

# **Myoelectric Prosthesis Control: Does Augmented Feedback Improve Internal Model Strength and Performance?**

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## **ABSTRACT**

Amputees lack some of the sensory information that able-bodied persons incorporate in the use of their limbs; as a result, the control of myoelectric powered prostheses requires constant visual attention and a high level of concentration, which may lead to poor performance. Recent advances in signal processing and sensory technology have enabled the development of various methods of sensory feedback, including auditory, vibrotactile and electrotactile, which may be used to augment the feedback provided to prosthesis users. Researchers have explored the advantages of this augmented feedback by looking at the short-term performance results, but have not explored its effect on the development of the user's internal model, which affects the long-term performance. In this work, we investigate the notion that some controllers provide better short-term performance at the expense of providing inadequate feedback to develop a strong internal model, whereas other controllers may provide adequate feedback, but at the expense of more noisy control signals. We hypothesize that augmented feedback may be used to mitigate this tradeoff, ultimately improving short and long-term control. Using psychophysical assessment tools, we measured the internal models developed for three myoelectric controllers: 1) raw control with raw feedback (RCRF), such as a regression, 2) filtered control with filtered feedback (FCFF), such as a classifier, and 3) filtered control with audio augmented feedback (FCAF), such as a classifier control with augmented regression feedback. We assessed the short-term performance of these three control interfaces using a multi degree-of-freedom constrained-time target acquisition task. Results obtained from 30 able-bodied subjects showed that the FCAF control strategy enabled the development of a stronger internal model than FCFF, better accuracy and path efficiency than RCRF. These results support our hypothesis that the use of augmented feedback control strategies may improve both short-term and long-term performance.