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Respiratory inductive plethysmography measurements on professional reed woodwind instrument players

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Abstract
Respiratory movements and lung volume variations during natural performance of wind instrument playing have been scarcely documented in the literature, but may provide a deeper insight into performance techniques, players’ physiological characteristics as well as into the physics of the instruments. Using Respiratory Inductive Plethysmography (RIP) respiratory movements of eight professional players (oboe, clarinet, alto-saxophone, bassoon) were measured during playing of exercises and orchestral solo voices. Calibration of the relative contribution of abdominal wall and rib cage regions was achieved from isovolume manoeuvres. Pneumotachometry was applied for absolute calibration of the RIP. Flow through a standard aerodynamic resistance at constant pressure was used for assessing the method of measurement under dynamic conditions. Different possible artifacts are described and discussed. The method yielded linear and accurate results, provided that significant body movement is absent, appeared to be non-disturbing to the musicians, accurate and robust. Depending on instrument and piece the players initiated the breath groups at 55% - 87% and terminated them between 14% - 52% of their vital capacity. Unlike what has been found for singers, the players generally showed simultaneous and in many cases equally important contributions from rib cage and abdominal wall during playing. In extreme cases, inhalations were achieved in approximately 300 ms and reasonably synchronised with the RIP signals.