Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 187 (2015) 250 – 255

Procedia
Social and Behavioral Sciences

PSIWORLD 2014

Brain to brain connectivity during Distal Psycho-informational Influence sessions, between spatially and sensory isolated subjects

Aliodor Manolea *

University of Bucharest, Faculty of Psychology and Education Sciences, 90 Panduri street, Bucharest, Romania
"CAROL I" National Defense University, 68-72 Panduri street, Bucharest, Romania

Abstract

Eight inducer subjects who were exposed to emotional visual stimuli and eight receiver subjects were participants, and at a time changed roles. Their electrical brain activity was simultaneously recorded and processed to determine the brain wave coherence, which is an estimator of brain connectivity. A t test for independent groups was used to determine if, there is a significant different outcome concerning the number and size of the brain connections for the two groups of subjects. Trained group showed a mean of difference of the EEG coherence in the brainwave theta band during exposure to visual stimuli from resting state, significantly higher than the average of the group without specific training ($t(636) = 2.7$, $p = 0.007 < 0.5$, $0.003 < 0.011 < 0.02$). The effect size was 0.21, after Cohen.

Peer-review under responsibility of the Scientific Committee of PSIWORLD 2014.

Keywords: brain connectivity; Distal Psycho-Informational Influence; subliminal communication; functional connectivity; EEG coherence

1. Introduction

In order to show that there is communication at subliminal, unconsciously level, between spatially and sensory isolated subjects, ever since 1965 (Duane and Behrendt, 1965), more experimental studies have been conducted. Such experiment usually analyses the phenomenon of brain connectivity within one pair inducer and receiver subject. The inducer subjects were exposed to a series of visual and auditory stimuli, with a strong affective significance or without any emotional significance. Most of the studies used the analysis of EEG recordings (Persinger et al. 2003) in order to show that, within the electrical activity of the brain, recorded simultaneously for

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: aliodor@glide.ro

Peer-review under responsibility of the Scientific Committee of PSIWORLD 2014.
doi:10.1016/j.sbspro.2015.03.047

inducer and receiver subjects, models may be deducted (Pérez Navarro, 2012), common EEG patterns both in time and frequency domains. Some studies chose as dependent variable, which should describe the connection between the subjects, the electro-dermal activity, as an expression of the activity of the sympathetic nervous system (Braud and Schlitz, 1989), while other studies used the functional magnetic resonance (fMRI) (Richards et al., 2005). The occurrence of a series of cerebral or electro-dermal activity patterns common to all subjects, synchronized in time with the exposure to the visual or auditory stimuli, was considered a proof of the existence of a distal psycho-informational influence (Charman, 2006). Some authors named this phenomenon transfer of neural energy or transfer of neuronal signals (Standish et al., 2003), other extrasensory perception (Duane and Behrendt, 1965) and others mental quantum entanglement (Wackermann et al., 2003). From all above mentioned one may deduct the idea that it is possible that the brain activity of one person is influenced by the mind of another person, without any physical or sensory contact between them. Moreover, studies have been conducted to assess this phenomenon in what the distance between the subjects is concerned (Orme-Johnson et al., 1982). The conclusion reached was that brain connectivity is independent from the distance between the subjects. An important factor which allows the mental connectivity between two persons, spatially and sensory isolated, was identified as being the initial „coupling" of the subjects. Some subjects were twins (Duane and Behrendt, 1965, Grinberg-Zylberbaum et al, 1994) others were „coupled" during the experiment by common relaxation or meditation sessions (Braud and Schlitz, 1989, Richards et al., 2005). The relevant studies showed that the subjects coupled in this manner had better results in what the intensity of the mental connectivity was concerned. This connectivity is consciously perceived only seldom, it manifests itself unconsciously (Charman, 2006), whereby it may have positive effects or not. The emotion, positive or negative, was identified as being the mediator of this type of Distal Psycho-informational Influence (DPsyI) (Manolea, 2013a, 2013c), whereby it played a triggering role in the brain coupling process, fact indicated by Braud and Schlitz in 1989. They repeated the study making a selection of the subjects in what the emotional response recorded during the pilot study was concerned. As receiver subjects, one selected those who showed an unusually high degree of sympathetic nervous system activation such as excessive emotional reactions, fear, cerebral tension, high blood pressure, mental and physical hyperactivity. The selection of the inducer subjects was made considering the way in which they managed to control their mental tonus and to express the intention revealed by the concentration power and the ability to maintain it. The recorded results were clearly superior, whereby the rate of success was of approximately 40% (Braud, W., Schlitz, M., 1989).

The connectivity studied in this experiment may be defined as the connection, without any physical mediation, between two neuronal networks belonging to two different brains. The method emphasizing this connectivity is that usually used to show the connectivity of different neuronal networks belonging to the same system, that is, the study of the coherence between two EEG signals (Sakkalis, 2011). The logic of this approach is equivalence, from a mathematical perspective, of the two types of EEG recordings. This enables the use of programs both for the analysis of EEG recordings comprising signals of the same scalp, as well as to emphasize the mathematical relationships (in this case the similarity or the coherence) between the electrical signals recorded on different scalps.

The hypothesis behind any EEG analysis is that certain models of the brain activity always correspond to the same triggering events and vice-versa, in other words, there is a biunivocal relationship between the triggering events and the pattern of the brain activity. A similar hypothesis was used by a team of Japanese researchers (Miyawaki, 2008) who managed to decode and rebuild the image, presented on video monitors to a series of subjects, from the fMRI recordings of their brain activity. They used a neural decoding program based on statistical data to associate the brain activity models with certain patterns of the visually perceived images. A similar experiment was also conducted by Johnson and Johnson in 2014, by which they managed to decode even the mental images of the subjects of this experiment. Therefore, if in the EEG analysis model, where the EEG channels, subject of the simultaneous analysis belong to different subjects and not to the same subject, as in the case of the conventional EEG analysis, we discover structures in the field of time or frequency of brain waves, which are similar, we may say that there is a high similarity degree between the events (emotions) which induces that structure of the brain activity, both at inducer subjects and at receiver subjects. The awareness degree in relation to a stimulus is related to a model of the brain activity dynamics which has two stages. The first stage comes immediately after the subject is exposed to a visual stimulus, when the visual cortex (areas of the brain handling the processing of the information received through the optical nerves) is activated. After approximately 300 milliseconds, other cerebral areas are also activated, including the prefrontal cortex, where processes specific to higher level cognition also take

place. The awareness in relation to the stimuli begins only after the second stage of the neuronal activity reaches a certain threshold (Kouider et al, 2013),so that an unconscious processing of the information can also take place, when this threshold is not reached. Therefore, it results that the decision to use the Fp1 point, in the 10-20 scheme of the EEG electrodes, to retrieve the data generated by the brain activity of the subjects exposed to visual stimuli with affective content, is justified as Fp1 point corresponds to the area of the prefrontal cortex.

2. Objectives and hypotheses

The goal of this study was to emphasize a series of common brain activity models between the inducer subject and the receiver subject, as a proof of the existence of the brain connectivity and of DPsyI respectively. Finding an estimator of the brain connectivity whose numeric values enable us the statistical analysis of the phenomenon, when subjects with a specific training and subjects without any specific training are used to determine the importance of the training in view of improving the performance in DPsyI and also to verify the subject's achieved performance during specific training.

The hypothesis to be checked was whether there is any statistically significant difference between the performances achieved by the two groups in what the coherence of the EEG signals is concerned, calculated as difference as compared to a reference interval, when the inducer subjects were exposed to images with emotional content.

3. Method

3.1. Participants

The participants were 16 subjects divided in two groups of eight participants each. The members of one group were students of the Faculty of Psychology of Bucharest University with ages between 19 and 22 years (m=20.12, SD=1.35), without any specific training, and the other group was made up of eight subjects with ages between 41 and 56 years (m=47.1, SD=5.62), who had specific training in what the attention and mental concentration are concerned. The subjects of the two groups were each in turn inducers or receivers.

3.2. Instruments

The experiment comprised the simultaneous exposure of the inducer subjects to visual stimuli with affective significance and the measurement of the effect of the presumed distal psycho-informational transfer to the receiver subjects (Manolea, 2013b). The brain activity of both categories of subjects was monitored using wireless EEG headphones (MINDWAVE Neurosky) with one channel, which communicated with a data acquisition system equipped with three portable computers, having the time synchronised via internet, on which the LINUX operating system run. On a master computer run PSYCHOPY software (Peirce, 2008), which managed the development in time of the experiment in what the exposure to visual stimuli with affective content is concerned. The visual stimuli were displayed simultaneous for all inducer subjects on eight monitors, using a video distributor. On the corresponding monitors, the receiver subjects could see only a cross marking in the centre of the black screen. The electrode of each EEG headphone was placed in the area of the prefrontal lobe of each subject, in the Fp1 point the 10-20 international scheme of placing the EEG electrodes on the human scalp.

3.3. Experimental design

The experiment was conducted during 26 sessions to which groups of subjects distributed according to Fibonacci row participated (Manolea, 2013a, 2013b). Each session comprised the exposure of the inducer subjects to a row of nine images each being displayed for six seconds, preceded by a warning pause of four seconds (reference interval). Some images had positive affective content, others negative content, and others were neutral from an emotional perspective, being retrieved from the GAPED data base (Manolea, 2013b) used for research in psychology. The

sessions with odd numbers (1, 3, 5... 25) had as inducers experienced subjects, and those with even numbers had inducer subjects with no specific training. There were eight subjects in room 1 and another eight in room 2, spatially and sensory isolated by a reinforced concrete wall. The brain activity thereof was recorded simultaneously by using a wireless EEG apparatus, with one channel, whose sensor was placed in Fp1 point of 10-20 international scheme. We processed the obtained data using several packages of programs for signal and data analysis: EXCEL, EDFBrowser, MATLAB, EEGLAB, ASAEEG and GPower, in order to extract the information encoded in the EEG structure. We equalled the EEG recording corresponding to each subject with one channel specific to one EEG recording having the electrode system arranged in 10-20 scheme. All individual EEG channels were reunited in one unitary structure corresponding to the EEG 10-20 scheme, with maximum 19 channels, of which we activated only 15 channels, because one channel of the data acquisition system broke down. In this way, we could use the analytical facilities of EEG analysis programs, which handle all signals simultaneously, so that the results were obtained unitary, by applying the same processing procedures, having the same values for specific parameters.

We used an experimental design with independent groups, in which the independent variable was the exposure to visual stimuli and the dependant variable was the coherence of the brain waves.

4. Results

Using the program ASAEEG for the analysis of EEG signals, we analysed the occurrence of common patterns at the inducer and receiver subjects with temporal correlation statistically significant. The 26 EEG recordings resulted and such were analysed in what the coherence of the EEG signals is concerned, which is an estimator of the correlation of the time series in the field of frequency and at the same time an estimator of the functional connectivity of the brain. The numeric data obtained for each pair of EEG channels, for each inducer receiver pair respectively (there was 319 for each group, experienced inducer with non-experienced receiver and non-experienced inducer with experienced receiver), represented the difference between the value of the coherence recorded in the reference interval and that corresponding to the interval when the subjects were exposed to affective images. These data were processed with SPSS using one t student test for independent groups to determine whether the two groups of subjects record various performances in relation to the number of the brain connections and the size thereof. Thus, the group which had a specific training, recorded an average of the difference in coherence in theta band of brain waves of 0.008 which is significantly higher than -0.003, the average recorded by the subjects with no specific training ($t(636)=2.7$, $p=0.007<0.5$, $0,003<0.011<0.02$). The size of the effect, according to Cohen, amounted to the value 0.21, which is small, in line with other studies in the field too.

The coherence of the time series is used in the EEG analysis to estimate the functional connectivity (Sakkalis, 2011) of a brain, to study the dynamics of neuronal networks during the execution of a task respectively. This parameter is statistically assessed because the brain is a very complex system and the electrical signals resulted from the operation thereof have quasi-random character. In what the amplitude of the coherence is concerned, there are neuronal networks belonging to the same brain that are strongly correlated, for which the value of this parameter is 0.8,…0.9, while other networks are at the bottom limit of the statistical significance which, for this estimator, is of approximately 0.2, in the case of a system with 19 degrees of freedom (Amos and Koopmans, 1963). In our case, the considered values of this estimator were within the interval 0.2…0.5. The differences as compared to the reference interval, recorded by the group who had specific training, were pretty low (the average was 0.008, about 4% difference in amplitude of mean coherence), whereby the size effect in this experiment amounting to 0.21 was low, according to Cohen's classification, but was in line with the values (0.2…0.35) returned by other studies in the field (Braud and Schlitz, 1989, Pérez Navarro, 2012). The effect size of the experiment was small, but thanks to the large number of repetitions (319 for each group of subjects) we achieved a power of 0.78, which is a satisfactory value.

5. Conclusions

The study was done to test the validity of the specific method of training, not specified here. Beyond the achieved results, which are in agreement with those given in other similar studies, regarding the mediator of this connection which is emotion, the theta band EEG frequency (Persinger et al., 2003) and the effect size, the experiment revealed the existence of a valid methodology to increase performance in DPsyI. The specific training as well as the

emotional and eventually genetic "coupling" of the subjects is necessary to obtain significant results. Researches now proceed with studying its physical and biologic mechanism, its generalizability to varying populations and relationships, and its clinical application (Standish, 2004). Another approach might be one that would allow the training of a small group of subjects, selected according to a specific algorithm, to reach a high level of DPsyI achievement, beyond any doubt, the performance being certified by the method described in this experiment.

Acknowledgements

This work was possible with the financial support of the Sectoral Operational Programme for Human Resources Development 2007-2013, co-financed by the European Social Fund, under the project number **POSDRU/159/1.5/S/138822** with the title ***"Transnational network of integrated management of intelligent doctoral and postdoctoral research in the fields of Military Science, Security and Intelligence, Public order and National Security – Continuous formation programme for elite researchers - "SmartSPODAS"."***

References

Amos, D.E., Koopmans, L.H. (1963).Tables of the distribution of the coefficient of coherence for stationary bivariate Gaussian processes. *Monograph SCR-483,* Sandia Corp., Albuquerque, New Mexico, , p. 56

Aniței, M. (2007). *Psihologie experimentală.* Ed. Polirom, Iași.

Braud, W., & Schlitz, M.(1989). A Methodology for the Objective Study of Transpersonal Imagery, *Journal of Scientific Exploration,* 3(1), 43-63.

Charman, R. A. (2006) Has direct brain to brain communication been demonstrated by electroencephalographic monitoring of paired or group subjects? *Journal Society for Psychical Research 70 (882) 1-24.*

Cohen, J. (1997). *Statistical Power Analysis for the Behavioral Sciences*. New York: Academic Press.

Delorme, A.&, Makeig, S.(2004).EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics. *Journal of Neuroscience Methods* 134:9-21, http://sccn.ucsd.edu/eeglab/index.html, accessed April 2014.

Duane,T.D., & Behrendt., T. (1965) Extrasensory electroencephalographic induction between identical twins. *Science, 150: 367*

Grinberg-Zylberbaum, J., Delaflor, M., Attie, L., and Goswami, A. (1994). The Einstein-Podolsky-Rosen Paradox in the brain: the transferred potential. *Phys Essays*, 7, 422-427.

Grinberg-Zylberbaum, J., Delaflor, M., Sanchez Arellano, M.E., Guevara, M.A., & Perez M (1992) Human communication and the electrical activity of the brain. *Subtle Energies,* 3(3):25-41.

Johnson, M.R., & Johnson, M.K.(2014). Decoding individual natural scene representations during perception and imagery. *Front Hum Neurosci. doi: 10.3389/fnhum.2014.00059*.

Kouider, S., Stahlhut, C., Gelskov, S. V., Barbosa, L. S., Dutat, M., de Gardelle, V., ... Dehaene-Lambertz, G. (2013). A Neural Marker of Perceptual Consciousness in Infants. *Science, 340*(6130), 376-380. 10.1126/science.1232509

Manolea, A. (2013a). Considerations on distant psycho–informational influence in warfare". *International Conference „STRATEGIES XXI"* „Carol I" National Defence University, Bucharest, Romania. April 18 – 19, 2013, ISSN 2285-8415, ISSN-L 2285-8318, (2013):577.

Manolea, A. (2013b).Items required to elaborate experiments on distal psycho-informational influence. International Conference „STRATEGIES XXI" „Carol I" National Defence University, Bucharest, Romania. April 18 – 19, 2013-03-29, ISSN 2285-8415, ISSN-L 2285-8318, (2013):585.

Manolea, A. (2013c). Fundamente epistemice ale influenței psihoinformaționale distale". *Buletinul UNAP nr.1/2013, pp. 378-382.*

Miyawaki, Y., Uchida, H., Yamashita, O., Sato, M.A., Morito, Y., Tanabe, H.C., Sadato, N., Kamitani, Y., (2008). Visual image reconstruction from human brain activity using a combination of multi-scale local image decoders, *Neuron 60*, 915-929.

Orme-Johnson, D.W., Dillbeck, M.C., Wallace, R.K., & Landrith, G.S. (1982). Intersubject EEG coherence: Is consciousness a field? *International Journal of Neuroscience*, 16, 203-209.

Peirce, J.W. (2008). Generating stimuli for neuroscience using PsychoPy. *Frontiers in Neuroinform. 2:10. doi:10.3389/neuro. 11.010.2008*,

Pérez Navarro, J. M. (2012). An empirical evaluation of a set of recommendations for extrasensory perception experimental research. *Europe's Journal of Psychology*, 8(1), 32-48. doi: 10.5964/ejop.v8i1.297.

Persinger, M.A, Koren ,S.A. & Tsang, E.W. (2003). Enhanced power within a specific band of theta activity in one person while another receives circumcerebral pulsed magnetic fields: a mechanism for cognitive influence at a distance?. *Percept Mot Skills. 97 (3 Pt 1): 977–94. doi:10.246/*

Richards, T.L., Standish, L.J., Kozak, L., & Johnson, C., (2005). Replicable functional magnetic resonance imaging evidence of correlated brain signals between physically and sensory isolated subjects. *Journal of Alternative and Complementary Medicine,* 11 (6) 955-963.

Sakkalis, V. (2011). Review of Advanced Techniques for the estimation of Brain Connectivity measured with EEG/MEG. *Comput Biol Med. 41 (12): 1110–1117. doi:10.1016/j.compbiomed.2011.06.020.*

Standish LJ, Johnson LC, Richards T, & Kozak L. (2003). Evidence of Correlated functional MRI signals between distant human brains. *Altern Ther Health Med;9:122–128*.

Standish, L. J., Kozak, L., Johnson, L. C., and Richards, T. (2004). Electroencephalographic evidence of correlated event-related signals between the brains of spatially and sensory isolated human subjects. *The Journal of Alternative and Complementary Medicine, 10, 307-314*.

Wackermann, J., Seiter, C., Keibel, H., and Walach, H. (2003). Correlations between brain electrical activities of two spatially separated human subjects. *Neuroscience Letters*, 336, 60-64.