

A Critique of Mackenzie's Analysis of Keyboard and Mouse Workload Biases

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No one has ever said that the keyboard/mouse set up currently used to interact with the desktop computer was perfect. However, Mackenzie has a very strong opinion about unbalanced division of work this environment forces on the user. His position is technically valid, however only proven by engineering models such as Fitts' without many other considerations for the user, task, or environment.

In Mackenzie's article, we are asked to consider the keyboard. There are three types of keys available: symbol keys (letters, numbers), executive keys (backspace, Function, etc.), and modifier keys (shift, control, etc.). He notes that although most modifier keys are mirrored in the layout for both left- and right-hand use, several many executive keys (such as the return, backspace, and arrow keys) are not. When a mouse is not in use, the right hand is responsible for over 80% of the executive keys. When a mouse is introduced, there is an even greater unbalance of work performed by the right hand because it is now responsible for over 80% of the executive keys and control of the mouse. While their right hand is on the mouse, the user now has the option of reaching over with their left hand to access these executive keys, or to release the mouse and access the executive keys with their right hand. Very Fitt's un-friendly, and this is Mackenzie's argument, but are the implications really that great?

Additionally, Mackenzie disregards Microsoft's scrolling wheel solution with the Intellimouse. His argument is the same as before, and the additional demands for the right-hand only increases what he calls "power-key bias". He proposes a more "balanced" solution of a touch strip (or scroll bar) where scrolling is delegated to the left hand. Indeed this has been considered by hardware manufacturers (Logitech, among other keyboard vendors have models which include a scroll option on the left of the keyboard), however I do not to expect to see an abandonment of the mouse scroll wheel in the future.

I believe that Mackenzie has failed to consider ethnographic variables which would effect a user's behavior with the keyboard and mouse. First, consider the executive keys for which Mackenzie feels over-burdens the right hand. These include Insert, Print Screen, Pause/Break, Home, End, Delete, Page Up, Page Down, and the arrow keys. Surely, there are a lot of keys for the right-hand to be responsible however their percent usage is minimal and in reality the number of *frequently used* executive keys is much more balanced.

Using the web as an example, it is a different kind of argument with the same conclusion. Web page interaction is simply point-and-click with very little or no input from the keyboard. According to Mackenzie's argument, web usage is even more right-hand biased than normal desktop computer usage. However, consider the motor tasks of the right hand. The right hand (or the dominant hand) is dedicated to navigation, whether it be clicking or scrolling. The rest of the user's attention is dedicated to the task at hand, often scanning, reading, or comprehending content. If Mackenzie's solution were implemented in the environment, the navigation tasks would be spread between two hands rather than one. Now, instead of having one hand dedicated to a single cognitive function – navigation – the user must now position a new hand (which often may need to be positioned) and coordinate motor actions between the two hands and navigate the page. His solution seems unreasonably complex for an set of actions which are easily grouped in to a single function.

To be fair, many advanced uses often offset many mouse-enabled interactions with left-hand key-stroke combinations. My experience with desktop environment design and advanced users would lead me to conclude this is more of a function of time rather than fatigue as many keyboard short-cuts are faster than using the mouse. I have also experienced beginner and novice users who prefer using the mouse for most or all navigation, using a single interaction metaphor rather than introducing an additional one in parallel.

In conclusion, Mackenzie's argument of unbalanced work delegation is valid – in a sterile lab environment devoid of all independent variables. In reality, real-life usage *is* the independent variable and scientists should strive to gather more ethnographic proof before using numbers to justify behavioral changes. Fitts' has been successfully applied to many applications from cockpit displays to icon placement in interface designs. It is a useful and powerful law however it has its appropriate applications, the suitability of a scroll wheel mouse not being one of them.

(This critical analysis has not considered the additional ergonomic strain including a mouse wheel would induce. There are better areas suited for improving that issue, such wrist angle and button position.)

References:

Mackenzie, S. (2003). Motor Behavior and Models for Human-Computer Interaction. Chapter 3 in HCI Models, Theories, and Frameworks, Carroll, J., editor. Morgan Kaufman Publishers. pp.48-53.