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Subliminal and Supraliminal Effects of Metaphors on Brain Activity:
Neuropragmatics Analysis in Hypnotherapy Speech Act

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ABSTRACT
Hypnotherapists commonly use metaphors in their suggestions. In hypnotherapy suggestions, metaphors contain a spoken effect. However, until now, metaphors in hypnotherapy speech on brain activity have not been specifically studied. The purpose of this study was to obtain a description of which brain activity appears influenced by different types of metaphors in hypnotherapy speech. The method used in this research is one shot case study. Data collected from one participants in the form of electroencephalograph (EEG) data recording results using hardware from OpenBCI, with 16 electrode channels installed based on the International System 10-20 and the OpenBCI GUI software. We provided stimuli in the form of subliminal metaphors and supraliminal metaphors to the participants. The collected data were then processed and analyzed using the standardized Low-Resolution Electromagnetic Brain Tomography (sLORETA) method using LORETA-Key Software. The sLORETA measurement results will show the active Brodmann Area and Power Spectral Density; then, these results will be interpreted based on brain activity when perceiving metaphorical speech during recording.

Keywords: *Hypnotherapy, metaphor, neuropragmatics, subliminal message, sLORETA*

1. INTRODUCTION

The conceptual system plays a central role in defining everyday reality and how humans think about what is experienced, felt, and perceived. Lakoff and Johnson (2003) states that it is a metaphorical problem. Metaphors are not only a linguistic problem but also a cognitive problem.

Since metaphors are related to cognitive problems, metaphors in everyday speech acts have a cognitive impact on the human brain. One of the speech acts that use metaphors are the use of speech acts in hypnosis and hypnotherapy. The use of metaphors in hypnotherapy is not without reason. The use of metaphors is seen to make it easier for someone to compare one thing to another.

The studies of the speech act in hypnosis that have been carried out include Nurhadi (2013) in his thesis entitled "Tuturan Hipnoterapi dalam Bahasa Indonesia: Suatu Kajian Pragmastilistika" Then the study of speech acts on the hypnotic aspect continued with a similar study, but focused on the problem of hypnodontic speech acts (dental hypnosis) conducted by Darmayanti Nurhadi, and Yubuliana (2014) with a study entitled "Tipe Tindak Tutur dalam Komunikasi Dental Hipnosis: Suatu Kajian Pragmatik" and Darmayanti, Ekawati, Wagiati, and Erlina (2018) "Language Aspects in Hypnosis Dental Therapy: Pragmatic and Stylistic Studies". Destiarlisa, Yubiliana, and Abdurrochman (2020) conducted a study of hypnotic speech acts on the aspect of intonation patterns with a study entitled "Pola Intonasi Tindak Tutur Direktif Berdasarkan Parameter Akustik Suara dalam Praktik Dental Hypnosis." In addition, the hypnosis object for the birth process (hypnobirthing) was carried out by Sekarsany, Darmayanti, and Suparman (2020) entitled "Tindak Tutur Ilokusi pada Proses Kelahiran dengan Teknik Hipnosis (*Hypnobirthing*): Suatu Kajian Pragmatik." These studies focus on the use of illocutionary speech acts, such as directive speech acts in various hypnosis applications, as well as intonation patterns. The analysis used was pragmatics and stylistics, as well as acoustic phonetics.

In general, this study still focuses on the aspects of language and the types of speech acts used in hypnosis and has not been linked to the mental aspects of speech partners. The mental aspect is related to the way speech partners perceive hypnotic speech. One way to review the mental aspect is by recording electroencephalography (EEG). There is a study of hypnotic speech acts in terms of EEG analysis, such as that conducted by Sudaryat, Nurhadi, Rahma, and Mayasari (2019), namely: "Hypnotic Direct and Indirect Suggestions for Improving the Efficiency and Depth of Sleep: An EEG Activity Signal Processing in Various Sleep Stages." In this study, the respondents' stimulus only distinguished two speech acts, namely direct speech and indirect speech on sleep quality, and there was no clear description of the response to the part of the brain that was activated when the stimulus was given.

The use of the EEG method on metaphors has been carried out by Bambini, Bertini, Schaeken, Stella, and Di Russo (2016) and Bambini, Canal, Resta, and Grimaldi (2019) with the title: "Disentangling metaphors from context: An ERP study" and "Time Course and Neurophysiological Underpinnings of Metaphors in Literary Context." However, these studies have not been linked to metaphors in hypnotherapy, especially those related to subliminal (hidden) messages. The study also has not made use of brain imaging. One method that can be used is Standardized Low Resolution Electromagnetic Brain Tomography (sLORETA), see Pascual-Marqui (2001, 2002). It can show activity in parts of the brain, according to Brodmann's (2006) area so that the functions of the mental aspects can be interpreted correctly.

Other pragmatic research that is experimental and relates to neurolinguistic aspects as far as the search has been carried out has not focused on this aspect of the speech effect, particularly the subliminal and non-subliminal effects of metaphors. Pragmatic and neurolinguistic research is able to provide a complete picture of the cognitive processes that take place in the human mind. As has been done by Politzer-Ahles (2020) in his research entitled "What can electrophysiology tell us about the cognitive processing of scalar implicatures?". From this study, the electrophysiological feedback from the brain can show the cognitive processes of scalar implicatures. The brain responses that appear neuroscientifically are useful for seeing how respondents perceive speech and how meaning is formed in the brain. Therefore, experimental pragmatics needs to be done to provide a broader interpretation than before (Meibauer & Steinbach, 2011; Noveck, 2018).

Thus, it is necessary to conduct a study, which can classify speech acts and other aspects of language that appear in hypnotherapy speech and be able to provide descriptions and interpretations of brain activity and cognitive processes that take place in the brain. For this reason, the research entitled "Subliminal and Supraliminal Effects of Metaphors on Brain Activity: Neuropragmatics Analysis in Hypnotherapy Speech Act" needs to be studied.

2. METHOD

This study used a one-shot case study. The data used in this study only used one participant. This one-shot case study is used to provide an initial overview and is part of the pre-experimental stage. The elements in this case study are the interpretation of the EEG recordings, including brain waves and brain maps in the form of brain tomography maps through neurolinguistic analysis using Standardized Low-Resolution Electromagnetic Brain Tomography (sLORETA) analysis (Pascual-Marqui, 2001, 2002; Pascual-Marqui, Michel, & Lehmann, 1994).

2.1. Data Collection Procedure

The data collection technique was carried out by observing EEG recording and measurement through the Open Brain-Computer Interface hardware and software. Recording of electrical signals in the brain through electrodes installed based on the International System 10-20 points, namely: Fp1 (Frontal Polar 1), Fp2, F3 (Frontal 3), F4, F7, F8, C3 (Central 3), C4, T3 (Temporal 3), T4, T5, T6, P3 (Parietal 3), P4, O1 (Occipital 1), O2, and reference points A1 (Earlobe 1), and A2.

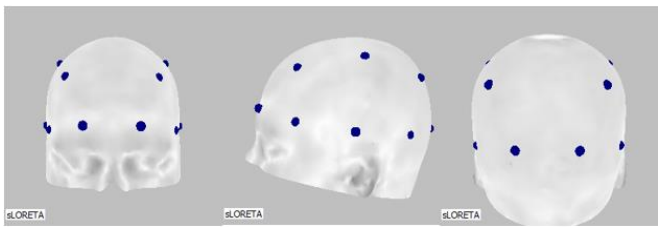


Figure 1. Electrode Mounting Points with MNI Coordinates for Tomographic Map Analysis using sLORETA

2.2. Data Processing Procedures

The EEG data that were ready were then processed using the LORETA Key v20200709 software. Before the EEG data was imported, the electrode placement was registered to the MNI (Montreal Neurological Institute) coordinates in Figure 1. Then the electrodes were transformed into a matrix (.sxyz) for sLORETA analysis. EEG data that had been prepared beforehand were computed into sLORETA (.slor). Then the computation results are opened in the LORETA Key Viewer. From the point of observation, the position of the Brodmann area and the position of the brain localization of the most active Brodmann area was analyzed. This tomographic interpretation can describe the comparison of mental representations based on electromagnetic activity in the provision of stimuli with

subliminal metaphors and non-subliminal metaphorical stimuli in hypnotherapy activities.

3. FINDINGS

Subliminal messages are stimuli that are below the threshold of perception or awareness, so they are not consciously aware. These stimuli cannot be identified even if someone tries or deliberately notices or looks for them. Meanwhile, supraliminal messages are above the threshold of perception or awareness so that they can be heard or seen, but are not noticed so they are not realized and affect a person.

3.1. Stimulus 1

Stimulus 1 contains utterances that contain metaphors and are conveyed subliminally. The following is stimulus 1. (The part colored in yellow is the subliminal speech).

1. Rasakan relaksasi dan ketenangan ini! (Pikiran Anda rileks dan tenang.)
2. Biarkan relaksasi dan ketenangan ini menjadi bagian dari pikiran! (Pikiran Anda dipenuhi relaksasi dan ketenangan.)
3. dan diri Anda menjadi bagian dari hidup Anda! (Saya berikan Anda kebebasan untuk masuk ke alam relaksasi Anda sedalam-dalamnya.)
4. Kapan pun saya minta Anda untuk rileks, (Kapan pun Anda mendengar sugesti saya,) Anda masuk ke alam relaksasi Anda seratus kali lipat lebih dalam dari sebelumnya! (Pikiran dan diri Anda rileks seratus kali lipat lebih dalam dari sebelumnya.)

Translation

1. Experience this relaxation and serenity! (Your mind is relaxed and calm.)
2. Let this relaxation and calmness be part of the mind! (Your mind is filled with relaxation and calm.)
3. And yourself become a part of your life! (I give you the freedom to enter into your deepest realm of relaxation.)
4. Whenever I ask you to relax (Whenever you hear my suggestion) you enter your realm of relaxation a hundred times deeper than before! (Your mind and self-relax a hundred times deeper than before.)

3.2. Stimulus 2

Stimulus 2 contains utterances that contain metaphors and are conveyed supraliminally. Here is stimulus 2.

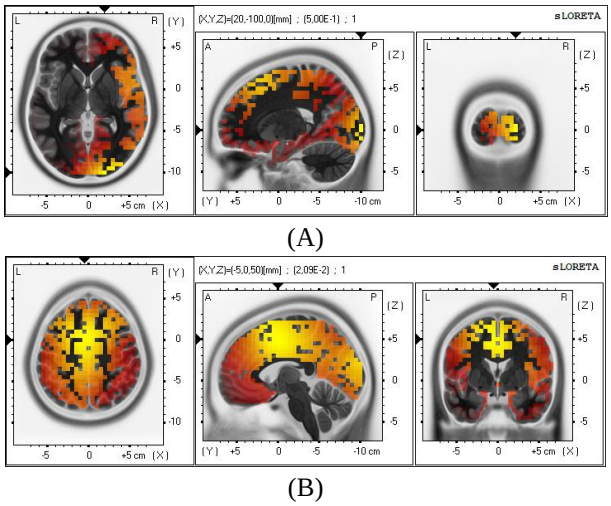
1. Rasakan relaksasi dan ketenangan ini!
2. Biarkan relaksasi dan ketenangan ini menjadi bagian dari pikiran!
3. dan diri Anda menjadi bagian dari hidup Anda!
4. Kapan pun saya minta Anda untuk rileks, Anda masuk ke alam relaksasi Anda seratus kali lipat lebih dalam dari sebelumnya!

Translation

1. Experience this relaxation and serenity!
2. Let this relaxation and calmness be part of the mind!
3. And yourself become a part of your life!
4. Whenever I ask you to relax, you enter your realm of relaxation a hundred times deeper than before!

Based on the results of EEG recording and analysis of sLORETA with different stimuli, namely stimuli with subliminal metaphors and supraliminal metaphors, the following results were obtained.

3.3. Comparison of Tomographic Maps in the Most Active Section

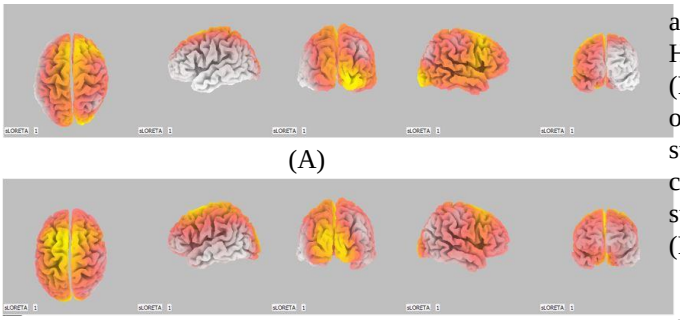


(A)

(B)

Figure 1 Comparison of the Tomographic Map between Subliminal (A) and Supraliminal (B) Stimulus.

Based on Figure 1 above, the stimulus in the form of a conveyed subliminally (A) metaphor activates the Occipital Lobe, to be precise, in the Middle Occipital Gyrus in Brodmann Area 18 (BA18). When BA18 is activated, the dominant process taking place in the brain is the visual association area. Meanwhile, the stimulus in the form of a metaphor that is conveyed supraliminally (B) activates the Limbic Lobe, precisely in the Cingulate Gyrus in Brodmann Area 24 (BA24). When BA24 is activated, the dominant process that takes place is to regulate emotions and pain. That part, too, is involved in predicting and avoiding negative consequences.



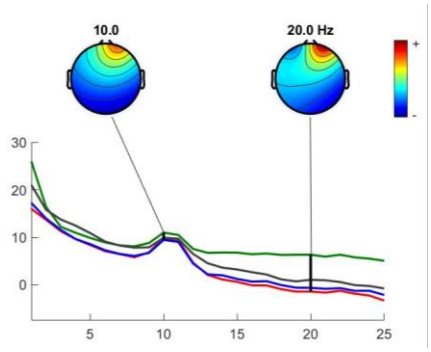
(A)

(B)

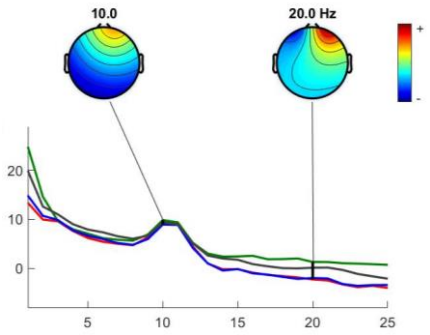
Figure 2 3D Simulation of Activated Parts based on Differences of Subliminal Metaphors (A) and Supraliminal Metaphors (B)

Based on Figure 2 above, the subliminal stimulus (A) predominantly activates the posterior and right hemisphere. In the supraliminal stimulus (B), the activated part tends to be in the middle of the brain and is slightly dominant to the right hemisphere.

3.4. Comparison of 10Hz (Alpha) and 20Hz (Beta) Frequency Based on Power Spectral Density (PSD)



(A)



(B)

Figure 3 Comparison of 10Hz (Alpha) and 20Hz (Beta) Frequency

Both the subliminal stimulus (A) and the supraliminal stimulus (B) increased at 10Hz and decreased at 20Hz. It suggests that both metaphors conveyed subliminally and supraliminally, both activate a state of relaxation (Alpha state). At a frequency of 10 Hz, the electric current in both stimuli is from Fp2 (Frontal Polar 2) to O3 (Occipital 3). The difference occurs at a frequency of 20Hz, the electric currents both start at Fp2, but in the subliminal stimulus, the negative current ends at O4 (Occipital 4), while in the supraliminal stimulus, the negative current ends at Fp1 (Frontal Polar 1).

4. CONCLUSION

Based on the analysis results, it can be concluded that there are differences in brain activation due to differences in stimuli in the form of subliminal and supraliminal metaphors. However, both subliminal metaphors and supraliminal metaphors increase the intensity of Alpha frequency (10Hz) and decrease Beta intensity (20Hz). Both of these stimuli can be used in the hypnotherapy process to increase relaxation. However, they will be perceived differently by the brain.

Because this research is preliminary, and the data used is still limited, this research can be further developed to see the various types of differences in individual speech acts on activities in the brain.

REFERENCES

Bambini, V., Bertini, C., Schaeken, W., Stella, A., & Di Russo, F. (2016). Disentangling metaphor from context: An ERP study. *Frontiers in Psychology, 7*, 1–14. https://doi.org/10.3389/fpsyg.2016.00559

Bambini, V., Canal, P., Resta, D., & Grimaldi, M. (2019). Time course and neurophysiological underpinnings of metaphor in literary context. *Discourse Processes, 56*(1), 77–97. https://doi.org/10.1080/0163853X.2017.1401876

Brodmann, K. (2006). *Brodmann's: Localisation in the Cerebral Cortex* (L. J. Garey, Trans). United Kingdom: Springer.

Darmayanti, N., Ekawati, D., Wagiati, & Erlina. (2018). Language aspects in hypnosis dental therapy: Pragmatic and stylistic studies. *International Journal of Language and Linguistics, 5*(2), 84–94. https://doi.org/10.30845/ijll.v5n2p10

Darmayanti, N., Nurhadi, J., & Yubiliana, G. (2014). Tipe tindak tutur dalam komunikasi dental hipnosis: Suatu kajian pragmatik. *Ranah, 3*(1), 135–142. https://ojs.badanbahasa.kemdikbud.go.id/jurnal/index.php/jurnal_ranah/article/view/44

Destiarlisa, A. M., Yubiliana, G., & Abdurrochman, A. (2020). Pola intonasi tindak tutur direktif berdasarkan parameter akustik suara dalam

praktik dental hypnosis. *Padjadjaran Journal of Dental Researcher and Student*, *4*, 1–8. https://doi.org/10.24198/pjdrs.v3i2.21989

Lakoff, G., & Johnson, M. (2003). *Metaphors we live by*. United States: The University of Chicago Press.

Meibauer, J., & Steinbach, M. (2011). *Experimental pragmatics/semantics.* Amsterdam: John Benjamins Publishing Company.

Noveck, I. (2018). *Experimental pragmatics: The making of a cognitive science*. Cambridge, England: Cambridge University Press.

Nurhadi, J. (2013). Tuturan hipnoterapi dalam Bahasa Indonesia: Suatu kajian pragmastilistika. In *Tesis Program Pascasarjana* (Unpublished). Bandung: Universitas Padjadjaran.

Pascual-Marqui, R. D. (2001). Low resolution brain electromagnetic tomography (LORETA*). Journal of Neurotherapy*, *4*(4), 31–33. https://doi.org/10.1300/j184v04n04_05

Pascual-Marqui, R. D. (2002). Standardized low resolution brain electromagnetic tomography (sLORETA): Technical details. *Methods & Findings in Experimental & Clinical Pharmacology, 24*, 5–12.

Pascual-Marqui, R. D., Michel, C. M., & Lehmann, D. (1994). Low resolution electromagnetic tomography: A new method for localizing electrical activity in the brain. *International Journal of Psychophysiology, 18*(1), 49–65. https://doi.org/10.1016/0167-8760(84)90014-X

Politzer-Ahles, S. (2020). What can electrophysiology tell us about the cognitive processing of scalar implicatures? *Language and Linguistics Compass, 14*(10), 1-22. https://doi.org/10.1111/lnc3.12401

Sekarsany, A., Darmayanti, N., & Suparman, T. (2020). Tindak tutur ilokusi pada proses kelahiran dengan teknik hipnosis (Hypnobirthing): Suatu kajian pragmatik. *Metahumaniora*, *10*, 14–26.

Sudaryat, Y., Nurhadi, J., Rahma, R., & Mayasari. (2019). Hypnotic direct and indirect suggestions for improving the efficiency and depth of sleep: An EEG activity signal processing in various sleep stages. *Journal of Physics: Conference Series, 1179*(1). https://doi.org/10.1088/1742-6596/1179/1/012146