

Embodied Cognition:

A Literature Review on the Extended Mind Thesis

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Abstract

This literature review is focused on the External Mind Thesis, which lies in the field of Cognitive Science, more specifically under Embodiment Theory. The purpose is to encourage future research on the Extended Mind Theory and elaborate on a few research methods. Literature focusing on the different types of memory processes are essential to successfully approach extended mind research or any other cognitive process. An overview about the behavioral observation method and coding mechanisms are included. Lastly, this review is wrapped up through an example of how this information could come into play in a real life External Mind research scenario. Results could potentially change the way people think about and use mechanisms such as pen and paper.

Introduction

Cognitive science being a young area of study, offers room for growth. A specific topic that still needs a case study for it to go from a theory to a fact is the Extended Mind Theory. This theory falls under Embodied Cognition, which states that a “body intrinsically constraints, regulates, and shapes the nature of mental activity” (Foglia & Wilson, 2013). In other words, the mind is shaped by one’s body and environment in which it is in. Since embodied cognition believes that the environment influences the way people think, it hypothesizes that the availability of certain mediums (e.g. pen and paper, phone) has changed the way the mind handles information. Through previous studies, it has been noted that a human mind is only capable of holding an approximate of $4 \pm$ number of objects at a time. However, through the use of the mediums like the ones listed previously, it

Memory and Processes

It is important to understand the way memory works to see if it is truly being affected by the use of mediums such as phones and notebooks. Memory is a result of many brain regions working together and facilitating different pathways such as: long term memory, short-term memory, working memory, and episodic memory. Long term memory is defined by the article “Neural Network Model of Memory Retrieval”, as a storage for, “names, facts, episodes, and other aspects of our lives and that it is practically unlimited” (Recanatesi et al, 2014). Short term memory can

seems like the brain can remember more. Through the use of tools such as a pen and a piece of paper to jot down mental thoughts, memory recall has been facilitated. There are people that oppose this view and say that such mediums cannot be considered an external mind because these mediums are not reliable, there is limited accessibility to them, and they are beyond the skin. Cognitive scientists are looking for ways in which to test the hypothesis that proves that humans have become so reliant on the environment for memory retrieval and cues that removing them would have the same impact as removing a physical brain region affecting memory. Hence, in order to test these hypotheses there are four main areas to first understand: the way memory works, how higher order processes are being affected, how behavioral observations are conducted, and how data should be analyzed.

typically hold anywhere from four to seven ideas at once; it is information that retained only as long as the focus does not shift away. Working memory is the activity in the brain that is concerned with your immediate circumstances. When exploring the possible effects of an extended mind on cognition it is important to specifically focus on working memory and long-term memory. Memory is a process underlying cognition such as higher order processing. Episodic memory is memory that retains facts about the world. On the other hand, the article entitled, “Defining Higher Order

Thinking”, offers a definition of higher order thinking, “that occurs when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations” (Lewis & Smith, 1993). This being said, in the article, “The Extended Mind”, the authors support the idea of an extended mind and state that

“once we recognize that the crucial role of the environment is constraining the evolution and development of cognition, we see that extended cognition is a core process, not an add-on extra” (Clark & Chalmers, 1998). However, in order to prove the extended mind and conduct significant research, the approach of behavioral observations must first be clearly understood.

Behavioral Observations

In order to gather information and meaningful data, a behavioral observation method must take place. The behavioral observation method as stated by the article titled “Nominal Cross Recurrences” is explained as the following, “behavioral stream that are measured on a nominal scale that reflects events in a person’s behavior or experiences during the day or laboratory task” (Dale et al., 2011). In simpler words, a scientist follows a specific set of people and records what they observe in reference to the behavior that is being studied. Furthermore, in the article “Defining Higher Order Thinking”, the authors see it as integrated process because scientists, “observe, measure,

infer, predict, classify, collect and record data, interpret data, control variables, and form hypothesis” (Lewis & Smith, 1993). It is a time-consuming job and that is why cognitive scientists at times think about this approach as inconvenient. While cognitive scientists can observe people for a few hours, they can sometimes observe them for months or even years. This is why it is usually left as a last resort method for studies as it is their best method to successfully collect data. Furthermore, in order for the scientists to be able to interpret the data meaningfully and analyze it, they must go through a training process coding different types of behaviors.

Analyzing Data and Working with a Team

A coding system is unique to each experiment just as much as the hypothesis itself. The article “Behavioral Observation & Coding”, argues that it is not okay to take another studies coding system. For example, a

coding system that is designed to fit research focused on toddler’s behavior during daycare will not work for research focusing on teenage behavior during football practice. Furthermore, it advises researchers to “begin with a set

of hypotheses and design the coding system around these hypotheses” (Bakeman, 2000). If a researcher hypothesizes that “families tend to argue more when it is dinner time” his coding system would include vocabulary terms such as: yell, voice tone, argument, etc. Such terms would

then get placed with a specific number that would facilitate the coding process. A functional coding system will allow the researcher to analyze the number of yells, for example, and give meaning to collected data, instead of writing many notes throughout.

Experiment

The reason why the Extended Mind Thesis still remains a thesis is because there have not been any concrete experiments done to prove the power of external things to help the mind. That is why cognitive scientists wanting to contribute into the field should look into designing an experiment that digs deeper into memory recall, carry research out by designing a coding scheme, and consider implementing a behavioral approach. For example, if someone were interested in researching the extended mind by using a behavioral observation approach to analyze the way Professors at the University of California, Merced use presentations as an aid to their memory, there would be many factors to consider. First, the researcher must make a hypothesis, such as “by using power point presentations, professors at the University of California Merced enhanced their working memory”. Then, the head

researcher must collect a team of committed helpers that are willing to be trained to learn the coding system and specific coding programs. An overview of what behavioral observation method entails will be essential. Furthermore, as discussed earlier in the essay, behavioral observations method takes a lot of time. The research team must decide whether watching professors will be done in person or watched through recorded lecture videos, as suggested by the article “Behavioral Observation and Coding” (Bakeman, 2000). Next, the team will need to create a coding scheme that fits the hypothesis. Possible ways could include stuttering, hand movements, types of slides used, etc. Once the coding is done and the data gathered for the first few, they must decide how many would they need to code in order to prove the extended mind hypothesis.

Conclusion

The purpose of this review is to inform readers about the Extended Mind

Theory, and to encourage cognitive scientists to pursue research on this topic. Further research on the effect of the

environment on the mind will not only help expand the field of cognitive science but could potentially help aid other fields. Lastly, this potentially encourages

students, professors, and the general public to look for other ways in which humans could improve memory recall.

References

- Bakeman, R. (2000). Behavioral observation and coding. *Handbook of research methods in social and personality psychology*, 138-159.
- Clark, A., & Chalmers, D. (1998). The extended mind. *analysis*, 7-19.
- Dale, R., Warlaumont, A. S., & Richardson, D. C. (2011). Nominal cross recurrence as a generalized lag sequential analysis for behavioral streams. *International Journal of Bifurcation and Chaos*, 21(04), 1153-1161.
- Foglia, L., & Wilson, R. A. (2013). Embodied cognition. *Wiley Interdisciplinary Reviews: Cognitive Science*, 4(3), 319-325.
- Lewis, A., & Smith, D. (1993). Defining higher order thinking. *Theory into practice*, 32(3), 131-137.
- Recanatesi, S., Katkov, M., Romani, S., & Tsodyks, M. (2014). Neural Network Model of Memory Retrieval. *Frontiers in computational neuroscience*, 9, 149-149.