The psychophysiology of motivation: Body and brain in action

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1. Motivation, Body, and Brain

Motivation can be briefly defined as the process that determines the direction and energization of behavior (Elliot, 2006). Motivation is concerned with action—the selection, preparation, and execution of goal-directed behavior. Thus, motivation research deals with understanding what organisms do, and how they do it.

The physiological processes that underlie and accompany the preparation and execution of action have always been a core research topic of psychophysiology. Programmatic research in psychophysiology started as an attempt to understand how the body prepares action and mobilizes resources to carry them out (e.g., Cannon, 1929; Duffy, 1957). A motivation research topic was also at the origin of psychological research on the brain. It concerned how cortical activation influences subjective experiences and performance and investigated which cortical arousal level is optimal for adaptation and well-functioning (Hebb, 1955). Other historical benchmarks of motivation research in psychophysiology were Obrist’s (1976) active-passive coping distinction and the specification of associated adjustments in the cardiovascular system, Gray’s (1987) theory of neural networks and processes that underlie motivational directions, Fowles’ (1988) identification of concomitant processes in the peripheral nervous system, Dienstbier’s (1989) analysis of psychoendocrinologic and autonomic adjustments that support performance and adaptation, or, more recently, Berridge’s (2004) identification of neural systems involved in wanting (i.e., goal striving) vs. liking (i.e., outcome consumption)—to name a few.

2. The Comeback of Motivation in Psychology
Other areas of psychology have seen more ups and down in the interest to understand motivation compared to the field of psychophysiology. Some decades in psychology research on action were dominated by pure cognitivism and the belief that understanding how organisms process information in a computer-like fashion would be sufficient to understand why and how they act. However, recent years have seen an impressive revival of motivation research in nearly all sub-disciplines of psychology and other scientific domains like economy, law, or political science. A new international society devoted to motivation research—the Society of the Study of Motivation—was recently founded, international research conventions exclusively focusing on motivation are held regularly, and new publication outlets specialized in motivation research, like the journal Motivation Science, and the series Advances in Motivation Science, have been launched. Additionally, several motivation handbooks have been published (e.g., Shah & Gardner, 2007; Ryan, 2012; Vohs, & Baumeister, 2016), integrating motivation research from different areas and perspectives. Motivation research is back to psychological science’s center of attention.

3. The Need For an Overview

As outlined above, there is a vital interest in how the body and the brain are involved in the preparation and execution of action. This is evident in the high number of motivation-related articles that have appeared in the International Journal of Psychophysiology, its close neighbor journals Biological Psychology, Psychophysiology, and the Journal of Psychophysiology, and many other publication outlets that occasionally publish psychophysiological research. But despite this high research interest, overviews integrating different contemporary perspectives on the psychophysiology of motivation are hardly
available. Some exceptions have been an edited volume on cardiovascular processes in motivation (Wright & Gendolla, 2012) and another volume on psychobiological processes in self-regulation (Gendolla, Tops, & Koole, 2015). But those volumes focused on specific aspects of motivation and physiological processes. An overview and concomitant in-depth examination of current research on the psychophysiology of motivation at large is still lacking. This special issue tries to fill this gap by providing an overview of the state of the art and recent developments in research on psychophysiological processes involved in motivation. The special issue includes both review papers and novel empirical studies to provide an integrative summary covering multiple psychophysiological processes and methods and focusing on both basic and applied research topics ranging from fundamental processes on the neural level to psychopathologies related to motivation.

4. **The Organization of This Special Issue**

The current special issue consists of 15 articles contributed by researchers located in a variety of laboratories and countries and is organized in four sections. Each section addresses unique aspects of the psychophysiology of motivation. The stage is set by two articles in Section I that present general conceptual perspectives, which are highly relevant for the study of the psychophysiology of motivation and research on the mind-body interaction in general. Richter (2017 – this issue) discusses ways, recommendations, and limitations related to the interpretation of physiological signals as indicators of mental states with a special focus on motivation. Silvestrini (2017 – this issue) presents an integrative analysis of psychological and neural mechanisms that are associated with cardiovascular response in cognitive control.
The other three sections focus on more specific processes and aspects of the psychophysiology of motivation. Section II highlights central nervous system processes in motivation. It starts with a review of research on the relationship between motivational direction and frontal cortical activity by Kelley et al. (2017 – this issue). This is followed by another conceptual article by Saunders et al. (2017 – this issue), presenting both theory and unique research on the emotive function of conflict monitoring in the medial prefrontal cortex. Next, Tops et al. (2017 – this issue) present a theoretical analysis and supporting research of neural networks and cortical lateralization involved in motivation and emotion. This is followed by a research article by van de Groep et al. (2017 – this issue), presenting a study on the effect of individual differences in dopamine system functioning on cognitive performance in a high-stake situation. Finally, Fairclough and Ewing (2017 – this issue) present research on the effect of task demand and incentive on central nervous system and cardiovascular responses.

Section III merges five articles highlighting the role of the autonomic nervous system activity in motivation. This section starts with a research article by Parisi et al. (2017 – this issue), reporting a study on the effect of stimulus valence, intensity, and predictability on defensive motivation reflected by the startle reflex. This is followed by a research article by Mlynski et al. (2017 – this issue), presenting a study on the link between fatigue and effort-related cardiovascular response during cognitive performance. Also, the third article in this section by Zafairiou and Gendolla (2017 – this issue) deals with cardiovascular response and reports a study that investigated the joint effect of implicitly processed age-primes and incentive on cognitive effort mobilization. The next contribution is a research article by Kuipers et al. (2017 – this issue) on cardiac responses in cognitive control. Finally, Kreibig (2017 – this
issue) presents an article highlighting the logic behind and the methods of computational reproducibility of physiological data from different autonomic nervous system activity indices, with an empirical example for findings in the psychophysiology of motivation.

This special issue closes with Section IV, which focuses on psychophysiological processes related to psychopathologies in motivation. The section starts with a conceptual article by Beauchaine and Zisner (2017 – this issue) presenting an integrative analysis of the role that brain systems, which are involved in emotion regulation and motivation, have in psychopathology. This is followed by a research article by Brinkmann and Franzen (2017 – this issue), reporting a study on the effect of depressive symptoms on impaired social reward sensitivity expressed by blunted effort-related cardiovascular response. Finally, Allali et al. (2017 - this issue) report an empirical study on the impact of apathy on higher levels of gait control in the context of motor and cognitive performance.

5. Concluding Thoughts

Taken together, the 15 articles of this special issue provide a broad overview over recent development and new insights in processes reflecting the mind-body interaction in the context of the preparation and execution of action—the psychophysiology of motivation. The 15 articles highlight a high number of motivation-related psychophysiological processes, covering processes in both the central and peripheral nervous systems in healthy individuals and persons suffering from motivation-related psychopathologies. That way, this special issue conceals many recent insights in the psychophysiology of motivation and provides information about progress and a momentary state of insight.

Without claiming that the here presented articles report the “final truth” or that they
are fully representative of all research activity in the psychophysiology of motivation, I am sure that this special issue gives a state of the art overview over a high number of important new insights and theoretical and empirical developments related to an old, maybe even classic research question in psychophysiology—how body and brain are involved in the preparation and execution of action. I would like to thank all authors of the present contributions for their valuable work that made this summary of new insights in the psychophysiology of motivation possible.
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