Wag Your Tail and Flap Your Ears: The Kinesthetic User Experience of Extending Your Body

Dag Svanæs*
Martin Solheim
Department of Computer and information Science
Norwegian University of Science and Technology
7491 NTNU
Norway

dags@idi.ntnu.no,
martin.solheim@me.com

* Also at: IT-University of Copenhagen, Denmark.

CHI'16 Extended Abstracts, May 07-12, 2016, San Jose, CA, USA
ACM 978-1-4503-4082-3/16/05.
http://dx.doi.org/10.1145/2851581.2890268

Abstract
As digital technology moves closer to the user's body, exemplified with smart watches and wearable computing, it becomes important to better understand how to design for the living human body. We report from two design projects involving mechanical body extensions for use in theatre settings. The resulting mechanical tail and ears are described, and we report on the users' experience with applying these body extensions on stage. The lessons learned are related to Merleau Ponty's phenomenology of *the lived body* and Don Norman's concept of mapping.

Author Keywords
Body-centric interaction design; Mechanical body extensions; Phenomenology; Merleau-Ponty.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Digital technology is currently moving closer to the user's body, exemplified with smart watches, digitally enhanced sports equipment, miniaturized bio-sensors and wearable computing. This poses a number of

Figure 1: The mechanical tail, worn by one of the authors.

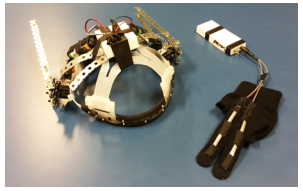

Figure 2: The mechanical ears and glove (above), being fitted to the actor (below).

challenges to interaction designers and to HCI as a research field, both concerning the need for new design practices and in relation to theoretical foundations for embodied interaction. To supplement our attempts at building a theoretical foundation for body-centric interaction design [1] with more cases for reflection, we got involved in a couple of design projects building mechanical body extensions for the stage. The projects were open-ended, and followed a research-through-design approach, although with the aim of contributing to theory building.

Designing for the lived body

The French philosopher Merleau-Ponty's concept of *the lived body* has been an important inspiration for the current work (see [1]). *The lived body* is our experienced body, the body through which we live our lives, which is different from seeing the body as an object in the world. Designing for the body with the first-person perspective of Merleau-Ponty makes us aware of how technology is incorporated into the experienced body, and how it thus changes us. One interesting design challenge concerning such technology is how to make it easy for the body to learn to use the artifact, so that it becomes a natural part of the living body and thus can take advantage of the user's "bodily-kinesthetic intelligence".

The tail

The first body extension project was to make a mechanical tail for the main character in Ibsen's *Peer Gynt*. The resulting tail is approx. 80 cm long and is worn in a belt (Figure 1). It consists of piano wires and 3D-printed joints, and is controlled by two servos, one for each degree of freedom (up-down, left -right). In the first version of the tail the servos were controlled externally with a remote control. The remotely controlled tail was tried on stage by the actor playing Peer in two rehearsals, but was rejected because wanted to control the tail himself. The tail was consequently moved from the main character to a troll in the play. In an improved version, the tail is controlled by the user using an IMU (accelerometer and gyro) on the hip and a mini Arduino. We learned from this that even with scripted movements such as in a play, the user should be in control and there must be a tight coupling between user and the artificial limb.

The ears

In the next project we were asked to make artificial movable ears for an elephant character in a play for children (Figure 2). Based on the experience with the tail, we chose to let the actor control the movements of the ears with bend sensors on a glove. The sensor data were sent through Bluetooth to a mini Arduino controlling the ears. Care was taken to make the *mapping* [2] between fingers and ear movements as simple and direct as possible. The actor found the glove to provide a very a natural interaction, and it enabled him to explore innovative ways of using the ears as a means of expression in the play.

Conclusions

The design of mechanical body extensions for the stage has provided rich cases for reflecting on the theoretical foundations for body-centric interaction design.

References

1. Svanæs, D. Interaction design for and with the lived body: Some implications of Merleau-Ponty's phenomenology. *ACM Transactions on Computer-Human Interaction* (TOCHI), 20(1), 8.
2. Norman, D. A. *The design of everyday things: Revised and expanded edition*. Basic books, 2013.