Enhancing Consciousness with Cognitive Load Theory

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Abstract
Of all God's gifts save life itself, the most prized by spiritual women has historically been the relationship with God through consciousness. God's gift of consciousness can become an authentic personal journey enhancing our relationship with the Spirit as we navigate transitions toward broader levels of consciousness. The authors believe this journey can be cultivated and propose a process model based on the neuropsychological evidence of consciousness interfaced with cognitive load theory. The authors will demonstrate how the process model may be used as a lens through which the biblical parables may be explored, thereby raising consciousness to glimpse the Essence of God.

Introduction

At the heart of this article is the concept of "in the beginning." Everything else follows this initial relationship to God: consciousness, spirit, history, gender, intellect, and creativity. Without this beginning, there is no liaison with God through consciousness. God's initial gift of Spirit can begin an authentic personal journey that has the potential to build in complexity to broader levels of consciousness. This journey can be cultivated, and we propose a process model based on the neuropsychological evidence of consciousness interfaced with cognitive load theory (CLT) to facilitate the growth of consciousness.

We believe throughout history, women have shared their singular experiences of God as mothers, sisters, daughters, wives, and friends. They have been particularly sensitive to the role of God in the community. Their stories or parables became models to which others could then add their personal experiences and perspectives, thus enriching the initial story every time a new layer of understanding was related.

The Bible recounts God's encounters with particular women who demonstrated distinctive gifts of the Spirit, such as Rebekah, Esther, Ruth, and Mary the mother of Jesus. Although their place and time in history are chronicled with different emphases and contributions to their cultures, these women had one commonality: they each played pivotal roles as exemplars of female consciousness or Spirit. The authors believe everyone has this Spirit and can enhance and enrich their consciousness through strategies of intentional development. One way to encourage this development is to use principles of neural biology and psychology with memory augmentation through CLT. This paper will discuss matters of the Spirit, neuropsychological principles, and CLT as each contributes to a process model that heightens awareness and generates a broader consciousness. We will then demonstrate how the process model can expand consciousness using the parable of the sower.

Spirit

In the Judeo-Christian Bible, the primal level of the Spirit is called the *Son* or *Word*, for example:

> "In the Beginning was the Word, and the Word was with God" (John, 1:1 NRSV).
>
> "All things came into being through Him, and without Him not one thing came into being" (John 1:2 NRSV).
>
> "In the beginning, God created the heavens and the earth…and the Spirit hovered over the earth" (Gen. 1:2 KJV).

In the Bible, we are instructed on the nature of the Spirit. In Judeo-Christian belief, not only is the Spirit present at the birth of creation, but it is seminal to the development of consciousness. In the New Testament, the Apostle Paul writes of *Pneuma* with a capital letter "*P*" as the word for the Holy Spirit. Paul claims that this *Pneuma* joins with our spirit, *pneumati*, to bear common witness that we are children of God. "It is that very Spirit bearing witness with our Spirit that we are children of God" (Rom. 8:16 NRSV).

The biblical accounts of selected women show us that having the Spirit is not gender selective. In many cases, the women were naive to religious orthodoxy. From these examples, *Pneuma* does not seem to depend upon patriarchy and social and religious hierarchy to generate itself. Also, various events in Acts demonstrate individuals who received the Spirit without the ritual of baptism, indicating that there may not be a rite of passage required for a person to receive the Spirit. Note the nature of The Spirit in the following scriptures:

1) "…source for a true inner knowledge, which becomes a calm inner authority whereby we know spiritual things for ourselves" (1 Cor. 2:1-16 NRSV).

2) "Spirit can be known only by Spirit—God's Spirit and our Spirits in open communion" (1 Cor. 14:2 NRSV).

3) "Spirit interprets our inarticulate groanings or internal communication" (Rom. 8:26 NRSV).

The authors' desire is to provide others with the cognitive means for spiritual development to reach the ultimate goal of broadening one's consciousness or Spirit and be in dialogue with God.

Biological Basis for Consciousness

A vast body of literature has explored consciousness from spiritual, philosophical, and cognitive perspectives since the early writings of Socrates to present day (Carruthers, 2005; Edelman, 1989). The term "consciousness" has evolved from a mere "awareness" to a higher-order mental-state through the lenses of evolutionary, developmental, psychological, and neurophysiological evidence. Early writings about consciousness were rooted in observations surrounding being conscious, having emotions, and conveying thoughts (Carruthers, 2005). However, not until William James published his essay "Does Consciousness Exist?" was the accepted division of concepts between science and philosophy significantly and explicitly challenged (Edelman, 1989). Even in James's early writings, consciousness was linked to memory:

> To deny plumply that "consciousness" exists seems so absurd on the face of it—for undeniably "thoughts" do exist—that I fear some readers will follow me no farther. Let me then immediately explain that I mean only to deny that the word stands for an entity, but to insist most emphatically that it does stand for a function (James, 1904).

James seems to clarify the division of consciousness as a psychological phenomenon and a neuro-biological function. James view seems foundational for future scientists who moved away from the philosophical concepts of consciousness toward a more scientific underpinning. This evolving neurological conceptual model is now, a widely accepted, evidence-based gender-inclusive theoretical foundation based on neuropsychology (Edelman, 1989). Edelman was inspired to explore consciousness early in his career, as he noted, "All of my life, my main goal has been to understand how I could come to be--to be aware, to sense, and to remember" (Edelman, 1989).

Excluding the tenets of perceptual consciousness, Edelman pursued a biological neural origin arising out of Darwin's theory of Neural Darwinism, a brain theory called neuronal group selection (NGS) (Edelman, 1978). According to NGS, evidence of consciousness exists through memories patterned in global neuronal mappings. The neuronal groups are not a repository of fixed or coded attributes to be called up and

assembled in a replicative fashion as in a computer. Instead, memory results from a process of continual re-categorization, which, by its nature, must be procedural and involve continuous neurological activity in repeated rehearsals. These neurological processes imply that consciousness can be deliberately enhanced. When new associations occur in different contexts, the purposeful NGS changes accordingly. Thus, the brain forms complex neuronal groupings or schemata for both function and infinite growth as new similar memory traces are "reintegrated." This development of schemata correlates to a higher order or expanded consciousness and can be enhanced with an appropriate learning framework.

Cognitive Load Theory

Our understanding of CLT is historically rooted in John Sweller's (1988) work on understanding learners' problem-solving strategies. Sweller terms the cognitive resources required for complex problem solving "cognitive processing capacity" and argues that the cognitive load (CL) imposed on a learner during problem solving can impair learning (Sweller, Chandler, and Paul, 1994). In other words, the cognitive work required to figure out how to solve a problem can interfere with one's ability to learn the actual principles that the problem is intended to teach. Therefore, CLT links memory and learning.

CLT offers a viable framework through which memory can be enhanced. Central to principles of learning is that we receive information through multiple sensory pathways (e.g., visual and auditory inputs) creating visual and auditory representations among neural networks. These representations are processed within the structures of working memory with the possibility of transferring and storing the information into long-term memory. CLT proposes the following basic assumptions about memory: 1) working memory is constrained and limited; 2) long-term memory is virtually unlimited; and 3) working and long-term memory structures can interact. Information processing within working memory is not a one-way input but can be retained in the infinite stores of long-term memory, after which it can be retrieved from long-term memory to interact with and facilitate working memory processes (Schnotz & Kürschner, 2007). The long-term memory includes all memory threads not currently used but needed to understand the concepts in question (Bower, 1975). In the neuropsychological model, these assumptions parallel the grouping of neurons into a complex schema that is built from the re-entry of new data. Therefore, long-term memory is organized into similar memory threads or traces forming categories or schema. While these schemas may hold very complex knowledge and informational elements, they are processed into working memory as one unit (Chi, Glaser & Rees, 1982). Given a learner's limited working memory, it is helpful for educators to manipulate the components of CL to enhance learning.

In CLT, there are three components of CL: 1) intrinsic, 2) extraneous, and 3) germane. Intrinsic CL considers the inherent difficulty of the learning goal, the degree of interactivity, and the learner's level of expertise in the subject matter. The greater the complexity and interactivity of the learning goal, the greater the intrinsic CL (Paas, Renkl, & Sweller, 2003). While the inherent difficulty of the learning goal cannot be changed, the component parts and interactivity of the learning goal can be identified, addressed in an appropriate learning strategy, and used to form the necessary strategies needed to meet the learning goal.

Interactivity describes the number of separate elements in the learning goal that would need to be held simultaneously in working memory (Leahy & Sweller, 2004). Educational activities should be designed so that the number of interactive components to be processed in working memory are three to five. While intrinsic CL is *certeris paribus*, or central to the material to be learned and cannot be modified, teaching strategies can be modified to enhance learning (Kirschner, 2002). The instructional goal's interactive elements are one of the intrinsic concepts in CLT that can be modified to enhance learning (Sweller & Chandler, 1994). Levels of element interactivity are determined by the extent to which learning elements can be assimilated individually or only in combination with other elements. When multiple elements interact, they must all be learned simultaneously, resulting in a heavy working memory load. Alternatively, if an element can be learned in isolation from other elements because it does not interact with them, then element interactivity is low.

The "expertise reversal effect" allows for the level of a person's expertise or the degree of existing complex schemata and implies that learning may require varying amounts of instructional support. Theoretically, less knowledgeable learners (e.g., novices) should be provided with a higher degree of instructional support for their learning activities. Conversely, learners with more complex schemata should be provided with a lower level of assistance, thus allowing them to use their previously developed schemas for guiding problem-solving activities. Due to the principle of reintegration from the Neural-psychological Model by Edelman, elements of long-term memory can be retrieved from long-term memory and interact with the elements in recent memory that are being newly processed. In that manner, schemata can expand into a more complex global mapping or consciousness. The main instructional implication of the expertise reversal effect within a CL framework is the need to adapt instructional methods to varying levels of learner expertise or existing schemata. In this article, the authors propose structuring an assessment of learner expertise before the learning exercise and then choosing a learning pathway or "algorithm" to decrease overall CL and enhance working memory.

Extraneous components of CL involve the effort required to process learning. In poorly designed learning activities, the extraneous CL is greater, and fewer informational elements are retained in working memory and transferred to long-term memory. In the remaining subsections of this article, the authors demonstrate how to identify concepts implied in the parable of the sower, presenting them in a manner that lowers the degree of interactivity and mental effort needed to process principles using working memory.

Working memory capacity imposes germane CL on the learner (Paas, Tuovinen, Tabbers, & Van Gerven, 2003). Germane CL, while increasing the overall CL of the learner, can be decreased if the extraneous instructional approaches promote, rather than detract from, understanding of the learning material. Identifying the appropriate amount and type of CL imposed on a learner during instruction is a significant factor in the success of an educator's instructional design (Paas, Tuovinen, Tabbers, & Van Gerven, 2003). The underlying assumption is that an instructional design that results in unused working memory capacity decreases the germane CL. Therefore, teaching strategies should balance intrinsic CL and enhance the extraneous CL with appropriate instructional procedures (Kalyuga, Ayres, Chandler, & Sweller, 2007). Given a learner's limited working memory, it is not only helpful for educators to understand the components of CL but also to design teaching strategies that decrease CL, enhance working memory, and build complex global schema in long-term memory.

Application of the Model

One of the benefits and, therefore, intentions of introducing a new model for interpreting biblical stories is to enjoy a richer level of consciousness beyond just a literal interpretation. The Bible recounts that Jesus told people simple stories, which we call parables. They are very much like the Midrash or stories the Jewish rabbis told. Biblical scholar C.H. Dodd explains a parable as "a metaphor or simile drawn from nature or common life, arresting the hearer by its vividness or strangeness, and leaving the mind in sufficient doubt about its precise application to tease it into active thought" (McKenzie, 2007). This definition highlights our hypothesis that Jesus taught these parables in this way so that the listeners could easily add to their current schemata, with the effect that new memories are reintegrated, resulting in more complex schemata. McKenzie (2007) states: "The parables seem like ordinary stories from first-century Palestinian village life. They seem realistic. But then, as we get into them, there is something strange, something not true to life as we know it." Memories that are added to the mix of our experience and knowledge stir things up, teasing our mind into active thought and pushing us into our imagination and expanding our knowledge beyond our past accumulated experience.

Similarly, the ancient teaching style of the rabbis introduced elementary concepts through stories to those who came to them for practical answers within a spiritual understanding of their communal religious life. The stories are universal, drawn out of and understood within a context of God's love of creation and the community's response of love in return. We propose Jesus was an early adopter of CLT by using parables to structure the philosophical teachings of God's love for man and man's response to that love. Jesus did not offer a complex sophisticated philosophy that was to be dutifully copied as in the Old Law. Rather, he used seemingly simple stories using culturally relevant language and metaphors to offer a continuum of possible interpretations, thereby raising the level of consciousness. While the parables were culturally relevant 2000 years ago, through CLT and the process model, these same principles also become relevant today. More importantly, the principles of the parables can be processed in short-term memory and imprinted in long-term memory, becoming part of the individual's global neural network. NGS becomes rich schemata whereby new memories are processed, interpreted, and categorized in the global network of the brain. Those complex neural networks are then available for reintegration as new memories are processed. The overall level of consciousness or Spirit is broadened. The authors believe this heightened consciousness positions the individual to be in dialogue with God.

The Parable of the Sower

That same day Jesus went out of the house and sat beside the sea. [2] Such great crowds gathered around Him that he got into a boat and sat there, while the whole crowd stood on the beach. [3] And he told them many things in parables, saying: "Listen! A sower went out to sow. [4] And as he sowed, some seeds fell on the path, and the birds came and ate them up. [5] Other seeds fell on rocky ground, where they did not have much soil, and they sprang up quickly, since they had no depth of soil. [6] But when the sun rose, they were scorched; and since they had no root, they withered away. [7] Other seeds fell among thorns, and the thorns grew up and choked them. [8] Other seeds fell on good soil and brought forth grain, some a hundredfold, some sixty, some thirty. [9] Let anyone with ears listen!" Mat 13:1-9 (NRSV).

The Process Model

In the following example applying CLT, Figure 1 identifies five principles of the chosen parable "The Sower" demonstrate how key elements ca n be processed in working memory, thereby encouraging learners to engage in cognitive processing that promotes more complex schema construction. Decreasing CL and the limits of working memory can be accomplished by addressing intrinsic factors such as the inherent nature of the material to be learned and the existing cognitive schemata of the learner. Since intrinsic CL is *ceteris paribus,* applying CLT begins with assessing the existing schema of the learner. Assessment of the learner's schema is adapted from the model proposed by Whittenburg, whose research identified components of individuals' schemata (Reavis, 1999) (Figure I). Adapting Whittenburg's model to Edelman's Neural-psychological Model pairs schemata components with the learner's existing neuronal groupings. Assessing each component allows the educator to place learners along the continuum of naïve learner to rich NGS learner or beyond.

In Figure 2, concepts in the parable of the sower are compared between a learner who is naïve to the parable and one who has a rich neural development surrounding the parables. The CL of both learners is an appropriate number of concepts to be held in working memory and therefore can be transferred to long-term memory and a more global network. Engaging the naïve learner in structured dialogue presumes the learner is also naïve to the agricultural concepts foundational to how plants grow to be healthy or succumb to farming hazards such as weeds, rocks, and lack of nutrients. The learner with a rich neural network does not need to relearn the basics of farming and can draw analogies between the parable's rudimentary concepts of farming and those more complex concepts dealing with the spirit. Once concepts are associated with the parable of the sower, they can be moved from working memory to long-term memory and be associated with other complex neural networks or schemata involving The Word.

Understanding the learner's known vocabulary has a twofold purpose: to avoid a sense of alienation where the learner is not familiar with the context of the story and to assess the learner's present knowledge of the story's concepts. Using the components in Whittenburg's diagram of schemata provides a framework for assessing the learner's present knowledge. For example, assessing the concepts of experience, knowledge, and culture in the model may draw a distinction between modern day city dweller readers and learners from rural agrarian settings. Exploring the concepts of caring and affective cognition may reveal emotional memories of the learner who has experienced thoughts coloring and adding depth to the principles in the parable. In introducing an alternative lens to view the story, we hope to encourage the learner to re-create a new context relevant to his or her life. In sum, using the Model may produce a germination of seeds, ideas, and concepts in a more complex schemata.

The naive learner initially may view the seeds as teachings from The Word, while he learner with a rich NGS may move the "seeds" concept to long-term memory, associating it in the neuronal group with other memories of Christian principles. The learner with broader consciousness may group these principles as truths to be interpreted and incorporated into a unique individual schemata from which to augment and interpret their world view, thus drawing closer to the Spirit.

The CL principles of interactivity are useful in drawing associations among the five principles in the parable. The five concepts in the parable could be learned separately, thereby decreasing element interactivity. It is also reasonable that associating only two elements would keep the working memory CL low. Therefore, the naïve learner may associate the seeds with soil needed to plant the seed. The rich NGS learner may view the "soil" as "nutrient-rich environment for germinating" leading to broader spiritual concepts. In like manner, teaching the naïve learner about the weeds and rocks may bring forth mental images of "hard" and "useless." For the rich NGS learner, the concepts surrounding the parable's allusion to weeds and rocks may be viewed as mental distractions, fewer resources, and shallow spiritual roots. Engaging the learner in dialogue and thought about The Word in like manner to the example of the parable of the sower provides structured learning experiences based on the principles of CLT. The authors believe that we cannot fully understand the parables until they become part of our life experiences that contribute to our own global neural network. It is the authors' belief that through similar exercises, a broader consciousness can be cultivated, thereby bringing the learner in communion with The Spirit.

Conclusion

The authors hope a heightened consciousness and methods broadening interpretations of the scriptures will result in intentional structured study of God's Word. But the beginning is not the end, just as what can be taught or learned with a parable is never finished or completely revealed. It is important to say there are no wrong paths, only more and unmarked paths. That makes the quality of religious experience precious. It comes from the unknown, accepted and open to the unexpected as revealed in dialogue with God. The past flows into the present to point to the future—related to the beginning but never the same again.

We cannot know all that you know, the way you know, or the interpreted meaning for your life, but we can teach you a process model to broaden your consciousness, thereby illuminating a pathway to glimpse the Essence of God.

References

Blayney, Paul, Kalyuga, Slava, and Sweller, John. 2015. "Using Cognitive Load Theory to Tailor Instruction to Levels of Accounting Students' Expertise," *Educational Technology & Society* 18, no. 4

Bower, Gordon. 1975. Cognitive psychology: an introduction. In W.K. Estes (Ed.). *Handbook of Learning and Cognitive Processes*. Hillsdale: NJ: Erlbaum

Carruthers, Peter. 2005. *Consciousness: Essays from a Higher-Order Perspective*. Oxford: Clarendon Press, 3.

Chi, Michelene, Glaser, Robert and E. Rees. 1988. "Expertise in problem solving." In *Advances in the psychology of Human intelligence*, edited by R. Sternberg 7-75. Hillsdale, NJ: Erlbaum.

Crossan, John. 1973. *In Parables - The Challenge of the Historical Jesus*. New York: Harper & Row, Publishers.

Dodd, C. H. 1989. *Parables of the Kingdom, Revised edition.* New York: Charles Scribner's Sons, 1961.

Edelman, Gerald M. 1989. *The Remembered Present: A Biological Theory of Consciousness* New York: Basic Books, 51.

Edelman, Gerald M. "The Mindful Brain". Extended and published in *Neural Darwinism – The Theory of Neuronal Group Selection*. MIT Press, 1978/1987.

Kalyuga, Slava. 2007. Expertise reversal effect and its implications for learner-tailored instruction. *Educational Psychology Review*, 19, 509–539.

Kirschner, Paul. 2002. "Cognitive load theory: implications of cognitive load theory on the design of learning." *Learning and Instruction, 12*.

Leahy, Wayne, Sweller John. 2004, 'Cognitive load and the imagination effect', *Applied Cognitive Psychology*, vol. 18, no. 7, pp. 857 - 875, http://dx.doi.org/10.1002/acp.1061

Lasdun, James. 2016. "Letter from Europe: Alone in the Alps." *The New Yorker*, April 11.

McKenzie, Alyce M. 2007. *The Parables for Today.* Knoxville: Westminster: John Knox Press.

Paas, Fred and Van Merrienboer, Jeroen. 1993.The efficiency of instructional conditions: An approach to combine mental-effort and performance measures. Human Factors, 35, 737-743.

Paas, Fred, Renkl, Alexander and Sweller, John. 2004. Cognitive Load Theory: Instructional Implications of the Interaction between Information Structures and Cognitive Architecture. Instructional Science 32: 1–8. http://healthsci.queensu.ca/assets/ohse/cogntive_load_theory_pass_2004_.pdf

Paas, Fred, Tuovinen, Juhani, Tabbers, Huib and Van Gerven, Pascal. 2003 Cognitive Load measurement as a Means to Advance Cognitive Load Theory. *Educational Psychologist*, 38(1), 63–71. http://peres.rihmlab.org/Classes/PSYC6419seminar/Measurecogload.pdf

Reavis, Catherine. 1999. The phenomenology and process of critical thinking in

nursing practice. *Journal of Epistecybernetics*, 1 (1), 128-135.

Schnotz, Wolfgang, and Kürschner, Christian. (2007). A reconsideration of cognitive load theory. Educational Psychology Review, 19, 469-508.

Sweller, John, 2009. "The Many Faces of Cognitive Load Theory." *Talent Development, Volume: 63. Issue: 8.*

Sweller, John, & Chandler, Paul. 1994. Why some material is difficult to learn. *Cognition and Instruction*, 12, 185-233.

Williams, Michael. "A Storyteller's Companion." In *The Storyteller's Companion to The Bible, Volume One: Genesis*, Edited by Michael E. Williams. Nashville: Abingdon Press, 1991.

Figure 1 Whittenburg's Model

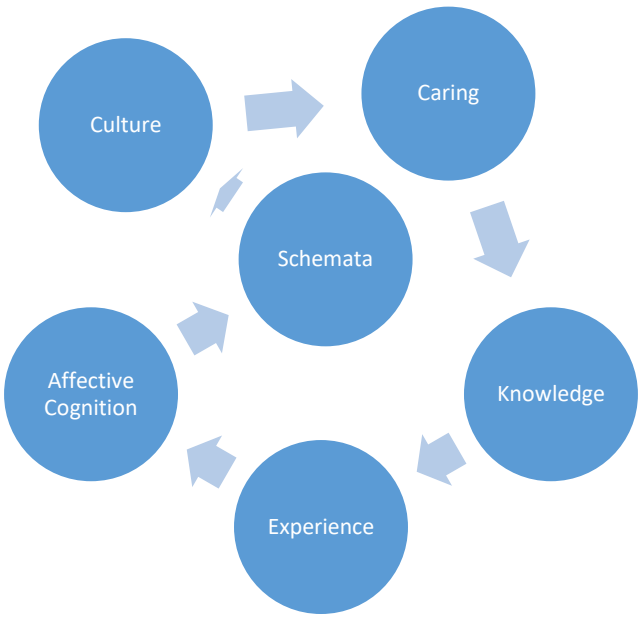

Figure 2 The Parable of the Sower Concepts