State of the Art

Fitts’ Law

Fitts [1] published in 1954 his law that represents a model for human movement to predict the time that it takes for a user to move from an origin to a target. This law establishes the relationship between time, distance and accuracy for aimed movements. He created a function that measures speed and accurary in pointing tasks. This model could be used in the real world or in digital devices because this law applies to actions like pointing and dragging like using a computer mouse or pointing in a touchscreen. This model is used in human-computer interaction investigations to predict user behivour [2].

Scott MacKenzie [12] addapted the formula to be *MT= a + blog2(A / W + 1)* where MT represents the movement time, a and b are the empiric constants that are adjusted to the specific device used. A is the amplitude or distance from the initial point to the center of the target. W measures the width of the target and could also represent the accuracy of the pointing task as it sets the limits of the action. Fitts’s ID or index difficulty determines the movement difficulty and has units of bits [13]. The most used formula for ID is Shannon formulation proposed by MacKenzie [14] ID = log2(A / W + 1).

Hick’s Law

Hick’s Law represents a way to predict the time used to make a decision when a multiple choice task is evaluated. This law can measure the capacity for cognitive information. The function to evaluate the required time, T, to choose among n choices is T = b log2(n + 1). This time, known as the *rate of gain of information*, is logarithmic beause people divide possible options into categories instead of evaluating one by one so they discard part of them.

Gender

One study performed in 2007 [4] with Chinese and British university students analyses the sex differences in the use of computers and Internet and claims that men start using computers earlier that women, more than five years before for british men students in this study. It also suggests the existance in the past of a stereotype that stated that computers were considered as masculine.

Another study [7] examines the differences between American college students from 1989 to 1997. In 1997 gender differences were reduced and students had more experience than people from previous years. Nevertheless men still had more experience in programming and in computers in general and this could influence the greather feeling of confort in using computers and the Internet.

For the United Kingdom sample, there were no gender differences in computer anxiety but males held more positive attitudes than females. For the Hong Kong sample, there were no gender differences in computer attitudes but males reported greater computer anxiety [8]

The results comparing the genders on interaction difficulty. Men scored higher than women, although the difference was not strongly sifnificant. [9]

The results of this experiment confirm the expected gender effect, with male subjects performing significantly better than female subjects on a computer-based tracking task. The size of this gender effect was large: men outperformed women by 50 percent of the average amount of time on target. In line with this finding, proportion of male subjects who answered "Yes" to the questionnaire item, "I think that computers are easy to use" (72%) was also significantly higher than the proportion of female subjects who answered "Yes" (36%). [10]

Ojo

We know the eye can move faster than the hand [5]

Keystroke

The Keystroke-Level Model was developed to predict accurately task execution time for mouse-and-keyboard systems [6]

Cultura

Cultural characteristics of website users is a key factor to determining the user acceptance of a website, current design practice take little account of cultural issues during the design process. It is evident from the views presented in this paper that culture has a significant impact on how the user perceives a website. [11]

Laterality

Using the dominant hand produces fast inaccurate responses; using the non-dominant hand produces slow accurate responses.  Small targets are hard; large targets are easy.  [3]

15

Fifty-two right-handed students (26 men, 26 women) participated in this experiment, (face recognition)

Accuracy and RTs showed that men are more strongly lateralized than women, with right hemispheric dominance.

16

Two experiments were conducted with the same subjects, a simple visual detection task and a classical pointing task

left hand shorter RTs for both tasks, emphasizing the role which right hemisphere dominance for visuospatial attention plays in manual aiming asymmetries. Moreover, a direct comparison of the RTs obtained in both experiments showed that the specific cost of movement planning was lower when using the left hand, therefore also revealing right hemisphere dominance for movement planning

17

100 healthy male volunteers of age group 18-25yrs were participated

In right handed individual all reaction time parameters of right hand are significantly faster when compared to left hand values. Whereas there is no significant difference between right and left hand values in left handed subjects.

18

To examine these questions, 81 right- and 60 left-handers were administered the Waterloo Handedness Questionnaire (WHQ) and completed a computer-based pointing action,

In left-handers, there is no advantage for one hand in ipsilateral space, while in right-handers it is their non-preferred left hand that appears to perform better in ipsilateral space.

19

articipants were instructed to press a button as soon as a target was observed. The target stimulus was a left hand, a right hand, or a neutral control. Each hemisphere showed faster responses to contralateral hand stimuli as compared with ipsilateral hand stimuli, consistent with the ideomotor compati- bility hypothesis.

Age

20

The old were 10% slower than the Young old, who were 23% slower than the young. Choice, compared to simple, was 13% slower.

Young (mean age 20.0), Young-old (mean age 67.3) old (mean age 78.0)

We demonstrated that rapid voluntary stepping was affected by age,

21

***Strength and power declined beginning by age 40 in both women and men.***

22

***In this experiment older and younger adults were compared on their ability to position a cursor with an electromechan- ical mouse.***

However, the older adults did produce as much force in the no-accuracy task as the youn- ger adults did in the accuracy-constrained task. This means that the slower performance of the older adults in the accuracy-constrained task was not caused by their inability to produce enough force, rather that the older adults chose to produce slower movements.

23

Older typists were slower in tapping rate and in choice reaction time but were not slower in speed of typing, apparently because they were more sensitive to caracteres farther in advance of the currently typed character than Young typists.

Suggests a possible mechanism that may allow older typists to compensate for lower perceptual motor efficiency.

Older typists have adapted to their slower rates of processing by planning further ahead.

1

Fitts, Paul M. (June 1954). "The information capacity of the human motor system in controlling the amplitude of movement".*Journal of Experimental Psychology* **47** (6): 381–391.[doi](https://en.wikipedia.org/wiki/Digital_object_identifier):[10.1037/h0055392](https://dx.doi.org/10.1037%2Fh0055392). [PMID](https://en.wikipedia.org/wiki/PubMed_Identifier) [13174710](https://www.ncbi.nlm.nih.gov/pubmed/13174710).

2

Towards a standard for pointing device evaluation, perspectives on 27 years of Fitts’ law research in HCI

R. William Soukoreff􏰀, I. Scott MacKenzie Department of Computer Science and Engineering, York University, 4700 Keele Street, Toronto, Ont.,

Abstract

Canada M3J 1P3

Available online 4 November 2004

3

Fitts's Law Studies of Directional Mouse Movement

James Boritz

Kellogg s. Booth2

Williarn B. Cowan

4

Gender and cultural differences in Internet use: A study of China and the UK

Nai Li a,

Gill Kirkup b,\*

5

EVALUATION AND ANALYSIS OF EYE GAZE INTERACTION

Linda E. Sibert

Human Computer Interaction Laboratory Naval Research Laboratory Washington, DC 20375 sibert@itd.nrl.navy.mil

Robert J. K. Jacob

Department of Electrical Engineering and Computer Science Tufts University Medford, MA 02155 jacob@cs.tufts.edu

James N. Templeman

Human Computer Interaction Laboratory Naval Research Laboratory Washington, DC 20375 templema@itd.nrl.navy.mil

6

**Using the Keystroke-Level Model for Designing User Interface on Middle-Sized Touch Screens**

**Evgeniy Abdulin**

7

Gender, Internet and computer attitudes and experiences

P. Schumacher \*, J. Morahan-Martin

8

A Cross-Cultural Comparison of Gender Differences in Computer Attitudes and Anxieties: The United Kingdom and Hong Kong

Mark Brosnan

University of Greenwich, United Kingdom

Wanbil Lee

Lingnan University, Hong Kong

9

**An Exploratory Study of the Effects of Gender on Student Learning and Class Participation in an Internet-Based MBA Course**

[**   J.B. Arbaugh**](http://www.researchgate.net/profile/JB_Arbaugh)

10

J. EDUCATIONAL COMPUTING RESEARCH, Vol. 14(2) 171-183, 1996

GENDER AND SOCIAL FACILITATION EFFECTS ON COMPUTER COMPETENCE AND A TTITUDES TOW ARD COMPUTERS

RODCORSTON ANDREW M. COLMAN *University of Leicester*

11

**Cultural Issues and Their Relevance in Designing Usable Websites**

Alao Olujimi Daniel1, Awodele Oludele2, Rehema Baguma3, and Theo van der Weide4

* *Computer Science & Mathematics Department, Babcock University, Illishan-Remo, Nigeria\**
* *Computer Science & Mathematics Department, Babcock University, Illishan-Remo, Nigeria\**
* *Faculty of Computing & Information Technology, Makerere University, Kampala, Uganda*
* *Radboud University, Institute for Computing and Information Sciences. Nijmegen, The Netherlands.*

12

I. Scott MacKenzie y William A. S. Buxton (1992). Extending Fitts' law to two-dimensional tasks. Procedimientos de la conferencia CHI 1992 de la [ACM](https://es.wikipedia.org/wiki/Association_for_Computing_Machinery) sobre Factores Humanos en Sistemas Informáticos, pp. 219-226.

13

Using Fitts’ Law to Model Key Repeat Time in Text Entry Models William Soukoreff and Scott MacKenzie

14

**Fitts' law as a research and design tool in human-computer interaction**

MaxKenzie

15

Sex differences in face processing: Are women less lateralized and faster than men? Ornella Godard \*, Nicole Fiori

16

Manual reaction time asymmetries in human subjects: the role of movement planning and attention

Sebastien Barthelemy, Philippe Boulinguez\*

17

**Effect of handedness on visual, auditory and cutaneous reaction times in normal subjects**

**Sunita B. Kalyanshetti1\* and B.C. Vastrad2**

18

Hemispatial Effects for Left- and Right-handers on a Pointing Task

Pamela J. Bryden1, Sara M. Scharoun1, Linda E. Rohr2 & Eric A. Roy3

19

Lisa Aziz-Zadeh Æ Marco Iacoboni Æ Eran Zaidel Hemispheric sensitivity to body stimuli in simple reaction time

20

Effects of Age, Step Direction, and Reaction Condition on the Ability to Step Quickly

Carl W. Luchies,1 Jeff Schiffman,1 Lorie G. Richards,2 Matthew R. Thompson,2 Doug Bazuin,3 and Alice J. DeYoung4

21

Age-Associated Loss of Power and Strength in the Upper Extremities in Women and Men

1211 E. Jeffrey Metter, Robin Conwit, Jordan Tobin, and James L. Fozard

22

Age-Related Differences in Movement Control: Adjusting Submovement Structure To Optimize Performance

Neff Walker, David A. Philbin, and Arthur D. Fisk

23

Effects of Age and Skill in Typing

Timothy A. Salthouse