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Associations between attention, affect and cardiac activity in a single yoga session for female cancer survivors: An enactive neurophenomenology-based approach

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ABSTRACT

Yoga practice is reported to lead to improvements in quality of life, psychological functioning, and symptom indices in cancer survivors. Importantly, meditative states experienced within yoga practice are correlated to neurophysiological systems that moderate both focus of attention and affective valence. The current study used a mixed methods approach based in neurophenomenology to investigate associations between attention, affect, and cardiac activity during a single yoga session for female cancer survivors. Yoga practice was associated with a linear increase in associative attention and positive affective valence, while shifts in cardiac activity were related to the intensity of each yoga sequence. Changes in attention and affect were predicted by concurrently assessed cardiac activity. Awareness of breathing, physical movement, and increased relaxation were reported by participants as potential mechanisms for yoga's salutary effects. While yoga practice shares commonalities with exercise and relaxation training, yoga may serve primarily as a promising meditative attention-affect regulation training methodology.

1. Introduction

Contemporary yoga practice consists of lifestyle prescriptions, postures, breath regulation, and meditative techniques, all of which can be modified depending on the desired outcomes and health status of the practitioner (Bower, Woolery, Sternleib, & Garet, 2005). Emerging research suggests yoga not only shares many of the benefits of exercise but also adds yoga-specific psychophysiological regulation of attention, respiration, relaxation, and autonomic nervous system function (Evans, Tsao, Sternlieb, & Zeltzer, 2009; Khalsa, 2004). Studies comparing yoga and exercise indicate that, in healthy individuals and those with various health conditions, yoga can be as effective as more contemporary Western forms of exercise including walking, jogging, cycling, and aerobics at improving a variety of health-related outcome measures, including

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quality of life, mood, stress, and fatigue (Ross & Thomas, 2010). Within cancer treatment settings, yoga practitioners compared to controls show greater improvements in overall health-related quality of life, psychological health, stress-related symptoms, fatigue, and sleep indices (Boehm, Ostermann, Milazzo, & Bussing, 2012; Cramer, Lange, Klose, Paul, & Dobos, 2012a,b; Culos-Reed et al., 2012; Lin, Hu, Chang, Lin, & Tsauo, 2011; Smith & Pukall, 2009), though reported improvements have not been uniform (Zhang, Yang, Tian, & Wang, 2012).

Yoga practices are said to have numerous applications, ranging from spiritual liberation or *Kaivalya*, as per the Yoga Sutras of Patañjali (YS IV.34) (Bryant, 2009), to ordinary physical and mental training (Rao, 2011). However, the root aim of yoga can be summarized in Patañjali's definition of Yoga as a path towards "stilling the changing states of the mind" – *Chitta vritti nirodaha* (YS I.2) (Bryant, 2009). Briefly, the term *chitta* in Indian yogic philosophy is used to denote the mind or consciousness in its entirety and associated functions. *Chitta* can be considered, "the seat of one's cognition, volition, feelings and actions" (Rao, 2005, p. 13). *Vritti* refers to any permutation or activity of this mind or consciousness. According to Patañjali, these mental states are in a constant state of fluctuation or change (Rao, 1998). *Nirodaha* refers to the complete control or stilling of these mental activities so that one experiences the mind or consciousness unrestricted by this constant state of mental vacillation (Rao, 2012). Control of these changing mental states comes from persevering practice aimed at both attaining and maintaining states of mental stability and equanimity over long, uninterrupted periods of time (YS I.12-I.14) (Bryant, 2009). Importantly, meditative states subjectively experienced during yoga practice are related to neurophysiological systems that mediate both focus of attention and affect regulation (Rubia, 2009; Telles & Raghavendra, 2011).

These meditative states can be further divided into two broad categories (Lutz, Slagter, Dunne, & Davidson, 2008): (1) *focused attention meditation*, which entails voluntary sustained attention on a meditation object of choice, whether external or visualized images, words or sounds, or physical sensations, including the breath; and (2) *open monitoring meditation,* which involves monitoring the content of present-moment experience without focus on an explicit object per se. Both meditative states have correlates in the Yoga Sutras of Patañjali, in which they are referred to as *dharana*, which requires focused attention, and *dhyana*, open monitoring in which an expansive mental state is reached (Telles & Raghavendra, 2011). Of importance to both forms of meditation is the maintenance of an optimum level of arousal or activation (Lutz, 2007). One seeks to avoid the two extremes of dullness or tiredness on the one hand, and excitement or tension on the other. The mind is initially calmed and distractions are reduced via focused attention. From this calm and focused state the practitioner develops a foundation to enter into open monitoring, in which the focus shifts from the meditative object to present-moment experience (Lutz et al., 2008; Slagter, Davidson, & Lutz, 2011; Telles & Raghavendra, 2011). It is thought consistent practice of these skills lead to a trait-like change in which the regulative skills of focused attention are applied less and less frequently, open monitoring meditative states become predominant, and mental calmness and focus become progressively more effortless (Slagter et al., 2011).

The purpose of the current project was to utilize a neurophenomenology-based approach to investigate associations between attention, affect, and cardiac activity in a single yoga session in a group of female yoga practitioners who had survived a cancer experience. The present study also used several supplementary psychological theories to frame the posited attentional, affective, and psychophysiological responses to yoga practice. Theories include: the Effort-Related Attention Model, the Circumplex Model of Affect, the Dual-Mode Theory of Affective Responses to Exercise, and the Neurovisceral Integration Model.

1.1. Neurophenomenology

Neurophenomenology is a mixed-methods research approach used to investigate conscious experience (Lutz & Thompson, 2003; Thompson, 2006; Varela, 1996). The neurophenomenological approach provides mutually informative insights between subjective first-person experience, second-person dialogical enquiry stemming from interactions between research participants and the investigator, and third-person neuroscientific data. Neurophenomenology has been used previously to examine contemplative practices, particularly among advanced meditation practitioners using primarily electroencephalography (EEG) or functional magnetic resonance imaging (fMRI) to directly measure brain activity (Farb et al., 2007; Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008; Lutz, Greischar, Rawlings, Ricard, & Davidson, 2004; Lutz, Lachaux, Martinerie, & Varela, 2002; Lutz et al., 2009). Emerging research has called for an integration of neurophenomenology, cognitive and affective neuroscience, and psychophysiology – an "affective neuro-physio-phenomenology" (Colombetti, 2013) – to investigate the neurophysiological underpinnings of different attentional and affective states and their relationship to consciousness. This "enactive" approach directs neurophenomenology towards understanding the relationship between subjective experience and the entire psychophysiological organism (Colombetti & Thompson, 2008; Thompson, 2005).

1.2. Attention

To investigate how yoga practice regulates attention, we explored research in the area of exercise science to further frame our study. Briefly, focus of attention during exercise can influence changes in affective responses (Lind, Welch, & Ekkekakis, 2009). Attention within exercise settings can be defined as associative, or focusing on present-moment physical sensations related to exercise, while dissociative attention can be defined as focusing on non-exercise-related stimuli and diverting attention away from internal sensations and present exercise experience (LaCaille, Masters, & Heath, 2004). In accordance with the Effort-Related Attention Model (Tenenbaum, 2001), associative and dissociative attention strategies during exercise