

WHAT IS HAPTICS???

A (VERY) BRIEF HISTORY

Revesz first introduced the term “haptics” in 1931. The origins of this word can be traced back to the Greek words *haptikos* meaning *able to touch* and *haptesthai* which translates to *able to lay hold of* (Revesz, 1950; Katz, 1989). Today the term, in its broadest sense, encompasses the study of touch and the human interaction with the external environment via touch. The field of haptics, inherently multidisciplinary, involves research from engineering, robotics, developmental and experimental psychology, cognitive science, computer science, and to a much lesser extent, educational technology.

HAPTIC DEVICES

The study of haptics has grown dramatically with the advent of touch in computing as many researchers are involved in the development, testing, and refinement of tactile and force feedback devices, as well as supporting software that allow users to sense ("feel") and manipulate three-dimensional virtual objects (McLaughlin, Hespanha & Sukhatme, 2002). Haptic devices can provide force feedback (simulating object hardness, weight, and inertia) and/or tactile feedback (simulating surface contact geometry, smoothness, slippage, and temperature) by employing physical receptors (tactile and kinesthetic) that gather information for the haptic system, which attempts to draw conclusions about a local object or environment (Jacobson, Kitchen, & Golledge, 2000). All haptic interface devices share the unparalleled ability to provide for simultaneous information exchange between a user and a machine as depicted in Figure 1. For a more complete description of the currently available haptic devices and user interfaces, see Hayward et al. (2004).

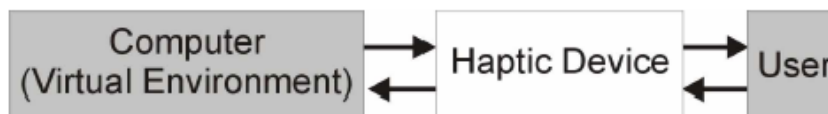


Figure 1. An illustration of the bi-directional information exchange unique to haptic interfaces.

Haptic feedback devices vary in sophistication and fidelity. One such variation is in the degrees of freedom (DOF) it affords the user. A DOF refers to a direction of movement such that a 6-DOF device allows for right-left movement (X), up-down movement (Y), forwards-backwards movement (Z), roll (rotation about the Z axis), pitch (rotation about the X axis), and yaw (rotation about the Y axis).

A LOW-COST SYSTEM

There have been relatively few studies that have directly investigated the impact of incorporating this technology into the teaching-learning process. This may in part be due to the fact that the cost of implementing these devices at present is quite high. Although the price of the interfaces have dropped considerably since their debut in the 1990's, it is unlikely that one would find an existing school computer lab outfitted with them. Recently, Novint Technologies, Inc. (<http://www.novint.com/>) unveiled its Falcon. This haptic interface is a 3-DOF force feedback device (Figure 2). The Falcon is able to track 3-DOF (x, y, and z coordinates) in a computer generated virtual environment and provide force feedback corresponding to these movements.



Figure 2. The Falcon by Novint Technologies Inc.

This device retails for around \$200 and is available in mass market quantities. Perhaps the combined affects of a growing research base and more affordable interfaces will lead to an increased use of haptics in the educational setting.

REFERENCES

- Hayward, V., Oliver, R. A., Cruz-Hernandez, M., Grant, D., & Robles-De-La-Torre, G. (2004). Haptic interfaces and devices. *Sensor Review*, 24, 16–29.
- Jacobson, R. D., Kitchen, R., & Gollodge, R. (2002). Multimodal virtual reality for presenting geographic information. In P. Fisher & D. Unwin (Eds.), *Virtual reality in geography* (pp. 382-401). New York, NY: Taylor & Francis, Inc.
- Katz, D. (1989). *The world of touch* (L. Krueger, Trans.). Hillsdale, NJ: Erlbaum. (Original work published 1925)
- McLaughlin, M., Hespanha, J., & Sukhatme, G. (2002). *Touch in virtual environments: Haptics and the design of interactive systems*. Upper Saddle River, NJ: Prentice Hall.
- Novint Technologies, Inc., <http://www.novint.com/>
- Revesz, G. (1950). *The psychology and art of the blind*. London: Longmans Green.

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