Critical Literature Review

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REHB 612: Disability Across the Life Span

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A man named Stephen Porges introduced a theory in 1994 and as fate would have it his theory came shortly before research became capable of shedding new light on the scientific importance of the body-mind connection. It is called polyvagal theory and while it may be flawed in some respects, one of the valuable insights from it is the benefits of somatic psychology. Since then, studies have reached similar findings concerning the complex nuances of cognition in humans. This paper will break the studies into three sections. The first will focus on four major networks in the brain, particularly the dorsolateral prefrontal cortex (DLPFC). The second will focus on new perspectives on somatic therapy based on these discoveries. The third will conclude the findings and look at what lies ahead.

Dorsolateral Prefrontal Cortex

The dorsolateral prefrontal cortex is a very interesting section of the human brain. We and other primates have it, but other animals do not. The DLPFC is in the prefrontal cortex of the parietal lobe. The vagus nerve affects the interaction between this section and the inferior parietal lobe in determining what should be done with the information. By the start of the 21st-century researchers were able to start demonstrating in studies how the DLPFC played an important role in someone successfully handling this (D'Esposito et al., 2000). At the time of these studies, the terminology was a little more limited than what is used in studies today. If the prefrontal cortex was mentioned, it was usually just that and not the DLPFC. As the studies continued and they were able to better identify the DLPFC, they were able to make more correlations between this and serious disorders such as major depressive disorder (Chang et al., 2011). Chang et al. (2011) had age as a factor in their study but also created an exclusion criterion. This is an important part of the study to mention because of what later studies revealed

by exploring combining more variables and age. This study also specifically mentions the link between depression, executive control, and the condition of the DLPFC.

However, at the same time studies started to demonstrate the power of the DLPFC they started identifying much more complex interactions between it and other networks of the brain. Even in disorders that may seem simpler, the DLPFC interacts with the rest of the brain in such a way that there are both obvious and subtle cognitive behavioral results. The study from Owens et al. (2019) focuses on addiction and delayed reward discounting (DRD) but the article does a beautiful job covering how the other networks are believed to be involved in cognition. However, it makes sure to point out there is much more for researchers to learn and any assessment of the various ways the networks interact should not necessarily be applied on a macro scale.

Something the article pointed out which is very important to remember when having discussions about the DLPFC is the role of the default mode network (DMN). In that portion, two articles are referenced that came out very close to each other and made the same conclusion (Andrews-Hanna et al., 2010, Buckner et al., 2008). The conclusion is that while someone may envision the DMN as passive most or all the time, it is crucial in how one interprets themselves and others in the world.

For the brain to switch between the central executive network (CEN) or executive control network (ECN) and DMN it needs the salience network (SN). Sridharan et al. (2008) utilized a task-frees resting state, a visual task, and an auditory task to determine which parts of the CEN, DMN, and SN are involved in each of those scenarios. They determined that the rDLPFC showed the most activity during the visual task. The study also helped clear up something else about the DMN. It helped to give researchers more clarity on the see-saw back and forth between

the CEN and DMN. Goulden et al. (2014) confirmed these findings a few years later in their study which had the same goal but utilized a different testing approach.

The final major network to keep in mind is the reward valuation network (RVN). It has been proven this network operates in tandem with the other three networks when assessing emotion and attachment when a reward or stimuli is presented. DRD is also taking place during this process. The CEN, specifically the DLPFC depending on what is happening, determines what action should be taken (Owens et al., 2019; O'Doherty, 2004). The study by Maier et al. (2015) utilized food and stress to further examine their influence on self-control choices. The three areas they honed in on were the ventromedial prefrontal cortex (vmPFC), the DLPFC, and the hypothalamic-pituitary-adrenal (HPA) axis. The HPA axis was proven to influence the connection between the vmPFC and DLPFC, but it was not entirely straightforward. Wang et al. (2016) give the reader an exciting look at the ways fMRI can not only be used to learn more about the RVN in animals and humans but the other three networks as well.

As researchers have discovered more of these nuances, it has created a shift in their approach to spirituality and religion (Perry, 2018). A big reason has been a better understanding of the effects of increased connectivity between the DMN and central executive network (CEN), which includes the DLPFC. Those at risk for depression are low in this but have increased DMN connectivity. Now it has been proven that high religion/spirituality (R/S) importance can reduce DMN connectivity. High R/S and the correlating increase in connectivity between the DMN and CEN can even help with resiliency (Svob et al., 2016). However, there is still a lot more research that needs to be done on R/S importance. Non-primates may not have a DLPFC, but some have the same networks (Wang et al., 2016).

The last important thing to share with the reader before moving on is the current understanding of the development of the DLPFC. While it is present in any human brain once the person is born, nothing happens with it until around adolescence. Two important things are usually factored into studies: the centrum semiovale (CSO) and the neurotransmitter choline. The interaction of these two with the DLPFC becomes very important during this time. Hence, one's childhood can have huge ramifications on its development. First, there is the fact that adolescents are still developing inhibitory control which means they can make risky and harmful behaviors. Second, symptoms of major psychiatric disorders develop during this time (Jaeger, 2013). Last is the effect of childhood trauma (CT). The interaction of the CSO, choline, and the DLPFC is already dealt with a great deal in adolescence. The timing and severity of CT combined with whether the person is helped are variables that alter this interaction (Foo and Pratiwi, 2021).

Somatic Discoveries

Just a little over half a decade after Porges introduced polyvagal theory researchers noticed that top-down and bottom-up processing had major implications for the PFC (Miller, E. K., & Cohen, J. D., 2001). Researchers started to see that one's environment and the reality that it is always changing could have effects on internal cognition in a multi-faceted manner. To fully examine this first we will go over the studies that have compared cultural differences in dealing with the body and mind in the past up to the present. Second, we will go over studies that have focused on physiological connections. From the start of our species any study of the body and mind, regardless of the culture, has been complicated by individual interpretations of societal beliefs versus body response. In the west, it was turned into the shadow (Rolef, 2015). While it was always going to be the first thing someone saw, we still tried to conceal what information people could gather from it. Religion and philosophy also contributed heavily to the differences

that emerged (Ben-Shahar, 2014). Interdisciplinary studies have also revealed commonalities that go beyond cultural differences. Unfortunately, these were not always positive (Ben-Shahar, 2014). Nature, particularly animals, is one of the most important ones because of how much we still don't know in that realm of science alone. Combining that complexity with the information found in this paper gives new insight into why somatic psychology in all cultures saw a connection with nature as a crucial part of merging body and mind (Fine, 2010). Haidt (2006) also touches on this in chapter one which examines all the different divisions we face internally and externally day to day. He points out that every culture going back to the beginning of our species used domesticated and non-domesticated animals in metaphors about cognition. He also utilizes this as a segue into another observation. The effects of technology meant we altered our metaphors and answers based on it, but we still do not seem to be any closer to an answer.

Whether it is focusing specifically on trauma or not, studies of polyvagal theory and somatic work have also demonstrated what has been mentioned previously concerning the subtle and complex reactions between the four networks. Scientists can map to a degree what is happening now when someone is interacting with someone else, and they start to go through a roller coaster of thoughts, emotions, and autonomic responses (Rolef, 2015). LaPierre (2015) is very fastidious in describing how the new somatic therapies combine new and old approaches by encouraging the therapist and client to embrace this while the therapist maintains proper ethics and pulls from previous therapies based on what the client needs. Two she mentions are psychoanalytic, continuing the tradition of moving away from Freud's focus on drives, and existential-humanistic. She mentions a section of Roz Caroll's book that has an excellent analogy for this. It uses improvising jazz musicians as a metaphor for a therapist achieving this with a client. While one must be very careful with spirituality, studies have been done that prove it can

work (Correa & Sandage, 2018). Correa and Sandage (2018) advise the profession of counseling and psychotherapy should still tread carefully as it moves forward.

Trauma has been utilized a lot in recent studies directly or indirectly focusing on the DLPFC and vagus nerve interaction because of how much must go right for someone to heal from it. It comes from a combination of what the trauma is, the four major networks, and the various nervous systems (Fisher, 2003). Fisher (2003) shares with the reader how counseling and psychotherapy have altered old and recent techniques to address the body and mind in trauma therapy. These have led to other studies on emotion regulation and emotion disorders. Kosel et al. (2011) focus on one that has shown up several times in this paper: depression. Their study harnessed vagus nerve stimulation (VNS) therapy to gain a better understanding of cerebral blood flow (CBF) in depressed patients. Their results confirmed an earlier study that showed rCBF to the lDLPFC. Patients who had this from VNS saw improvements in their depression. Nakkas et al. (2022) balance focusing on what they were assessing for their study and clarifying for the reader what the current view is on polyvagal theory. In the section before they discuss the actual study the neurovisceral integration model (NIM) is used for comparison. Through this, the reader sees that the similarities in neuroanatomical structures between polyvagal theory and other concepts that have come out since are where it has validity. The effect of respiratory sinus arrhythmia (RSA) and how it should be measured is where the disagreements are focused. The authors ensure the reader still understands RSA has a lot of developmental importance. "Correspondingly, attenuated baseline RSA and excessive RSA withdrawal to emotional challenges have been observed in children and adolescents with mental health and behavioral problems (Beauchaine et al., 2013)" (Nakkas et al., 2022). The authors do not forget to elaborate on what happens if this continues into adulthood.

Conclusion

There was a purpose behind including so many articles that ended up covering so many different aspects of the body and mind. It was to hopefully give the reader the best overall picture of what studies have determined and all the paths one could go down in the future. It is undeniable now that the DLPFC is an important factor in human cognition. However, it interacts with so many other networks that many questions surround it. Although in the brain there are four major networks and the nervous system has two, new networks are being identified every day. The studies have made it clear that the order in which the connections are made and the different sections that connect are not always what our initial guess might be. These discoveries as well as our growing understanding of nature have also given new insight into the cultural similarities and differences in somatic psychology throughout history. This in turn has caused researchers to alter how religion and spirituality are incorporated into the profession. A therapist must be able to treat a person holistically while being ethical, no matter what their beliefs are. The new therapies that are trying to incorporate this are not necessarily attempting to create a lot of new interventions and techniques. They are just making a shift in perspective. It is very hard to say where the research will go from here but there are many exciting possibilities.

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