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Musicians' psychophysiological activation before, during, and after performance and the moderating effect of anxiety

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Purpose: A comprehensive view on the time dynamics of the psychophysiological responding in a music performance context and how this responding is influenced by music performance anxiety (MPA) is largely lacking. The present study aimed at assessing (a) the affective experience, self-perceived somatic symptoms, and cardiorespiratory parameters and (b) the moderating effect of MPA before, during, and after a private and a public performance in 66 music students. **Method:** Participants underwent individual testing during three sessions (baseline, private, public), each separated by approximately one week. The private and the public sessions encompassed a warm-up phase to tune the instrument or the voice, a pre-performance phase (in a preparation room), a performance phase (in an adjacent concert room), and a post-performance phase (again in the preparation room). Each phase lasted for approximately 10 minutes. The only difference between the private and the public session was the presence of an evaluative audience and an audio recording of the performance in the public session, whereas the musicians were performing alone in the private session. All sessions took place in music schools. The electrocardiogram, respiratory volume and time parameters, and accelerometer ACC data were assessed with the LifeShirt system (VivoMetrics, Inc, Ventura, CA), a noninvasive ambulatory assessment device acquiring and storing data continuously. The LifeShirt is a snugly fitting t-shirt using respiratory inductive plethysmography. End-tidal pCO₂ (PetCO₂) was recorded by means of a nasal canula connected to a nondispersive infrared CO₂ monitor (Microcap Handheld Capnograph; Oridion Medical 1987 Ltd, Jerusalem, Israel). **Results:** Heart rate, minute ventilation, and all self-report variables (anxiety, tension, shortness of breath, difficulty breathing, palpitations, trembling, sweaty hands) increased in the public session compared to the private session. Furthermore, all variables were higher (respectively lower for the total breath duration) during the performances than before or after. The differences between the phases were larger in the public than in the private session for almost all variables. After the public performance, minute ventilation and heart rate did not recover to the same levels as after the stress-free private performance session. Finally, while higher MPA scores were associated with higher scores and with larger changes between sessions and phases for self-reports, this association was less coherent for the physiological variables. PetCO₂ increased from the private to the public session for musicians with low MPA levels and decreased for musicians with high MPA levels; heart rate, minute ventilation and total breath duration did not show MPA-dependent differences in the response pattern between the private and the public session. **Conclusion:** This study makes a novel contribution by showing how the presence of an audience influences low- and high-anxious musicians' self-reported affective experience, somatic symptoms, and cardiorespiratory parameters before, during, and after a performance. The hypothesis of a hyperventilation tendency in high-performance-anxious musicians is supported. Yet, overall, the findings are more consistent with models of anxiety that emphasize the importance of cognitive factors as opposed to physiological ones in the experience of MPA. **Keywords:** psychophysiology; performance; musicians; music performance anxiety (MPA); stage fright; reactivity; recovery