

PRACTICING HATHA-YOGA, SENSE OF COHERENCE AND SENSE OF AGENCY. NEUROPHENOMENOLOGICAL APPROACH

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SUMMARY

Background: A growing body of evidence supports the belief that yoga benefits physical and mental health. The aim of the study is to investigate whether the sense of coherence and sense of agency are more developed in people practicing hatha-yoga than in the group of people who have never practiced yoga.

Methods: TAHE, SOC-29 questionnaire and short microphenomenological interview conducted on a group of 15 people (8 yoga instructors, 7 in the control group).

Results: It has been shown that the study group has significantly higher scores in both the sense of agency and sense of coherence than the control group. In addition, a statistically significant correlation was observed between the part of the values mentioned above.

Conclusions: There are indications that the hatha-yoga exercise increases the sense of agency, which in the long run can contribute to better mental health. In order to find a clear and certain link between the sense of coherence and the sense of agency additional research is necessary.

Key words: sense of coherence - sense of agency – neurophenomenology - TAHE

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INTRODUCTION

A lot has been written about the therapeutic potential of yoga practice in both mental and physical conditions, its influence on wellbeing, feeling of integrity and cognitive capabilities. Yoga proved to be an efficient complementary therapy for e.g. anxiety, depression, body image disturbances, hypertension and low back pain (Cabral et al. 2011, Wieland et al. 2017). However, the vast majority of papers published on this topic concentrate on searching for cures for specific diseases. In this article authors decided to explore a different standpoint called the salutogenic approach.

The term “salutogenesis” is coined by the medical sociologist A. Antonovsky (Antonovsky 1987). The notion of stressor plays a major role in this model. According to it, every stimulus which disturbs organism's homeostasis can be considered as a stressor. However effect of facing stressors could have different outcome (could be beneficial or destructive), depending on how each individual manages to utilize his or her generalized resistance resources. The salutogenic model assumes that health and illness are two extremes of the same continuum. Taking that into account, the role of the physician is not to diagnose separated nosologic units, but rather to help the patient (treated as a whole) to move towards the health side of continuum. For this reason it is vital to measure one's capability of dealing with stressors.

Antonovsky proposed for this purpose the concept of ‘sense of coherence’ (SOC). It is, as author declares, “a global orientation that expresses the extent to which

one has a pervasive, enduring though dynamic feeling of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable and explicable; (2) the resources are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement” (Antonovsky 1987). It measures one's subjective ability to face difficult life's challenges. SOC has proved to be a very effective and affordable predictor of both mental as well as physical health (though the latter to a lesser extent). It is not focused on the incidence of a single condition but rather on general inclinations for diseases. If a person has a high sense of coherence, he or she will strive actively to utilize the generalized resistance resources available in such a way as to transform the negentropy of the environment to maintain one's homeostasis. People with low sense of coherence will lose homeostasis what will result in getting ill. For this reason, from a public health viewpoint, it is crucial to look for factors that can contribute to the development of a high sense of coherence (Larsson 1996).

As stated above, the yoga practice proves to be effective in treating many diseases. In this paper we decided to investigate whether prolonged practice of some types of yoga (hatha-yoga) results in improvement of general resistance to stressing stimuli, which would be measured quantitatively by the sense of coherence questionnaire.

Moreover, in the presented study, as the title states, we assumed the so called ‘neurophenomenological’ ap-

proach. Although the clear definition and well established set of neurophenomenological methods are yet to surface, we are committed to the idea of Francisco Varela (1996, 1965) of combining strict and scientifically rigorous phenomenological - first person (or 'second person' is up for debate, see e.g.: Petitmengin 2006) qualitative approach with equally strict and scientifically sound third-person approach. Such commitment allows us to debate very subtle aspects of human cognition and mental health while giving justice to its experiential, phenomenological part and sustaining frames of scientific debate.

In our everyday life we tend to perform goal-directed actions which we normally do not reflect upon such as grasping a glass of water when we are thirsty. The question, however is, how do we know that we ourselves are the ones grasping the glass of water? We expect then our intention to move in a certain way will result in certain consequences and associate perceived glass with feeling of the arm moving. This pre-reflective integration of proprioceptive, motor and visual signals not only direct performance of the motor task, but also contributes to the feeling that we are initiators and agents of perceived motion. This experience of oneself as the agent of one's own actions - and not of others actions - has been described as 'the sense of agency' (David 2008, Gallagher 2000).

In our study, to further explore sense of agency we decided to use method already well accommodated within neurophenomenological approach - 'The Alien Hand Experiment'. Further on it will be called TAHE for short. It is similar to experimental paradigms such as Rubber Hand Illusion (Blanke 2012, Botvinick 1998, Ehrsson 2007) in that regard, that it uncovers what some authors (Blanke 2009) call 'minimal phenomenal selfhood' by detaching sense of agency from sense of ownership (Gallagher 2000), but also provides means to quantify and measure individual differences.

The concept of a sense of agency or its disorders may be important for understanding the essence of nosologic units such as anorexia nervosa or BPD, and even some psychopathological symptoms that occur in schizophrenia (such as derealisation), as shown by earlier experiments made with TAHE (Sørensen 2005).

Taking that into consideration, we decided to combine these two methods. There were two main reasons for doing so: both of the research approaches assume priority of first-person perspective and are not reductionist in that regard.

Our research hypotheses were that results of SOC-29 correspond with sense of agency, and therefore the latter could be indirectly measured using this quantitative research tool. Formulating the hypothesis above we assumed that people practicing yoga would present a better sense of agency than the rest of the population. That assumption is based on data, indicating that yoga influences body image (Hall 2016).

SUBJECTS AND METHODS

Participants of the study (n=16) were divided into following two subgroups:

- Study group which includes 4 males and 4 females who regularly practice hatha-yoga
- Control group which includes: 4 males and 4 females who had never practiced any type of yoga

Members of the study group were participants of the 'Yoga' Scientific Circle working at Academy of Physical Education in Katowice. Most of those subjects were also yoga instructors, practicing at least 3 times a week for several years. The control group was recruited with the snowball sampling method. Criteria for inclusion to the both groups were: age above 18 years old, no neurologic, psychiatric, orthopaedic nor rheumatologic disorders or any other conditions that might affect appropriate performance of the examined task.

Subjects were studied, using two methods: one of the research tool was a questionnaire with 29 items 'Sense of coherence scale' adapted to polish language (Januszewski 2011) and the second one was 'The Alien Hand Experiment' procedure (Gallagher 2003, 2006, Nielsen 1963).

Sense of Coherence consists of three mutually intertwined conceptual dimensions:

- Comprehensibility, which indicates understandability of life's events and their order.
- Manageability is factor of sense of having skills and abilities to cope with encountered events and having perspective of possible help and support from environment.
- Meaningfulness, which is ability to get satisfaction from life, having will to participate in it and believing that events around are interesting and worthy of care.

Before the appropriate experiment participants were asked to complete the polish version of SOC-29. Each of the questions represent one of three aforementioned components in 1-7 scale. The subjects also had the possibility to leave their telephone number in case of being willing to participate in the experimental part of study. After contacting those who gave consent for participating in the experimental part of the study, to each telephone number identification number had been ascribed. Later telephone numbers were deleted from our database to preserve anonymity of sensitive data. Participants' results were analysed using only their identification codes.

For the experimental part of our research apparatus designed by Nielsen was used (Figure 1). TAHE is a phenomenologically inspired method employed in neurophenomenological paradigm of cognitive science (Bockelman 2013, Varela 1965, 1996) and it mixes both rigorous qualitative and quantitative approaches. (For the details on the design of TAHE procedure, see: Nielsen 1963).

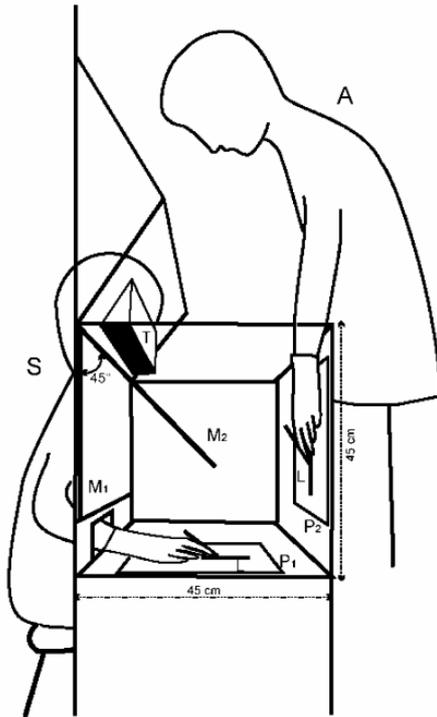


Figure 1. The alien-hand experiment (Nielsen 1963)

We made some slight modifications in the way the experiment was performed in comparison to the classical one. First of all, we decided to make two trials without manipulation (mirror in M2 position is manipulated one), instead of one. This decision was dictated by unexpected discrepancies between study group and control one, so we wanted to give subjects a more difficult and more differentiated task. We also wanted to explore interesting situation where subjects don't see the difference or otherwise. It also allowed us to force more efficient subjects to pay more attention to the task, and allow us to differentiate subjects who guessed the mechanism early, therefore are performing better (while not really exhibiting better sense of agency), from the ones who have better cognitive skills. In our version of TAHE manipulation was absent in trials 3 and 7 - near beginning and towards the end. As a source of light we used a smartphone: Motorola Moto G3 with 'Fanarik' application installed in order to control precisely applied time and intensity of the light. The smartphone's flashlight was switched on by the experimenter for a period of 3 seconds.

In between every trial a short semi-structured interview was conducted. The form of the interview was inspired by the microphenomenological interview method (also known as elucidation interview) (Petitmengin 2006, 2017, 2009) a second-person interview method based on content-empty questions, employing 'ericksonian language'.

A 5-point rating scale was used in the interpretation of the qualitative material. We resigned from normative nomenclature used in previous studies (Figure 2). We felt that scale where grade 5 would mean 'intact sense

of agency', like in Sørensen's TAHE experiment on bulimic woman (Sørensen 2005) wouldn't reflect our research claims since the study group subjects were showing better performance in the given task than control group. Classical rating would imply that only group of people practicing hatha-yoga would show intact sense of agency, which is obviously wrong.

Sørensen's scale (Sørensen 2005)		Scale used
1: Lack of sense of agency	S attributes alien hand as her or his own	1: Undetectable sense of agency
2: Heavily reduced sense of agency	S is puzzled, but gives external or internal explanation for his or hers error	2: Heavily reduced sense of agency
3: Ambivalent sense of agency	S doubts hers or his agency, gives external and internal explanation for his or hers error.	3: Ambivalent sense of agency
4: Lightly reduced sense of agency	S states she or he doesn't see their own hand, but isn't sure.	4: Good sense of agency
5: Intact sense of agency	S clearly and surely states that seen hand isn't hers or his own.	5: Expert sense of agency

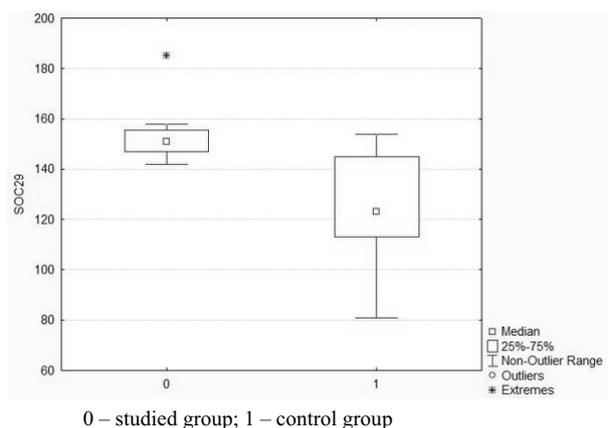
Figure 2. Scale used for quantifying qualitative data, adapted from Sorensen (2005) and modified to accommodate for expert yogis group

Based on that scale we graded every single trial with 1-5 rating, and then we extracted the arithmetic mean, while counting manipulated and unmanipulated trials separately. Separation of those two ratings was needed in order to better account for it being completely different cases and as such they produced discrepancies in the received values, for example: subject who gives answers rated 5, can get 1 in trial 3 or 7 if he or she doesn't recognise his own hand, and vice versa.

RESULTS

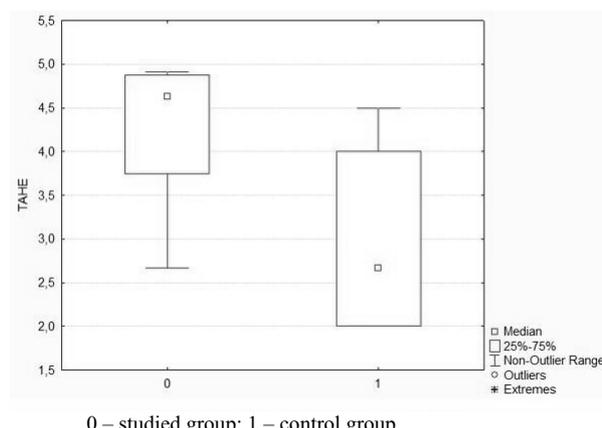
In first stage of the study, data collected via SOC-29 questionnaires (n=50) were tested by Shapiro-Wilk test of data normality. It confirmed that for SOC-29 questionnaire parametric tests are viable. In the second part of the study 18 people participated, however 3 of them needed to be for various reasons excluded (see: Discussion). Mean value for SOC-29 is 141.13, SD=23.71. Control group showed very averaged results, mean for SOC-29 is 126.14 with SD=24.77, compared with 154.25 with SD=13.32 in studied group. The results in SOC-29 differed between control and studied groups with statistically significance (t-test, p<0.05). What regards subscales of SOC-29, we found statistically significant differences between the SOC-29 scores in study group on Comprehensibility (p=0.00497) and Manageability (p=0.0424) but the Meaningfulness scale showed no such difference (p=0.0921).

Mean score in TAHE for study group was 4.260 (SD=0.849), and for control group was 2.929 (SD=0.981). Control and study groups show very clear differences in favour of study group. The overall results of p=0.01, in non-manipulated trials p=0.005 and in manipulated trials it is slightly above the irrelevance threshold (p=0.067, t-test) (Figure 3, 4).



0 – studied group; 1 – control group

Figure 3. Results in SOC-29



0 – studied group; 1 – control group

Figure 4. Results in TAHE

Table 1. Correlation between SOC-29 and TAHE

	SOC-29	Comprehensibility	Manageability	Meaningfulness	TAHE	TAHE non-manipulated	TAHE manipulated
SOC-29	1.000	0.861	0.949	0.930	0.340	0.481	0.153
Comprehensibility	0.861	1.000	0.706	0.685	0.403	0.542	0.213
Manageability	0.949	0.706	1.000	0.872	0.375	0.487	0.217
Meaningfulness	0.930	0.685	0.872	1.000	0.129	0.282	0.051

We observed moderately strong, statistically significant correlation between Comprehensibility subscale of SOC-29 and TAHE mean scores calculated from trials without manipulation (Spearman's R correlation = 0.542 with $p < 0.037$). For the Manageability subscale results were: Spearman's R correlation = 0.487 with $p < 0.066$.

All the participants of the study were divided into two groups: subjects older 50 years old and the rest. Older people are getting higher results in questionnaire SOC-29 (148.86) than younger ones (134.38), however the results are statistically insignificant (t-test, $p = 0.252$). The difference in mean in both SOC-29 and TAHE between sexes (seven men and eight women) is statistically insignificant (t-test, $p = 0.709$, $p = 0.625$ respectively) (Table 1).

DISCUSSION

The nature of hatha-yoga, other yoga and meditative practices have beneficial and well documented influence on cognitive capabilities (Lutz 2008) such as: increased functional networks connectivity (Hasenkamp 2012) better efficiency in attention tasks (Hasenkamp 2012) and even emotion regulation in PTSD (Goldin 2010, Sciarrino 2017). Our intuition was that better integration of different modalities inputs (and therefore, better sense of agency), more stable body scheme (Gallagher 2006) which is better reflected in body image, would coincide with better sense of coherence.

This postulate found some reflection in the results obtained. We showed significant differences in TAHE scores and SOC-29 scores between the groups compared. Moreover, significant correlations between the SOC-29 scores on the scale of manageability and comprehensibility and the results of TAHE have been found.

Perhaps one of the reasons for the differences observed is the hatha-yoga's therapeutic potential. A study group was selected to be long time yoga practitioners and teachers in order to exclude those who practice yoga only occasionally or leisurely. Treating yoga as merely an occasional gymnastics is a gross misrepresentation. Exercises consist of working with one's own breath, which determines the individual pace of asanas. Practitioners learn not to treat their body objectively as something alien to them. With a better understanding of their body, they learn to trust their bodily and emotional reactions, which are the source of valuable information. Moreover, the abovementioned understanding is supported by the lack of competitive atmosphere, contrary to most of sports traditionally practiced in the West. Competence obtained in this way can be translated into other areas of reality. Thus, it can be stated that practicing yoga in a committed and regular manner is a radical change of attitude towards reality or the *Weltanschauung* for the more phenomenological term.

We cannot however simply infer that yoga practice contributed to increased sense of agency and sense of coherence, as yoga practitioners may engage in different activities which influence increase in SOC or sense of agency. A number of intermediaries might be involved here. A reversed relation is also plausible: people with higher sense of coherence are better at handling stressors, such as unfulfilled basic needs (in spirit of A. Maslow psychology it would mean that they more frequently find themselves at the top of hierarchy of needs pyramid) and that is the reason why they spend time on activities like yoga, which helps to improve their sense of agency.

A number of comments are needed before discussing conclusions.

First of all snowball sampling is vulnerable to selection error. In spite of our great care for constant filtering, this method prefers groups of people good at networking, with a wide range of social contacts. This is an important feature that was not controlled in our research. That is why the choice of the sample involved the selection of candidates. Although overall 18 subjects were studied, three male participants had to be excluded from end results. They showed abnormally high levels of sense of agency in TAHE, and therefore were not representative of general population. After interview we found out that one subject was professional drawer, and other was an expert gamer, third subject was university professor. All of them had results only found in yoga practitioners group, but were different in some regards. Gamer subject and drawer gave similar explanations, they 'just knew' it was not their hand, but could not at first explain why. When they were pushed a little harder, employing ericksonian language, they proposed that they feel and see 'micromovements' (both used the same word) that are incongruent with visual input. University professor subject, rated high for a different reason. When he noticed that he perhaps is being manipulated, he tried to position his pen differently and verify each time whether it is his own hand or not, much like in case of scientific testing procedure of verifying or falsifying hypotheses. Those three cases are interesting and worth mentioning, even though they were not included in the final study.

Another point worth mentioning is that (apart from general questions after the zero trial whether subject sees the paper sheet, and whether s/he is ready to do the task), the visual focus was not monitored among TAHE participants. Since a large proportion of people were over 40 years old, presbyopia could have been a factor negatively affecting the quality of the task being performed in both study and control groups.

While the observed differences are considerable and statistically significant, they should be interpreted with great caution. The studied group was small, and therefore generalization of the obtained results for the whole population would not be valid. The reason for that was that the design of the study conducted was rather qualitative than quantitative. Classical cognitive science paradigm deepened by microphenomenological method, already proved to be most useful in uncovering new, interesting insights (Petitmengin et al. 2013) and is applicable to medical research (Petitmengin et al. 2007). However, it is important to say that we didn't conduct a full blown microphenomenological interview, although it might be an interesting direction to investigate in the future studies.

CONCLUSIONS

The study showed that yoga practitioners reveal a higher sense of coherence and a higher sense of agency than the control group. In addition, the components of comprehensibility and manageability of SOC correlate

strongly with the results of TAHE. Conducting longitudinal studies on larger sample is needed to investigate whether the causal link between the measured values exists. Confirmation of the above hypothesis might help to establish hatha-yoga as an effective complementary therapeutic method for the treatment of many mental illnesses.

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Contribution of individual authors:

Study conception and design: Oleg Fedyk, Paweł Gwiaździński;

Acquisition of data: Magdalena Krawczyk;

Analysis and interpretation of data: Mateusz Szymański;

Drafting of manuscript: Oleg Fedyk, Paweł Gwiaździński;

Critical revision: Oleg Fedyk, Paweł Gwiaździński, Magdalena Krawczyk.

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