

Symbiont Consciousness: Sociocultural Embodied Augmentation of Humanity

Faiola, A., Srinivas, P. Finch, R. J., & Wu, Z.

**Indiana University – School of Informatics and Computing
Department of Human-Centered Computing
Indianapolis, Indiana USA**

Abstract

The psychology of consciousness as explained by Vygotsky is the ability of one to focus on the inner state of being. Vygotsky's proposition of external tools redistributing mental and external processes into internalized acts lacks the concept of embodied mediational tools existing in the current world as computational artifacts extending or augmenting human capabilities. This paper proposes sociocultural embodied augmentation theory (SEAT) as a means to explain the impact of augmenting technologies on Vygotsky's original notion of "psychological tool," therefore initiating an inevitable transformation of the sociocultural mind. Hence, a new social mind is posited as an evolving symbiosis between human life and artificial life that extends consciousness: a symbiont consciousness.

Introduction

Vygotsky (1987v1/1934) explained the psychology of consciousness as the ability of one to focus more on the inner state of being, to one's subjective being and its cognitive management. His notion of consciousness is represented as someone attaching meaning and sense during an activity, with "conscious awareness." As such, consciousness emerges out of social life, as an influence of sociocultural structures and processes and the development of knowledge, drawn from their engagement with others, both historically and situationally. The fundamental principles underlying this idea are based on the use of external tools that mediate an activity and their corresponding influence on the contextual structure of human behavior. Vygotsky envisioned external tools used in performing an activity as mediators that re-distributed natural mental and external processes into internalized instrumental acts (Kaptelinin & Nardi, 2012). Vygotsky's vision, however, lacked the extended notion of embodied mediational tools that exist in the current world as computational artifacts (or advanced digital technologies) that can be used to extend or augment human biosensory, neurocognitive, and musculoskeletal capabilities, i.e., human enhancements (Faiola, 2013).

This paper posits sociocultural embodied augmentation theory (SEAT), stating that augmenting technologies impact Vygotsky's (1987v1/1934) original notion of psychological tools, therefore initiating an inevitable evolution of the sociocultural mind. Hence, a new social mind is posited as an outcome of an evolving symbiosis between human life and artificial life. The production of such symbionts will result in consciousness that extends into the sociocultural world in ways that change our notion of embodiment. In sum, the possibility for the co-existence of artificial consciousness and natural processes in the evolution of cultural mediation are presented.

Vygotsky's Consciousness and Current Technologies

Vygotsky understood the production of the mind as the result of society and culture and that human consciousness was the process in which humans continually construct their environment by engaging in activity. According to Vygotsky (1987v1/1934), we “use consciousness to denote awareness of the activity of the mind—the consciousness of being conscious” (p. 170). In other words, active and conscious processes of reflection become part of our “active transformation of reality...”

In trying to analyze the sociocultural aspect of mind, Vygotsky (1987v1/1934; 1978/1934) introduced the notion of higher psychological functions. According to this notion, when humans interact with the world by performing an activity using computational artifact(s), the natural psychological functions of the human mind are re-structured and distributed to create instrumental acts through the process of internalization. Vygotsky understood this change in human behavior and mental structure to be mediated by culturally developed means (Kaptelinin & Nardi, 2012). Vygotsky, however, did not envision computational artifacts as mediational tools in resolving human limitations. This suggests, in particular, the augmentation and extension of the human biosensory, neurocognitive, and musculoskeletal systems for purposes of either restoration of human systems or supplemental enhancements not existing in the original physio-neuro- psychological construction of humanity.

Vygotsky's notion of social consciousness and those cognitive processes associated with cultural historical development should embrace the transhumanization of consciousness. Developing pervasive digital artifacts are ubiquitously transforming the nature of human-computer interaction, while disrupting traditional cultural boundaries and sociocultural structures. Vygotsky never fathomed embodied artificial consciousness as a new cultural-historical paradigm: the enhanced production of human-computer consciousness that would give rise to artificial life. Kaptelinin (2012) argues that because technology is not neutral, a mutual shaping is transpiring between technology and human consciousness. This transformation continues to disintegrate the boundary between subject and cultural mediation—what we believe to be the evolving formation of transhumanized social consciousness augmented by digital technologies (Clark, 2004). Here, the production of the mind is constructed (in part) artificially because new neural pathways that are computationally fused with synthetic life amplify the human senses.

Socio-Embodied Augmentation of Human Systems

Taking from Vygotsky, Wertsch (1985) claims that in the study of social origin and social nature, “higher mental processes in the individual have their origin in the social processes” from which there is the emergence of a “conscious relation of mental process.” Vygotsky stressed the purpose of the role of mediational tools in the social process as “technical tools of production,” making consciousness the central paradigm of his work, referring to it as the “struggle for consciousness” in the Soviet age of psychology (Wertsch, p. 185). Within Vygotsky's original sociocultural model of tool usage, the “inclusion of a tool in the behavioral process” would initiate a number of new functions all “connected with the use and control of the given tool.” In so doing, a number of natural processes would eliminate any unnecessary work by virtue of the tool. This process, he argues, would dramatically modify the course, the intensity, the duration,

and the order of all “mental processes included in the instrumental act.” Thereby “replacing some functions with others, i.e., it recreates, reconstructs the whole structure of behavior just like a technical tool recreates the entire system of labor (Vygotsky, 1987v3, p. 87)”

We argue that within the new sociocultural experience, awareness of self and self-extension into the world merge Heidegger’s (1962) embodied experience with Vygotsky’s understanding of the conscious mind of reflection. In other words, Vygotsky’s sociocultural world has shifted dramatically. How we learn and engage the world through technology is quite different than the technical tools of the first half of the 20th century. Today’s exponential change is not the mere ‘incorporation’ of new tools, but the creation of a systemic reconfiguration of consciousness through a symbiosis with artificial life (Clark, 2007). In the early stages of mediated consciousness, technology did not possess core consciousness, reflection, and self-awareness, but rather subordinate processes and memory, allowing consciousness to be distributed beyond the boundaries of body and mind. Hence, what we propose is that the emergence of new psychological tools are radically affecting consciousness and the mediational experience of the sociocultural mind. In other words, in a post-human age, higher mental processes will unit with artificial cognition. The result of this union will be a mutually-beneficial incorporation of life, the organic and the artificial, which will give rise to a new kind of social mind that is not only embodied, but exploits memories and cognitive systems that are shared within and outside the body.

Research shows the neural schema of human brain that defines actions capable of being performed by humans has a high degree of plasticity. Studies show that using a stick as a tool can help the human brain make distinctions between the space within and beyond reaching distance, thus altering neural body schema to consider the stick as part of the body (Carmena et al., 2003). Through deeper neural changes, it is possible for a conscious agent to experience a transparent use of the tool and hence differentiate between the incorporation of the tool into the human neural scheme, i.e., the mere use of the tool. Hence, human embodiment comprised of a highly engineered symbiosis can produce sybiants capable of intentionality, self-regulating, and problem-solving, all brought on by a host of situational, societal, and cultural experiences.

For example, performance artist Stelarc (Stelios Arcadiou) deploys a mechanical actuator controlled artificial hand through pre-programmed sequences of motion from an electronic manipulator. (See Figure 1, Left image) In function, the hand operates without human volition, which we perceives as an addition to his biological hand. Although the work is creative in nature, its eerie sights and sounds suggest the inevitability of humanity. Hence, the artist/actor has an experience that does not require conscious thought or effort on his part to move the mechanical hand, functioning apart from his conscious control. Stelarc’s third hand is a work that represents the transhumanist experience at the intersection of body and machine. As an inter-mediated transformation of body and mind, his consciousness extends the transhumanization of the socio-embodied human (Stelarc, 2013a, 2013b). Also, Neil Harbisson was born with achromatopsia, a rare condition that causes complete color blindness (Harbisson, 2013). (See Figure 1, Right image) In 2004, Harbisson and Adam Montandon developed a new technology, Eyeborg, a cybernetic body apparatus that translates color into sound. The device fits on the Harbisson’s head and is designed to allow Harbisson to perceive color through sound waves. It works with a head-mounted antenna that senses the colors directly in front (BBC, 2012; Hadden, 2012; Harbisson, 2013a). Harbisson states that his use of the Eyeborg technology is not merely a connection between the technology and his physical brain, but a cybernetic union between the software and his brains neural pathways (Ganapati, 2008). Harbisson’s experience of symbiosis

illustrates cultural mediation as an organic merging of natural and artificial processes.



Figure 1. On the left, Stelarc, pictured with his mechanical actuator controlled artificial hand; and on the right (Stelarc, 2013a), Neil Harbisson, wearing his Eyeborg technology that translates color into sound (Harbisson, 2013b).

We posit that consciousness is no longer merely a product of society (nor of work in the world), where we become “human by engaging in the process of labor” (Wertsch, 1985, p. 77; Marx and Engels, 1968). Although computational systems still lack intentionality, they are inseparable from the distributed mind, serving as an integral partner of embodied activity—evidenced by the degree by which society has surrendered its mind voluntarily.

Today’s technology only slightly resembles the extension of our bodies and minds. That is to say, future intelligent systems will be both organic in nature, growing and learning as we live our lives in a social world (Bibel, 2004). Hence, the coupling of embodiment theory and cultural-historical activity theory, situated within an activity system of every-day life. In a typical pedestrian life, advanced technologies will become more than tools of cultural mediation, but rather indistinguishably interwoven into embodied socially distributed consciousness. Embracing the future includes acknowledging a shift to a transhumanistic era of mediation, where there is an increasing fusion of active minds, active bodies, and active technologies as indistinguishable—where human acuity begins with what is subjectively experienced, i.e., “see and understand” (Dourish, 2001, p. 21).

We further argue that SEAT can inform the way we think about socially distributed consciousness retrospective of the design and symbiosis of technology, where embodied consciousness is mediated through advanced cultural artifacts. In so doing, augmenting technologies impact Vygotsky’s original notion of psychological tools. SEAT is a phenomenologically inspired notion that argues that tools of cultural mediation are now grounded in transhumanism, where physical bodies are first, interactively and contextually

engaged in a social world (Dourish, 2006; Kaptelinin, 2012), second, where sociocultural embodied minds and technologies are synthesized, and third, the evolution of cyborgian life gives rise to a new kind of consciousness. Hence, a new social mind is posited as an outcome of an evolving symbiosis between human life and artificial life. We believe that our understanding of socially distributed consciousness can lead to a more profound grasp of how socially constructed intelligence can be distributed through purposefully built technologies. In particular, as noted by Salomon (1993), intelligence can be “distributed by off-loading what could be ...error-prone mental reasoning processes as action constraints of either the physical or symbolic environments” (p. 48).

In a post-human era, artificial consciousness will no longer replace natural processes, but rather the two arise from a single agent. From this departure, technology becomes less about distributed cognition and more about an organic fusion with consciousness that extends into the sociocultural world—the next stage beyond Bateson’s (1972) notion of memory being half in the head and half in the world. In the transhumanist era, the social mind no longer separates subject from mediated tool (Haraway, 1991; Hayles, 1999; Clark, 2007). During the time of post-human symbiosis extends beyond the interaction of man with machine. Here, the union of the embodied mind with technology as psychological tool allows for a different construction of consciousness, where symbiotic consciousness extends into the sociocultural world. This is transhumanism in its early stages. Vygotsky claimed that in the social origins of the mind, the social nature of the individual emerges, but in the future, the social mind merges with artificial intelligence, giving rise to a new species of social mind (Anderson, 2003): a mind that is both embodied and artificially extended within and outside the body.

Conclusion

Vygotsky claimed that in the social origins of the mind, the social nature of the individual emerges, but in the future, the social mind merges with artificial intelligence, giving rise to a new species of social mind (Anderson, 2003): a mind that is both embodied and artificially extended within and outside the body. The last two decades have seen the exponential emergence of mediational change in human consciousness due to the ubiquitous use of information technology. This has had a profound influence on our human relationships and activity in a sociocultural embodied world. In sum, we cannot distinguish between body and machine, because the body is augmented and computational processes alter the mediational experience. The subject and tool become one, where Vygotsky’s social origin of the mind is reconstructed and behavior is altered with a new system of labor. As noted, in a post-human era, artificial consciousness will not replace natural processes, but rather the two will become one, where consciousness is extended into a sociocultural world: a genesis of symbiosis life, an evolution of cyber-cultural mediation.

REFERENCES

- Anderson, M. L. (2003). Embodied cognition: A field guide, *Artificial Intelligence*, 149(1), 91-130.
- Bateson, G. (1972). *Steps to an ecology of mind: A revolutionary approach to man's understanding of himself*, New York: Ballantine.
- BBC. (2012). The man who hears colour. *BBC New Magazine*, London: BBC, Retrieved from <http://www.bbc.co.uk/news/magazine-16681630>

- Bibel, W. (2004). *Converging Technologies and the Natural, Social and Cultural World: Special Interest Group Report for the European Commission via an Expert Group on Foresighting the New Technology Wave*. European Commission.
- Carmena J.M., Lebedev M.A., Crist R.E., O’Doherty J.E., Santucci D.M., Dimitrov D.F., Patil P.G., Henriquez C.S. and Nicolelis M.A.L. (2003) Learning to control a brain-machine interface for reaching and grasping by primates. *PLoS Biology* 1(2), 193-208
- Clark, A. (2004). *Natural-born cyborgs: Minds, technologies, and the future of human intelligence*. Oxford: Oxford University Press.
- Clark, A. (2007). Re-inventing ourselves: The plasticity of embodiment, sensing, and mind. *Journal of Medicine and Philosophy*, 32(3), 263-282.
- Dourish, P. (2004). *Where the Action Is: The Foundations of Embodied Interaction*. Cambridge: MIT Press.
- Faiola, A. (2013). Distributed Creative Activity: Augmenting Interpersonal Cognition in Clinical Activity through Health Information Technology, *Proceedings of the Scientific Conference on Fundamental Problems of Psychology, Extended Abstracts, Parallel Session on the Psychology of Humans Immersed in Information Technology*, June 1, 2013, Moscow State University, Moscow, Russia, 295-299.
- Ganapati, P. (2008). Eye Spy: Filmmaker Plans to Install Camera in His Eye Socket, *Wired*, New York: Wired Publishers.
- Hadden, G. (2012). Color-Blind Artist Neil Harbisson Uses Webcam-Like Eyeborg to ‘Hear’ Color, *Boston: The World: WGBH Educational Foundation*, Retrieved from <http://www.theworld.org/2012/02/neil-harbisson-color-eyeborg/>
- Haraway, D. (1991). *Simians, cyborgs and women: the reinvention of nature*. New York: Routledge.
- Harbisson, N. (2013a). *Neil Harbisson: Cyborgist and Colourologiest*. Retrieved from <http://eyeborg.wix.com/neil-harbisson>
- Harbisson, N. (2013b). Arizona State University: Distinguished guests list, retrieved from http://emerge2013.asu.edu/distinguished_guests/
- Hayles, N. K. (1999). *How We Became Post Human: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: Chicago University Press.
- Heidegger, M. (1962). *Being and Time*. New York: Harper and Row.
- Kaptelinin, V. & Nardi, B. (2012). *Activity Theory in HCI: Fundamentals and Reflections*, San Rafael, CA: Morgan and Claypool Publishers.
- Kaptelinin, V. & Nardi, B. (2012). Activity theory in HCI: Fundamentals and Reflections. *Synthesis Lectures Human-Centered Informatics*, 5(1), 1-105.
- Marx, K. and Engels, F. (1968). *The German Ideology*. Moscow: Progress.
- Salomon, G. (Ed.) (1993). *Distributed Cognitions: Psychological and Educational Considerations*. Cambridge, UK: Cambridge University Press.
- Stelarc, (2013a). Extended arm, CEC25, *Canadian Electroacoustic Community*. Retrieved from http://cec.sonus.ca/econtact/14_2/stelarc_gallery.html
- Stelarc, (2013b). Extended arm, *Stelarc art website*. Retrieved from <http://stelarc.org/?catID=20218>
- Vygotsky, L. (1987v2/1934). The instrumental method in psychology. In: *The Collected Works of L. S. Vygotsky: Problems of the Theory and History of Psychology*, Vol. 1-3, Edited by

Robert W. Rieber and Jeffrey Wollock. New York: Plenum.

Vygotsky, L. S. (1978/1934). *Mind in Society: the development of higher psychological processes*. Cambridge: Harvard University Press.

Wertsch, J. V. (1985). *Vygotsky and the Social Formation of Mind*, Cambridge, Mass: Harvard University Press.