks Virry.Life VR technology on HeadHunter employees.

4. Audience

The study was conducted in summer at HeadHunter headquarters.

47 people took part in the study of the instantaneous impact of a conscious break experience in virtual reality.

21 people took part in the longitudinal study of the effects of a conscious break in virtual reality that lasted over 4 weeks.

All participants took part in the study on a voluntary basis, had normal or corrected to normal vision, were mentally healthy, had no cardiac or neurological diseases, and did not take any medication during the study period that could significantly affect the brain and heart work.

5. Description of the study

For data recording we used the VNS-Micro NeuroSoft Neuropathy Analyzing System (Neurosoft LLC, Russia). The heart rate measurement procedure was performed in the study three times: before and after the first immersion in the virtual savannah with Virry Life and after 10 visits to the virtual savannah.

The measurements were carried out 1.5-2 hours after breakfast in the morning. Before the start of the study, participant had a short period of adaptation to environmental conditions lasting 5-10 minutes. We recorded a 5-minute sitting ECG (corresponding to a background sample) and a 5-minute standing ECG (corresponding to an orthostatic test) in a quiet, separate room with a constant temperature (23°C). The study used time and spectral parameters for HRV analysis:

- standard deviation of the NN interval, SDNN, ms
- the square root of the mean squared differences of successive NN interval, RMSSD, ms
- pNN50%,ms
- high frequency, HF, ms²
- low frequency, LF, ms²
- very low frequency, VLF, ms²
- total power, TP, ms²
- LF/HF, y. e

The study using HRV examinations was carried out before and after the first visit to the virtual savannah, and also after passing the last stage of longitudinal research.

The self-assessment of the psycho-emotional state by the participants was carried out on four scales: determination, mood, motivation and energy. Measurements were taken before and after each conscious break with Virry, during working hours for four working weeks.

6. Results

During the study, there was a decrease in the median heart rate after the session compared with the initial data in the background sample: 72.3 (66.3; 77.5) bpm versus 73.8 (67.9; 79.05) bpm ($p = 0.002$).

Table 1 - Background Recording. Visit 1. Parameters of stress before and after the first visit to the virtual savannah.

Parameter	SD NN, ms	RMSSD, ms	pNN50, %	LF,ms:	HF, ms	VLF, ms:	TP, msec:	LF/HF
Before Virry								
N	47	47	47	47	47	47	47	47
M	62,26	48,17	16,74	1932	1128,32	1823,79	4884,06	2,39
SD	21,98	26,38	14,01	3707,53	1987,44	2168,61	7174,85	1,74
95%	55,98-68,54	40,63-55,71	12,73-20,75	872,05-2991,95	560,13-1696,51	1203,81-2443,77	2832,84-6935,28	1,89-2,89
Me	57	39	13	1182	579	1078	2938	2,09
IQR	46,5-69	33-53,5	7,35-21,8	754,5-1936,5	363-898	747,5-1863	2046,5-4464,5	1,2-3,06
Min	34	19	0,3	175	123	325	1120	0,35
Max	131	161	65,7	26095	11780	10540	48394	9,73
After Virry								
N	47	47	47	47	47	47	47	47
M	66,98	52,98	21,13	2490,89	1530,38	1853,6	5874,68	2,51
SD	19,81	27,67	15,98	4705,42	2638,69	2033	8789,85	1,74
95% ДИ	61,32-72,64	45,07-60,89	16,56-25,7	1145,66-3836,12	776-2284,76	1272,39-2434,81	3361,75-8387,61	2,01-3,01
Me	63	44	16,4	1543	768	1319	3387	2,29
IQR	52-81	34-63,5	10-29,25	1013-2264	402,5-1567,5	821,5-2206,5	2493-6876,5	1,26-3,2
Min	37	22	0,5	344	59	284	1284	0,2
Max	126	175	77,9	32955	14886	13339	61180	9,24
Level p	0,066	0,198	0,004	0,027	0,047	0,112	0,04	0,611

Statistical analysis of the recording before and after the first visit to the virtual savannah (table 1.) revealed an increase of the fraction of consecutive intervals, the difference between which exceeds 50 ms (pNN50) and the power of spectral density in the high-frequency range (0.15–

0.4 Hz) (HF). This data indicates an increase in the parasympathetic link of the nervous system and an increase in its effect on the regulation of the activity of the heart and respiration. An increase in the study of the magnitude of the power of spectral density in the low-frequency range (0.04–0.15 Hz) (LF) with high probability can indicate normalization of the regulation of vascular tone by increasing the influence of the sympathetic system. There was also a trend towards a statistically significant increase in the SDNN parameter ($p = 0.066$).

7. Long term effect analysis

Table 2. Background recording. Visit 1-2. Stress parameters before and after the first visit to the virtual savannah.

Parameter	HR, beats/min	SDNN, ms	RMSSD, ms	pNN50, %	LF, ms ²	HF, ms ²	VLF, ms ²	TP, ms ²	LF/HF
Before Virry									
N	21	21	21	21	21	21	21	21	21
M	73,7	67,14	50,52	15,94	2874,33	1336,62	2375,38	6586,29	2,52
SD	8,83	22,49	24,76	8,33	5411,97	2466,4	2934,14	10089,09	1,43
95% ДИ	69,92-77,48	57,52-76,76	39,93-61,11	12,38-19,5	559,63-5189,03	281,74-2391,5	1120,45-3630,31	2271,19-10901,39	1,91-3,13
Me	74	63	41	16	1453	717	1154	3482	2,22
IQR	67,7-76,9	47-83	35-57	7,6-21,6	984-2549	460-921	958-2269	2205-5949	1,44-3,03
Min	62,2	44	25	4,5	382	276	466	1685	0,55
Max	99,5	114	117	30,6	26095	11780	10540	48394	5,79
After Virry									
N	21	21	21	21	21	21	21	21	21
M	73,17	60	49,38	19,3	1244,57	823,62	1106,29	3174,52	2,29
SD	9,19	19,21	37,24	13,73	690,78	983,91	442,24	1522,97	1,44
95% DI	69,24-77,1	51,78-68,22	33,45-65,31	13,43-25,17	949,12-1540,02	402,8-1244,44	917,14-1295,44	2523,15-3825,89	1,67-2,91
Me	73,5	59	43	16,4	1071	558	1124	3089	1,62
IQR	66,1-77,4	51-65	32-52	7,5-29,4	820-1605	336-926	835-1301	2292-3620	1,02-3,39
Min	59,6	37	20	1,8	329	162	396	1294	0,53

Max	96,2	133	201	42,6	2744	4845	2049	8742	4,68
Criterion	Wilkinson criterion	Wilkinson criterion	Wilkinson criterion	T-test	Wilkinson criterion	Wilkinson criterion	Wilkinson criterion	Wilkinson criterion	Wilkinson criterion
Level p	0,759	0,181	0,715	0,263	0,016	0,59	0,019	0,042	0,32

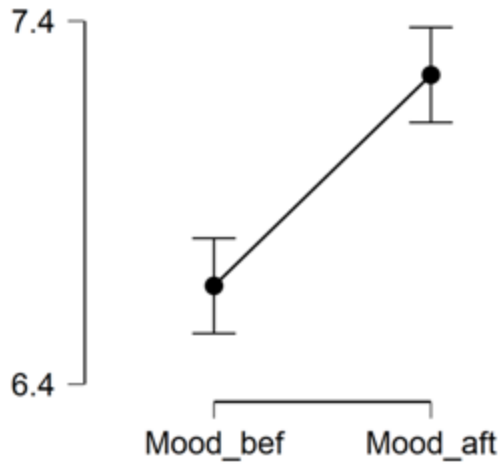
During the study, the following indicators significantly decreased (table 2):

- power of low-frequency oscillations (LF): 1071 (820; 1605) ms² compared to 1453 (984; 2549) ms² initially.
- power of ultra-low-frequency oscillations (VLF): 1124 (835; 1301) ms² compared to 1154 (958; 2269) ms² initially.
- the indicator of the total spectrum power (TP) also decreased during the study: 3089 (2292; 3620) ms² compared to 3482 (2205; 5949) ms² initially.

A decrease in the study of LF in combination with other factors may indicate an increase in sympathetic regulation and normalization of vascular tone regulation.

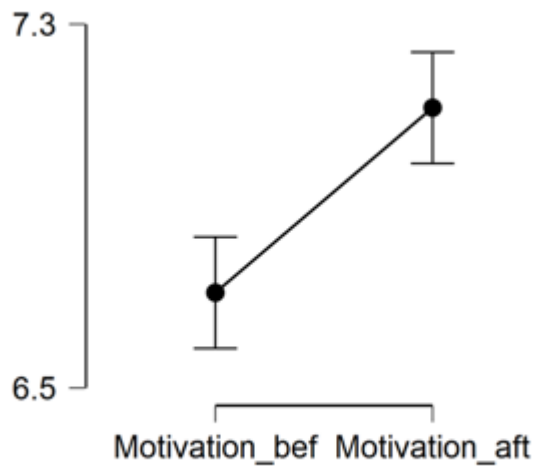
8. Self-report analysis

Comparing the answers received before and after visiting the virtual savannah, statistically significant differences were obtained, allowing us to come to the conclusion about the credibility of the research. However, when considering the median indicators and inter-quarterly range in connection with the 10-point scale of assessments, the differences are not obvious. For illustrative purposes, the indicator uses the change in the average value for each self-reporting scale used in the study. For a full description of self-reporting tests, see Appendix 1



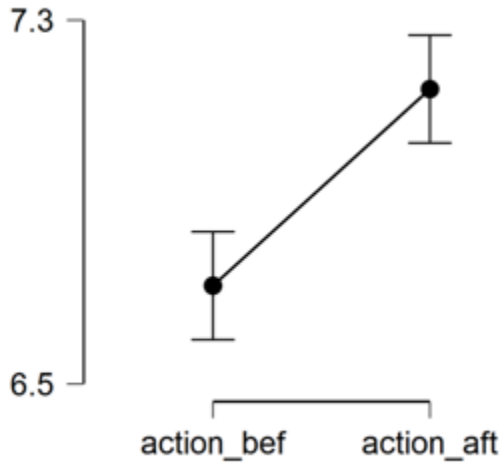
Scale 1. The dynamics of the indicator of “assessing one’s own mood” before and after visiting the virtual savannah.

The indicator reflecting the assessment of one's own mood significantly increases from 6.7 to 7.3.



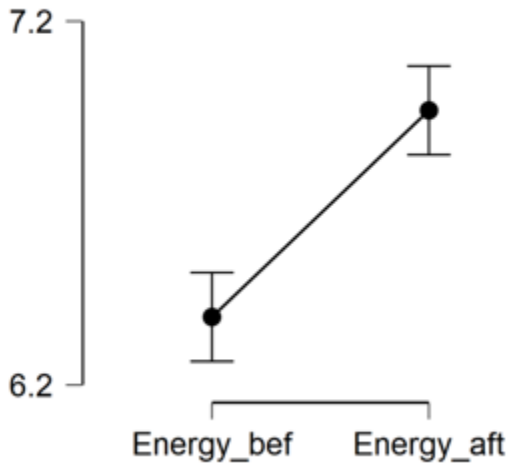
Scale 2. Dynamics of the indicator “assessing one’s own motivation” before and after visiting the virtual savannah.

The assessment of personal motivation when considering average indicators significantly increases from 6.7 to 7.1.



Scale 3. Dynamics of the indicator "readiness for action" before and after visiting the virtual savannah.

The average indicator of readiness for work and new actions significantly increases from 6.7 to 7.2.



Scale 4. The dynamics of the indicator "assess your own level of energy" before and after visiting the virtual savannah.

The average assessment by employees of their own energy varies from 6.4 to 7.

9. Conclusion

After a single session we notice an increase in the activity of the parasympathetic part of the autonomic nervous system which complies with our previous studies and is the body's response to rest after stressful exposure. An increase in the power indicator in the frequency range LF indicates the restoration of vascular tone, which, in turn, increases the body's resistance to the negative consequences of psycho-emotional stress.

Statistical analysis of the orthostatic test before the first visit to the virtual savannah with background indicators after the visit leads to the following conclusions. The increase after the standard deviation of the normal interval (SDNN) value, the square root of the average square of the differences in the values of successive pairs of intervals (RMSSD), the percentage of successive RR intervals, the difference between which exceeds 50 ms (pNN50) and the power of high-frequency oscillations HF indicates an increase in parasympathetic link of the nervous system and increasing its effect on the regulation of the activity of the heart and respiration. The pNN50 value is considered to be the most sensitive to psycho emotional stress. At the same time, an increase in the power of spectral density in the lowest frequency range (≤ 0.04 Hz) (VLF) indicates an increase in the activity of the sympathetic part of the autonomic nervous system. The index of vagosympathetic effects on the heart rhythm of LF / HF after an orthostatic test was shifted toward sympathicotonia (LF / HF > 1); after the session, the median of the relationship remained biased towards sympathicotonia, but at the same time it decreased significantly (by 43.2%).

A decrease in the power of low-frequency oscillations (LF) and power of ultra-low-frequency oscillations (VLF) indicates a decrease in sympathetic tone. This means that the resistance to the negative consequences of the background (everyday) psycho-emotional stress is achieved after the first procedure and lasting for a long period and is observed even after the end of the course. The data of the psychophysiological part of the study are consistent with the self-reporting indicators of the participants in the long term part of the experiment.

We can conclude that a conscious break with Virry favorably affects the psycho-emotional state of HeadHunter employees both in terms of self-reporting and more objective psychophysiological indicators.

APPENDIX 1

Throughout the series of initial screening, employees could go online using their own devices by clicking on the link http://virry.life/tests_before/en, to fill in the application form and pass the tests in the beginning and the end of research and also everyday:

1. Name and surname
2. Position
3. Mood at the moment

horrible 😞

very bad 😞

bad 😞

could be better 😞

so-so 😞

ok 😞

not too bad 😞

good 😊

very good 😊

fantastic 😊

4. Gender
5. Age
6. Chronic diseases
7. Do you suffer from allergies?
8. Do you suffer from heart diseases?

9. What do your friends think of you?

1 Overly emotional/ dramatic

2

3

4

5

6

7

8

9

10 Chilled out

10. In terms of sleep are you

- 1 late riser
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 early bird

11. Are you?

- 1 Introverted
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Extraverted

13. What is your attitude towards the natural world?

- 1 I don't really care
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 I'm with Greta

14. The best way for you to relax is to

- 1 Do nothing
- 2
- 3
- 4
- 5

- 6
- 7
- 8
- 9
- 10 Be very active

15. What is your work position?

- 1 I don't have any management tasks
- 2 I do some decision making
- 3 Responsible for myself and my work-flow
- 4 Manage 1-2 people
- 5 Project manager
- 6 Head of department
- 7 Company director

16. What VR experience did you choose?

- Elephants
- Rhinos
- Lioness
- Leopard
- Hyena
- Vervet monkeys
- Zebras
- River
- Waterfall

17. The Hospital Anxiety and Depression Scale

18. Tailor Anxiety Scale

19. Beck Depression Inventory

20. Life Satisfaction Scale

21. Psychological Distress Scale

22. Semantic Differentials Scale

APPENDIX 2

1. «Virry VR with Drozdov»; «Virry VR: Feel the Wild»

SAVANNAH

Lioness. Set duration of 3 minutes 10 seconds.

The viewer sits on the dry grass of the savannah. The viewer lures a lioness by shaking the joystick to “drop” the meat. The lioness approaches, sniffs the meat, studies the viewer, licks, “bites” and leaves without eating the meat.

Leopard. Set duration of 3 minutes 40 seconds.

The viewer is near a tree in the long grass. As in the set with a lioness, the viewer lures a leopard. The leopard is a very cautious animal and the action takes place at a greater distance than that of the lioness.

Elephants. Set duration of 5 minutes 35 seconds.

The viewer is surrounded by long grass. The viewer lures elephants with an acacia branch. A herd of elephants approaches, a curious baby elephant sniffs the viewer and runs away. The viewer can simultaneously observe the elephant eating an acacia branch.

Hyena. Set duration of 4 minutes.

The viewer is in a field surrounded by long grass. In front of him is a zebra carcass. A hyena appears, cautiously emerging from the grass. The hyena eats the remains of the zebra and leaves.

FOREST

Vervet monkeys. Set duration of 4 minutes.

The viewer is among the trees. Shaking the joystick, he lures vervets with a watermelon. They appear, jump from the branches to the ground, break open and bite off a piece of watermelon.

Black rhino. Set duration of 2 minutes 45 seconds.

The viewer is in a large mud puddle next to Nikki, a large black rhino who is bathing in it.

Zebras. Set duration of 2 minutes 40 seconds.

The viewer is in the middle of a green meadow, watching the zebras grazing in the distance. One of the zebras approaches the camera, sniffs it, gets scared and runs away. The herd of zebras also runs away, smelling a lion nearby.

Black rhino cub. Set duration of 2 minutes 25 seconds.

The viewer is in the African forest. A black rhino cub appears. The viewer lures it with grass.

River. Set duration of 3 minutes 20 seconds.

The viewer moves from one place to another, clicking on the paws to travel along the river, spending as long as is desired in each place.

2. «Virry Safari: Wild encounters»

Elephants. Set duration of 5 minutes 40 seconds.

The viewer is surrounded by long green grass. The voiceover offers to feed the lions, which the Rangers have seen here recently. Suddenly, instead of lions, a herd of elephants appears and studies the meat with curiosity. The viewer has a unique opportunity to see the elephants at such close proximity that even the hairs on their trunks are visible.

Giraffe. Set duration 3 minutes 40 seconds.

The viewer is near some trees, under one of which is a giraffe called Nditu (meaning "girl" in Swahili). The giraffe can be fed with oranges by nodding twice, which causes them to fall. The viewer calls the giraffe by name and watches as she eats.

Cheetah. Set duration of 1 minute 55 seconds.

The viewer nods their head to feed the cheetah. The cheetah studies the meat but decides not to eat it.

Rhinoceros and African buffalo. Set duration of 5 minutes.

The viewer nods their head to feed grass to the buffalo. A buffalo approaches, sniffs the grass and licks the camera, which gives the impression of licking the viewer. The viewer continues to observe the black rhinoceros whilst feeding it.

Hyena. Set duration of 4 minutes 25 seconds.

The viewer is in an open area of dry grass. Nodding their head, they throw some meat. A hyena sneaks up, sniffs the meat and drags it away, approaching the viewer's face several times.

Baboons. Set duration of 3 minutes 20 seconds.

A warning is given about a possible feeling of discomfort caused by the camera falling from the tree when it is dropped by a baboon. The viewer lures the baboons and observes them. The baboons, in turn, carefully study the camera, giving the impression that they are studying the viewer.

Cub rhino Kitui. Set duration of 2 minutes 30 seconds.

The viewer is in a wooded area. A rhino cub emerges and drinks milk from a bottle when called by the viewer.