Human Interaction and Emerging Technologies (IHIET 2024), Vol. 157, 2024, 427–434
https://doi.org/10.54941/ahfe1005502

The Probable Impact of Social Media on Your Brain

Kweon Sang Hee[1], Kang Bo Young[2], and Ryou Jihyun[3]

[1]Department of Media & Communication, SKKU 0339, Korea
[2]Entertainment Management, Dong-Ah Institute of Media & Arts, Korea
[3]YOU Creative Communications, Korea

ABSTRACT

This study explores to test the differences in brain waves during visual (highly liked) social media networking image fusion acceptance or viewing of social media (Youtube, Blog, and Instagram) and low liked SNS ("low liked"). The study follows a 2(low liked SNS and highly liked linked) X 3(genre-Youtube, blog, and Instagram) research design of the brain wave responses. Brain waves were measured using EEG responses by recording alpha (α) waves (8-12.99Hz) and beta (β) waves (13-29.99Hz). Different parts of the brain (frontal lobe, temporal lobe, occipital lobe) were also measured in order to compare the response difference to stimulus.The experimental study was based on a statistical analysis on the EEG responses obtained through a total of 60 subjects. The brain wave difference between the low liked SNS and high liked social media were measured first. Then, responses were measured by 2X3 experimental design in order to measure the difference in brain waves according to the SNS type (Youtube, Blog, Instagram). The subjects' brain waves were measured after viewing low liked SNS and high liked social media. Social media contents are similar message fall into the following categories: Youtube, Blog, Instagram.

Keywords: Exemplary paper, Brain wave, Social brain, Social modelling language

INTRODUCTION

The social brain refers to a network of brain regions that are involved in various social cognitive processes, such as empathy and theory of mind. These processes allow us to understand and interact with others, infer their mental states, and navigate social situations. Two key aspects of the social brain are co-activation and connectivity among different networks.

Neuroscientists created an Instagram-style app to investigate the effects of social media on our brains. Through fMRI scans, they observed adolescents scrolling through photos on the app and identified the activated regions of their brains. The researchers manipulated variables such as the number of likes and the content of the photos (risky or neutral behaviours). These findings, which intrigued and concerned the scientist as a parent of a six-year-old, were subsequently replicated with young adults and in scenarios involving giving and receiving likes.

Review of Literature

The 'social brain' is the network of brain regions that are involved in understanding other people, and includes the medial prefrontal cortex (mPFC) and the posterior superior temporal sulcus (pSTS). These regions are key to the process of mentalizing — that is, the attribution of mental states to oneself and to other people

The structure of the social network is correlated with activity in the amygdala, which links decoding and interpreting social signals and social values. The structure also relies on the mentalizing network, which is central to an individual's ability to infer the mental states of others.

Seeing photographs with more likes was associated with increased activity in brain regions responsible for social cognition, rewards (the dopamine system), and attention (the visual cortex). When participants viewed photos with more likes, their overall brain activity and the activation of the visual cortex were heightened. This suggests that we pay more attention to and focus on images that receive more likes, examining them in greater detail.

To ensure that image differences did not influence the results, the researchers randomly assigned the number of likes across images and controlled for factors such as luminosity and content. The findings held true whether participants were looking at their own photos or others' photos. This implies that when we see social media images with higher like counts, we tend to scrutinize and engage with them more intensively.

The activation of the mentalizing network and regions associated with social skills was observed when individuals viewed their own photos with more (randomly assigned) likes. Our brains process self-images within a social context, considering how others perceive us and our connections with them. Furthermore, receiving more likes on one's own photos activates the dopamine reward system, which plays a role in pleasure, motivation, and Pavlovian responses.

Having more likes on one's own photos activates the social brain and stimulates the mentalizing network. When individuals see photos of themselves with a higher number of likes, their brain activity increases in regions related to social skills and imitation. This suggests that when we view our own photos, our brains engage in thinking about how others perceive us and consider the social context surrounding the photos.

RESEARCH QUESTION

In this study, to learn about the differences for the human recognition between few social network and large social network, we will proceed with the following topic of social media as social brain activities. In practice, compared to low liked SNS, the social brain activities are less then high liked SNS.

Social interactions have played a pivotal role in the evolution of human brains and behaviour. This literature review investigates the neurobiological basis of social connections, delving into the evolutionary advantages of social engagement, the neural mechanisms governing social behaviours, and the contemporary implications of social media on brain responses.

Evolutionary Significance of Social Interaction: Loneliness, often perceived negatively, could have an evolutionary benefit. Cacioppo and Patrick (2008) propose that loneliness persists due to its role in motivating individuals to establish, repair, and maintain social relationships. This theory is supported by research on primates, where larger brains were favoured in more social species (Dunbar, 1998), and on humans, where neocortex size correlated with social group size (Lewis et al., 2011).

Neural Mechanisms Underlying Social Behaviours: The human brain's response to social interactions involves the dopamine reward system. Eisenberger, Lieberman, and Williams (2003) found that social exclusion activated brain regions associated with physical pain, while the ventral striatum played a key role in romantic love (Aron et al., 2005), cooperation (Rilling et al., 2002), social comparisons (Fliessbach et al., 2007), and altruism (De Quervain et al., 2004).

Impact of social media on Brain Responses: The advent of social media has transformed the landscape of social interactions. Sherman et al. (2016) studied brain responses to receiving likes on social media, demonstrating its rewarding nature. Subsequent studies extended these findings to young adults (Sherman et al., 2018) and revealed brain activation during giving and receiving likes (Sherman et al., 2018). However, concerns about potential negative effects have been raised (Meshi et al., 2013; Allen, 2017).

The studies reviewed underscore the fundamental importance of social connections in shaping the human brain's structure and function. Loneliness serves as an evolutionary motivator, neural mechanisms underlie social behaviours, and contemporary technology like social media influences brain responses. This review highlights the dynamic interplay between social engagement and brain processes, offering insights into the intricate relationship between human biology and social interactions.

- Research Question 1:
  How do α-waves and β-waves differ between high-liked vs. low liked SNS and social YouTube social media (high-liked vs. low liked)?
- Research Question 2
  Will different wavelengths in two channels appear for between high liked vs, low liked SNS and social YouTube social media (high-liked vs. low liked)?

RESEARCH METHOD

In general, brain waves are divided into delta (δ) waves (0.2-3.99 Hz), theta (θ) waves (4-7.99 Hz), alpha (α) waves (8-12.99 Hz), beta (β) waves (13-29.99 Hz), and gamma (ζ) waves (30-50 Hz) based on the range of frequencies at which they oscillate. While electroencephalography can measure all frequencies of brain waves, only the α- and β-waves, which are the most interpretive, are extracted and used in brainwave research.

Alpha waves are dominant in relaxed states, such as relaxation. Their amplitude increases as you become more stable and relaxed. They are generally regular, steady waves that are largest in the parietal and occipital lobes and smallest in the frontal lobe.

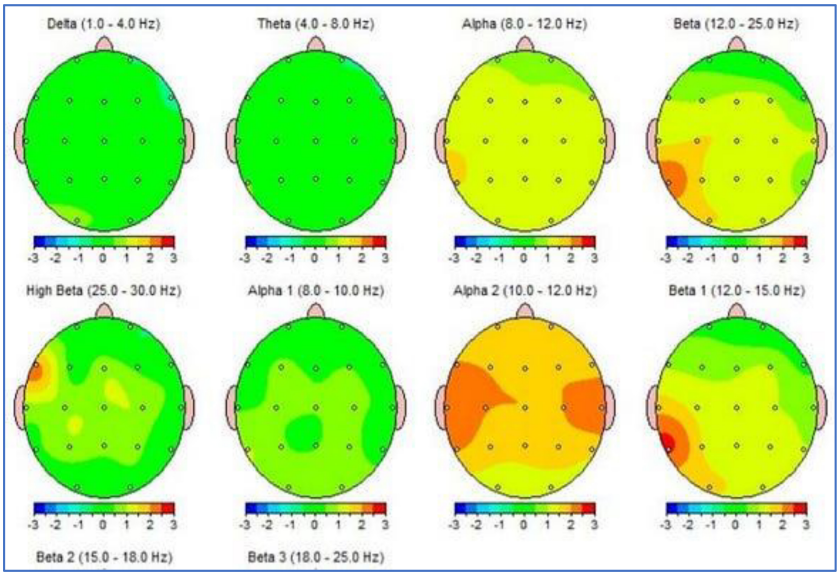

Figure 1: Brainwave measurement.

Beta waves are predominant in the frontal lobe and are present during all conscious activity, such as waking and talking. They are often seen when we are anxious, engaged in complex thinking or calculations, and when we are nervous.

The cerebral cortex beyond the surface of the head is divided into the frontal lobe, parietal lobe, temporal lobe, and occipital lobe, and each part plays a different role. The occipital lobe, located at the back of the head, contains the primary visual cortex, which is responsible for processing primary visual information, and the parietal lobe, located near the crown, contains the somatosensory cortex, which is responsible for processing motor/sensory information.

Table 1. Related brain waves and functions of each channel of the equipment.

Right	CH 1	CH 2	CH 3	CH 4	REF
	RED Prefrontal (β) Complex thinking	YELLOW Frontal lobe (β) Auditory	Green Temporal Lobe Visual + emotional thinking	Blue Occipital Lobe (α) Grounding	(Red) Earlobe
Left	**CH 5**	**CH 6**	**CH 7**	**CH 8**	**GND**
	Orange Prefrontal (β)) Complex thinking	Purple Frontal lobe (β) Auditory	Gray Temporal Lobe Visual + emotional thinking	White Occipital Lobe (α) Grounding	Black Back of hand

When different types of social media (high-liked vs. low liked) are shown to subjects, wavelength changes by channel can be used to identify the structure of the brain and its developmental functions. In particular, α and β waves have the characteristic of establishing an inverse relationship. If the α wave is high after watching a social media (high-liked vs. low liked), the β wave is likely to be relatively low, and in this case, it can be expected that the visuals are intensively stimulated and emotional thinking becomes active. On the other hand, if the β wave is high and the α wave is relatively low after watching a social media (high-liked vs. low liked), it stimulates the entire frontal lobe from the temporal lobe to the frontal lobe, which stimulates the auditory system and leads to planning and complex thinking rather than emotion.

RESULT OF THE RESEARCH

First, we can analyse the results of research question 1. To analyse the results, we used paired t-test to compare the results. In other words, based on the results, we can compare the difference between α and β waves between flat and stereoscopic images.

Table 2. Comparison of average brainwaves of high-liking social media and low-liking social sites.

Class		Low-Liked	High-liked	t	Sig.
α Wave	YouTube	17.61	10.34	4.01	.017
	Blog	16.99	10.91	2.54	.036
	Instagram	39.54	12.43	5.23	.003
β Wave	YouTube	23.92	80.55	−8.39	.000
	Blog	26.40	76.10	−4.12	.009
	Instagram	35.04	58.90	−3.07	.035

In the above experiment, the waveforms of a flat image and a stereoscopic image are recorded. Overall, we can see that alpha waves are higher in flat images, and beta waves are higher in stereoscopic images. In the case of alpha waves, sports, animation, and promotional social media (high-liked vs. low liked) all have t-values greater than 0, and the probability of significance is lower than .05. Therefore, we can see that low-liked SNS are higher than high-liked SNS in alpha waves. This can be interpreted as low social brain of low liked SNS images. In the beta (B) wave, Youtube, blog, and Instagram all have negative t values, and the probability of significance is lower than .05. In other words, in the beta B wave, high-liked SNS have higher values than low-liked SNS. Overall, high liked SNS were found to be more stimulating.

Table 3. Analysis of the absolute value of wave A for low and high likes on social sites.

	Type		Low Liked	High-Liked	t	Sig
α Wave	YouTube	Ch 1	24.66	13.39	6.534	.000
		Ch 2	26.12	13.63	6.127	.000
		Ch 3	12.94	11.57	5.418	.000
		Ch 4	13.19	11.26	4.583	.001
		Ch 5	13.27	9.33	2.196	.056
		Ch 6	12.89	10.82	4.719	.001
		Ch 7	12.77	10.62	3.964	.003
		Ch 8	15.40	12.15	3.482	.007
	Blog	Ch 1	27.94	13.36	3.686	.005
		Ch 2	28.74	13.58	3.906	.004
		Ch 3	12.82	10.46	6.315	.000
		Ch 4	13.39	10.37	5.953	.000
		Ch 5	7.682	9.98	4.469	.002
		Ch 6	11.91	10.57	3.827	.004
		Ch 7	11.73	9.56	4.566	.001
		Ch 8	23.87	10.13	2.094	.066
	Instagram	Ch 1	45.65	12.69	1.879	.093
		Ch 2	52.23	13.06	1.697	.124
		Ch 3	19.37	10.20	2.509	.033
		Ch 4	25.06	10.24	2.012	.075
		Ch 5	53.67	8.65	1.121	.291
		Ch 6	83.19	9.74	2.144	023
		Ch 7	18.15	9.54	5.064	.061
		Ch 8	48.90	10.12	3.144	.001
β Wave	YouTube	Ch 1	35.17	81.78	–2.401	.040
		Ch 2	33.16	85.05	–2.533	.032
		Ch 3	17.62	59.65	–1.674	.128
		Ch 4	14.18	49.75	–1.862	.096
		Ch 5	39.37	121.73	–1.488	.171
		Ch 6	25.66	79.13	–2.173	.058
		Ch 7	11.46	41.40	–1.621	.140
		Ch 8	14.74	54.57	–2.019	.074
	Blog	Ch 1	42.57	77.02	–1.273	.235
		Ch 2	39.78	83.35	–1.110	.296
		Ch 3	20.20	40.47	–2.393	.040
		Ch 4	16.10	30.82	–3.838	.004
		Ch 5	28.95	134.80	–3.168	.011
		Ch 6	22.10	92.75	–2.673	.026
		Ch 7	15.65	25.32	–9.242	.000
		Ch 8	25.77	27.87	–13.067	.000
	Instagram	Ch 1	43.67	88.60	–2.921	.017
		Ch 2	46.55	92.54	–2.098	.065
		Ch 3	24.23	40.73	–4.228	.002
		Ch 4	22.11	30.47	–5.408	.000
		Ch 5	45.27	99.91	–2.934	.017
		Ch 6	54.43	51.68	–5.671	.000
		Ch 7	16.21	24.16	–6.311	.000
		Ch 8	27.83	26.62	–8.723	.000

ACKNOWLEDGMENT

The authors would like to acknowledge for all research comments.

REFERENCES

Allen, M. (2017, November 9). Sean Parker Unloads on Facebook: 'God Only Knows What It's Doing to Our Children's Brains.' Axios. Retrieved from https://www.axios.com/sean-parker-facebook-children-brains-8af0c0ab-8c4b-46eb-8a37-e237a8c5f3b1.html.

Aron, A., Fisher, H., Mashek, D. J., Strong, G., Li, H., & Brown, L. L. (2005). Reward, motivation, and emotion systems associated with early-stage intense romantic love. *Journal of Neurophysiology, 94*(1), 327–337.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the Autistic Child Have a 'Theory of Mind'?. *Cognition, 21*(1), 37–46.

Berns, G. S., Capra, C. M., Moore, S., & Noussair, C. (2010). Neural mechanisms of the influence of popularity on adolescent ratings of music. *Neuroimage, 49*(3), 2687–2696.

Cacioppo, J. T., & Patrick, W. (2008). *Loneliness: Human Nature and the Need for Social Connection*. New York: W. W. Norton.

Cacioppo, J. T., Cacioppo, S., & Boomsma, D. I. (2014). Evolutionary mechanisms for loneliness. *Cognition and Emotion, 28*(1), 3–21.

Dennett, D. C. (1978). *Brainstorms: Philosophical essays on mind and psychology*. Montgomery, AL: Harvester Press.

De Quervain, D. J. F., Fischbacher, U., Treyer, V., Schellhammer, M., Schnyder, U., Buck, A., & Fehr, E. (2004). The neural basis of altruistic punishment. *Science, 305*(5688), 1254.

Dunbar, R. I. M. (1998). The social brain hypothesis. *Evolutionary Anthropology: Issues, News, and Reviews, 6*(5), 178–190.

Dunbar, R. I. M. (2011). Neocortex size as a constraint on group size in primates. *Journal of Human Evolution, 22*(6), 469–493.

Eisenberger, N. I., & Lieberman, M. D. (2004). Why rejection hurts: A common neural alarm system for physical and social pain. *Trends in Cognitive Sciences, 8*(7), 294–300.

Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science, 302*(5643), 290–292.

Falk, E. B., O'Donnell, M. B., Tompson, S., Gonzalez, R., Dal Cin, S., Weber, R.,... & Strecher, V. (2015). Functional brain imaging predicts public health campaign success. *Social Cognitive and Affective Neuroscience, 10*(3), 487–493.

Fliessbach, K., Weber, B., Trautner, P., Dohmen, T., Sunde, U., Elger, C. E., & Falk, A. (2007). Social comparison affects reward-related brain activity in the human ventral striatum. *Science, 318*(5854), 1305–1308.

Jolly, A. (1966). Lemur social behavior and primate intelligence. *Science, 153*(3735), 501–506.

Lieberman, M. D. (2013). *Social: Why Our Brains Are Wired to Connect*. New York: Oxford University Press.

Maliske, L., Schurz, M., & Kanske, P. (2021). Interactions within the social brain: Co-activation and connectivity among networks enabling empathy and theory of mind. *PsyArXiv Preprints*. https://doi.org/10.31234/osf.io/52z4f

Matthews, G. A., Nieh, E. H., Vander Weele, C. M., Halbert, S. A., Pradhan, R. V., Yosafat, A. S.,... & Tye, K. M. (2016). Dorsal raphe dopamine neurons represent the experience of social isolation. *Cell, 164*(4), 617–631.

Nation, D. A., Gonzales, J. A., Mendez, A. J., Zaias, J., Szeto, A., Brooks, L. G.,... & Schneiderman, N. (2008). The effect of social environment on markers of vascular oxidative stress and inflammation in the Watanabe heritable hyperlipidemic rabbit. *Psychosomatic Medicine, 70*(3), 269–275.

Nonogaki, K., Nozue, K., & Oka, Y. (2007). Social isolation affects the development of obesity and type 2 diabetes in mice. *Endocrinology, 148*(10), 4658–4666.

Olds, J., & Milner, P. (1954). Positive reinforcement produced by electrical stimulation of septal area and other regions of rat brain. *Journal of Comparative and Physiological Psychology, 47*(6), 419.

Pavlov, I. P. (1927). *Conditioned reflexes: An investigation of the physiological activity of the cerebral cortex* (G. V. Anrep, Trans. & Ed.). Oxford: Oxford University Press.

Rilling, J. K., Gutman, D. A., Zeh, T. R., Pagnoni, G., Berns, G. S., & Kilts, C. D. (2002). A neural basis for social cooperation. *Neuron, 35*(2), 395–405.

Ruan, H., & Wu, C.-F. (2008). Social interaction-mediated lifespan extension of Drosophila Cu/Zn superoxide dismutase mutants. *Proceedings of the National Academy of Sciences, 105*(21), 7506–7510.

Schurz, M., Radua, J., Aichhorn, M., Richlan, F., & Perner, J. (2014). Fractionating theory of mind: A meta-analysis of functional brain imaging studies. *Neuroscience and Biobehavioral Reviews, 42*, 9–34.

Schurz, M., Radua, J., Tholen, M. G., Maliske, L., Margulies, D. S., Mars, R. B., et al. (2021). Toward a hierarchical model of social cognition: A neuroimaging meta-analysis and integrative review of empathy and theory of mind. *Psychological Bulletin, 147*(1), 293–327.

Sherman, L. E., Greenfield, P. M., Hernandez, L. M., & Dapretto, M. (2018). Peer influence via Instagram: Effects on brain and behavior in adolescence and young adulthood. *Child Development, 89*(1), 37–47.

Sherman, L. E., Konrath, S. H., Raby, K. L., & Smalley, D. (2018). What the brain 'likes': Neural correlates of providing feedback on social media. *Social Cognitive and Affective Neuroscience, 13*(7), 699–707.

Sherman, L. E., Payton, A. A., Hernandez, L. M., Greenfield, P. M., & Dapretto, M. (2016). The power of the like in adolescence: Effects of peer influence on neural and behavioral responses to social media. *Psychological Science, 27*(7), 1027–1035.

Stranahan, A. M., Khalil, D., & Gould, E. (2006). Social isolation delays the positive effects of running on adult neurogenesis. *Nature Neuroscience, 9*(4), 526–533.