Eight New Input Devices—Eight New Ways to Move

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Abstract
We present 8 input device concepts that can be used to retrofit existing applications such that they allow or require physical activity.

Keywords
Pointing device, hardware, optical sensor, mid-air input, 10 foot user interfaces, exertion interfaces.

ACM Classification Keywords
H5.2 [Information interfaces and presentation]: User Interfaces. Input devices and strategies; B 4.2 Input Output devices

Introduction
One approach to exertion interfaces is to create installations that combine a customized input device with a specific game concept, such as Break Out for Two [2] or Dance Dance Revolution [3]. In this paper, in contrast, we propose retrofitting existing applications with an exertion component. In step 1, we modify common input devices such that they *allow* users to move around. In step 2, we add functionality that *requires* users to move. We present 8 concepts. All of them—except soap [1]—are design mockups with no functional electronics yet.

Modifying input devices so users can move
We have modified a series of existing input devices such that they allow users to leave their desk: trackball Figure 1, touchpad Figure 2, mouse Figure 3 and 4 [1].

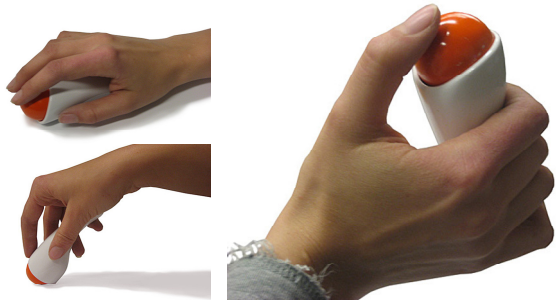

Figure 1: *Tri-track* is a trackball that can be operated as a pen or as a mobile trackball. A strong magnet holds the ball in place.

Figure 2: The *brush* is a one-handed touchpad designed for mobile use. The handle in the back of the device makes sure it stays put during physical activity.

Figure 3: Users can operate *thigh mouse* without a desk. Retractable rubber feet prevent it from slipping.

Figure 4: *Soap* is a combination of mouse and mouse pad in a single device [1]. An optical sensor inside the device is looking outwards. As the user drags the hull across the core, the optical sensor perceives the motion. Unlike accelerometer-based solutions, shaking the device does not affect input, allowing users to use soap while running or exercising.

Four devices that require physical activity

Early "exertion" computer games, such as *Summer Games* [5], required users to move a joystick back and forth to make the game character row faster, etc. Coin-up games offered more sophisticated input devices, such as life-size paddles for rowing a boat. On the flipside, these devices were so specific that they were useful only for the game they were designed for. They also required a substantial amount of space.

Here are 4 input devices that take a middle road. They take a known device concept, such as a game controller and add an aspect that requires physical action.

Figure 5: Users click the mobile trackball *guppy navigator* by tapping its white sensor stick against the user's arm, a table, or a wall.

Figure 6: The *D7 game controller's* center joint offers more degrees of freedom than *MS Side Winder Dual Strike* [4]. Operating the joint is designed to require physical effort. The actions shown are left/right, forward/back, shear, & up/down.

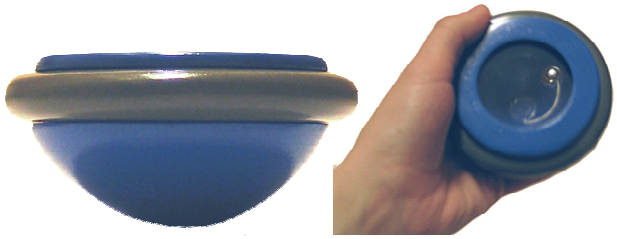

Figure 7: The faster a user moves *Orbiter* in a circle, the faster the marble inside spins and the more energy is given to the user's game character or the faster a web page scrolls.

Conclusions

We have presented eight input device concepts designed to allow or require physical activity. Unlike existing exertion interfaces, (1) all devices are application-agnostic and each one is compatible with an existing input device class, making it easier to retrofit existing applications with exertion characteristics. (2) All the devices we have presented are mobile and portable, making them suitable for non-arcade use, such as a living room or on the go.

Next steps will involve the creation of functional prototypes and the evaluation of these prototypes.

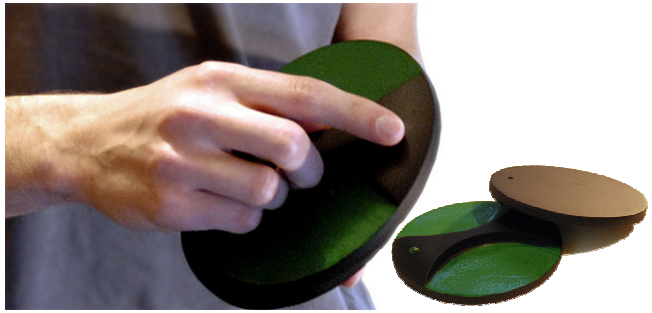

Figure 8: *Defibrillator's* two disks can be thought of as mouse and mouse pad. The size of the pads allows keeping them in contact without requiring visual attention. During fast-paced games, users accelerate their game character by rapidly rubbing the disks against each other.

Acknowledgements

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References

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[5] http://en.wikipedia.org/wiki/Summer_Games