How to Build a Hard-to-Use Mouse

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ABSTRACT
Computer games do not afford much physical activity and hence do not require significant energy expenditure, which can contribute to the prevalence of a sedentary lifestyle. A "hand exerciser" handgrip can help strengthen hand and forearm muscles through a simple spring mechanism. We are presenting the mousegrip, an exertion interface to control computer games while simultaneously exercising hand and arm muscles based on a handgrip device. Unlike conventional vision or accelerometer-based exertion interface devices, the mousegrip is very low-cost and supports cheap force-feedback through a simple spring mechanism. Due to its low cost, its mobile form factor and compatibility to existing mouse drivers, the mousegrip can augment traditional mouse interactions with an exertion activity to make exercising more enjoyable, and gameplay healthier. It provides a familiar affordance of interaction and supports increased calorie expenditure, hence contributing to people's fitness. We hope to encourage other researchers to incorporate exertion activity into their interfaces in order to support a healthy lifestyle.

Categories and Subject Descriptors
H5.2. Information Interfaces and presentation (e.g., HCI): User Interfaces.

General Terms
Human Factors, Design.

Keywords
Handgrip, exercise, Exertion Interface, physical, tangible, sports, active, exhausting, RSI, sweat.

1. INTRODUCTION
The western world faces an escalating obesity problem, mainly due to the lack of activity in our sedentary lifestyles; children in particular are affected [4][6].

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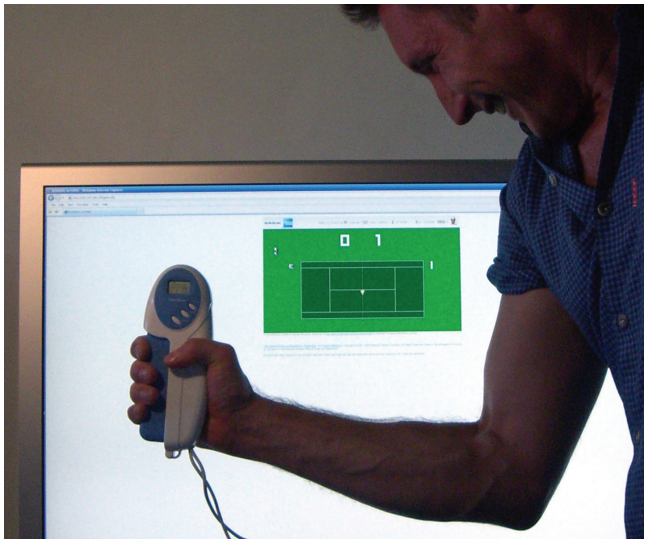

Figure 1. Player playing Pong using the mousegrip.

Incorporating dedicated exercise programs into one's life can increase the energy expenditure and address the energy intake imbalance. However, not everyone enjoys sports or has the time to engage in dedicated sports games. On the other hand, incorporating moderate physical activity on a regular basis can contribute to a healthier existence and work against the pitfalls of a sedentary lifestyle. Computer games, in particular, are often criticized for facilitating a "couch potato" experience. Button presses on game pads and joysticks do not afford high energy expenditure. In contrast, a "hand exerciser" handgrip is a small device that can help strengthen a user's grip and improve the hand's motor skills and increase circulation (according to our handgrip's manual). It can be used in high repetitions for endurance training, and rock climbers use it to strengthen their finger, hand and forearm muscles. It has also been suggested as a stress management tool. Users hold the handgrip device in their hand and try to make a fist, pressing against a built-in spring mechanism. The more force is applied, the more the spring is squeezed together and the stronger the workout is. Some studies that advocate the benefits of using handgrips suggest that handgrip exercises can help lower blood pressure [1]. Others suspect a correlation between handgrip strength and a person's overall strength [5] and some suggest usage by musicians. However, exercising with a handgrip is a very repetitive and mundane activity. It usually does not offer any quantifiable feedback and the force exhibited is not utilized any further.

2. MOUSEGRIP

We have augmented a handgrip device with user input technology to allow health conscious gamers to exercise their hand and forearm muscles while being engaged in a computer game. The pressing action exhibited on the handgrip controls the avatar on the screen. Our current implementation emulates a standard mouse, and is therefore suitable for a wide range of PC games. Furthermore, it is platform independent. The stronger the force the user applies to the handgrip device, the further the mouse cursor travels. Figure 1 shows a user with our prototype controlling an unmodified Pong game that runs in a browser via Shockwave [2]. The game is normally played with a conventional mouse, however, simply plugging in our prototype allowed the user to play and exercise with the handgrip. The pressing action required can exhaust the user very quickly, therefore the device satisfies the requirements for an *Exertion Interface* [3]. It deliberately makes the interaction physically demanding and exhausting, unlike the interaction with an original mouse. We call our prototype *mousegrip* due to its synergy of a handgrip device and a computer mouse.

3. IMPLEMENTATION

The *mousegrip* prototype was built mainly out of two components: a commercially available handgrip and the parts of a used mechanical computer mouse. We augmented the handgrip with the electronics of the mouse so that the pressing action of the handgrip is measured by the infrared receivers of the mouse hardware. Due to the fact that these are original mouse components, no special driver is required, and the mouse cursor reacts natively to the instructions of the *mousegrip*. Any application that uses a mouse input is therefore suitable for the *mousegrip*.

4. WORK IN PROGRESS

Due to the nature of a handgrip device, a *mousegrip* can only support mouse movements along one axis. It is therefore currently suitable for games that use one axis, such as Pong or the iPod games. The Blackberry device demonstrates that PDA applications can be controlled via one axis through its thumbwheel interaction. In order to control the mouse in the horizontal and vertical axis, we are currently building two handgrips, one for each hand.

5. BENEFITS

The main benefits of our *mousegrip* are its size and cost: the handgrip fits comfortably in the palm of a hand and takes up little more space than a traditional mouse on a desk. Although the current version is wired, replacing the assembled electronics with components from a wireless mouse could turn the handgrip into an un-tethered version, allowing for more mobile use. Due to the fact that it uses a standard mouse driver, the *mousegrip* could be used to control miniature PCs or PDAs with mouse drivers while on the go.

The original handgrip we modified cost less than $US 10. We built the interface to the computer out of an old mouse, hence the total cost for the current prototype was approximately $US 15, including additional cables.

6. CONCLUSION

We have presented *mousegrip*, a low cost input device for computer games that affords exertion of the hand and forearm muscles. It is easily implemented because it uses standard mouse drivers and is therefore platform independent. The *mousegrip* can be used discreetly and spontaneously due to its small size. It supports simultaneous participation in exercising and playing games, making the exercise appear less mundane and more fun. Our prototype aims to make the computer game experience beneficial for general health and fitness. The *mousegrip* has potential to be easily modified to support wireless transmission for mobile use. We believe the *mousegrip* can promote and support physical activity in computer games for a very low cost. It can provide a valuable augmentation to traditional input devices due to its health benefits and can therefore have a positive impact on people's lives.

7. REFERENCES

[1] Hitti, M. Handgrip Exercises May Lower Blood Pressure. WebMD Oct 8, 2004. http://www.webmd.com/content/article/95/103180.htm

[2] http://stoppong.com.au

[3] Mueller, F., Agamanolis, S., Picard, R.: Exertion Interfaces: Sports over a Distance for Social Bonding and Fun. In Proc. CHI 2003. Fort Lauderdale, USA: ACM Press, USA (2003)

[4] Stettler, N., Signer, T., Suter, P. Electronic games and environmental factors associated with childhood obesity in Switzerland. In Obesity Research. 2004. 12:896–903

[5] Top End Sports. Handgrip strength test. http://www.topendsports.com/testing/tests/handgrip.htm

[6] Vandewater, E., Shim, M., Caplovitz, A. Linking obesity and activity level with children's television and video game use. In Journal of Adolescence, Vol. 27, Issue 1, Feb. 2004, 71-85.