
Imaging skin deformation during pincer grasp.

Sophie Du Bois De Dunilac^{*1}, David Córdova Bulens¹, and Stephen Redmond¹

¹University College Dublin [Dublin] – Ireland

Abstract

Tactile feedback is crucial for dexterous manipulation, but the underlying mechanisms are not well understood due to the complex interplay between predictive and feedback control in setting our grip force (GF) in response to varying load forces (LF). The GF-LF relationship has been investigated for decades using instrumented objects that measure forces, but these instrumented objects do not measure tactile feedback. Recent developments in skin strain imaging have provided a proxy measurement of tactile feedback during the manipulation of such instrumented objects. However, these instrumented objects only image a single finger, providing an incomplete picture of cutaneous tactile feedback.

To address this limitation, we present a novel instrumented object capable of imaging both the index finger and thumb in a pincer grasp with high contrast. Our pilot study aims to investigate the beginning of grip and lift phases using a size-weight illusion paradigm which renders visual cues and anticipatory scaling of GF unreliable. Without the ability to reliably predict the GF, we expect any subsequent GF adjustments to be informed by tactile feedback, including cutaneous sensation from the finger and thumb. We anticipate that our device will provide a more comprehensive understanding of the role of tactile feedback in GF adaptation.

Our pilot study's findings may help establish a causal link between partial slips and grip force adaptation, shedding light on the underlying mechanisms of dexterous manipulation.

Keywords: Instrumented object, Grip force, Tactile feedback

^{*}Speaker