

# An Empirical Study of Drury's ID and Movement Time Regression Coefficient

黃月美、林房儻；宋明弘

E-mail: 9900276@mail.dyu.edu.tw

## ABSTRACT

Because of the increase in the people who have cars in the domestic; it then makes the driver to pay more attention to the driving-safe. The exactness and the duration of validity of feet action are always the key factors to decide the severity grade of an accident caused by a car, which is in high velocity. Therefore, it is the most urgent to establish prediction of feet moving-time target based on the anthropometry of the countrymen. The regression coefficient of feet moving-time of Drury's ID is the efficient target to predict the feet moving-time, however it was based on occidentals anthropometry. Therefore, this study is on the bases of the difference of anthropometry amount the races and the view of theory of leverage making use of the study method in a laboratory to research the regression coefficient of feet moving-time of Drury's ID, that will predict feet moving-time of the countrymen and availability and modify the design of practical foot-controller to feet moving-time. It result is found that the anthropometry, the parameter of pedal-design exists an obvious difference with feet moving-time. For this reason, it exists a range to modify by using feet moving-time of Drury's ID to predict feet moving-time of the countrymen and practice in reality. So this study is to order a modification of regression coefficient of feet moving-time of Drury's ID that is depending on the anthropometry of the countrymen, and that is in order to be able to decide exactly feet moving-time of the countrymen and provide some practical and reference suggestions in design to the research, such as foot-controller's design, prediction of feet moving-time.

Keywords : Anthropometry ; Leverage Theory ; Movement Time ; Drury's ID

## Table of Contents

目錄 頁次 封面 簽名頁 國科會授權書 摘要 Abstract 誌謝 目錄 圖 目錄表 目錄 第一章緒論 1.1研究背景 1.2研究動機 1.3研究目的 1.4研究方法 1.5研究流程 1.6研究範圍 第二章文獻探討 2.1 Fitt's law法則 2.2Drury's ID 2.3人體計測值 2.4人體槓桿原理 2.5控制器 2.5.1腳控器 2.5.2汽車煞車與油門踏板 2.6汽車座椅設計 2.7總反應時間 2.7.1反應時間 2.7.2動作時間 2.7.3煞車之反應時間 第三章 研究方法與實驗環境建立 3.1實驗目的 3.2實驗設計流程 3.3實驗方法 3.4實驗變項與實驗控制 3.5實驗設計 3.5.1實驗設備 3.5.2實驗模型設計 3.5.3實驗程序 3.5.4實驗假設 第四章 實驗結果分析 4.1人體計測參數分析與檢定 4.2踏板設計設置參數分析與檢定 4.3控制變因間交互作用探討 頁次 4.4 Drury's ID 預測值與實驗值分析 4.5 Drury's ID係數修正 4.6修正前後相對誤差檢定 4.7結果討論 第五章結論與建議 5.1結論 5.2未來研究方向 參考文獻

## REFERENCES

- 1.交通部 (1991), 交通工程手冊, 行政院交通部。
- 2.李玉龍編著 (1991), 人體工學概論, 六合出版社。
- 3.李玉龍、杜壯 (1986), 我國青年期人體計測調查研究, 行政院 國家科學委員會專題研究。
- 4.邱魏津 (1989), 台灣地區女子(19-23)人體計測調查之研究, 技術學刊, 第四卷, 第三期, 291-300。
- 5.美國國家高速公路交通部 (1991), 交通工程手冊, 美國國家高速公路局。
- 6.紀佳芬 (1995), 眼球運動的Fitt's Law研究, 行政院國家科學委員會專題研究。
- 7.許勝雄、彭游、吳水丕編譯 (1991), 人因工程, 滄海書局。
- 8.陳正勇, 人體計測, 行政院勞工委員會勞工安全衛生研究計畫, 4-1-4~4-1-13。
- 9.張清波 (1999), 台灣地區大專生課桌椅之人因工程研究, 工業工程學刊Vo.16, 147-159。
- 10.黃耀榮 (1996), 台灣區高齡者靜態人體尺寸計測分析, 建築學報, 第19卷, 101-125。
- 11.葉偉成編著 (1996), 物理學, 科技圖書股份有限公司。
- 12.盧瑞琴、劉天賜 (1993), 國中學生人體計測, 高雄工商專學報, 第23期, 387-401。
- 13.Ayoub,M.M.,and Trombley,D.J.(1967).experimental determination of an optimal foot pedal design .Journal of Industrial Engineering,17,550-559.
- 14.Anders, R.O.,and Hartung,K.J.(1989).Prediction of head movement time using Fitt's law.Human Factors ,31,707-713.
- 15.Al-Haboubi,M.h.(1992).Anthropometry for a Mix of Different Populations. Applied Ergonomics,Vol.23,No.3,191-196.
- 16.Brown,J.,Knauff,E.and Rosenbaum, G.(1947).The accuracy of positional reactions as a function of their direction and esyent .American Journal of Psychology,61.167-182.
- 17.Benjamin,T. and John,M .(1969).Preliminary Investigation of Movement Time Between Brake and Accelerator Pedals in Automobiles,Human Factors ,11(4),407-410.
- 18.Benjamin,T. and John,M .(1970). Preliminary Inv estigation of Movement Time Between Brake and Accelerator Pedals in Automobiles,Human Factors,12(6),p557-561.
- 19.Crossman,E.R.(1956).The measurement of perceptual load in manual operations,Ph D.thesis,University of Birming-ham.
- 20.Card,S.K.,English,W.K.and Burr,B.J.(1978).Evaluation of mouse,rate controlled isometric joystick,step key,and text keys for text selection on a CRT.Ergonomics,21,601-613.
- 21.Calhoun,G.L.,Janson,W.P.and Arbak,G.J.(1986).Use of eye control to select switches.Proceeding of the Human Factor Society 30thAnnual Meeting,154-158.
- 22.Casey,S.M.,and

Rogers, S.P. (1987). Ergonomic design of automotive foot floor control and transmission shifters. Santa Barbara, CA: Anacapa Sciences.

23. Domey, R.G. and Farland, R.A. (1963). The operator and vehicle design. In Bennet, et al. (Ed) Human factors in technology. New York: McGraw-Hill.

24. Davirs, B.T. and Watts, J.M. (1970). Further investigations of movement time between brake and accelerator pedals in automobiles. Human Factors, 12(6), 559-561.

25. Drury, C. (1975). Application of Fitts' Law to foot-pedal design. Human Factors, 17, 368-373.

26. English, W.K., Engelbart, D.C. and Erman, M.L. (1967). Display selection techniques for text manipulation. IEEE Transactions on Human Factors in Electronics, 8, 5-15.

27. Fitt, P. (1954). The information capacity of the human motor system in controlling the amplitude of movement. Journal of Experimental Psychology, 47, 381-391.

28. Glass, S. and Suggs, C. (1977). Optimization of vehicle brake pedal foot travel time. Applied Ergonomics, 8, 215-218.

29. Hoffmann, E.R. and Sheikh, I.H. (1994). Effect of varying target height in a Fitt's movement task. Ergonomics, 36, 1071-1088.

30. Kroemer, K.H.E. (1971). Foot operation of controls. Ergonomics, 14(3), 333-361.

31. Kerr, R. (1978). Diving, adaptation, and Fitt's law. Journal of Motor Behavior, 10, 255-260.

32. Knight, I. (1984). The Heights AND weights of Adults in Great Britain, HMSO, London, UK.

33. Lindgren, G. (1976). Height, Weight and menarche in Sweden Schoolchildren in relation to social-economic and regional factors, Annals of Human Biology, 3, p510-528.

34. Longolf, G.D., Chaffin, D.B. and Foulke, J.A. (1976). An investigation of Fitts law using a wide range of movement amplitudes. Journal of Motor Behavior, 8, p113-128.

35. Mortimer, R.G., Segel, L., Dugoff, H., Campbell, J.D., Jorgeson, C.M. and Murphy, R.W. (1970). Brake force requirement study. Driver-vehicle braking performance as a function of brake system design variable (HSRI Final Report No. Huf-6a). Ann Arbor, MI; University of Michigan Highway Safety Research Institute.

36. Mackenzie, I.S. and Buxton, W. (1992). A note on the information theoretic basis for Fitt's law. Journal of Motor Behavior, 21, 323-330.

37. Mackenzie, I.S. and Buxton, H. (1992). Extending Fitt's law to mensural task. Proceedings of the CHI '92 conference on Human Factors in Computing Systems, 219-226.

38. National Highway Traffic Safety Administration (1983). Recall campaign 1987-1983 model Audi 5000 vehicles equipped with automatic transmission, installation of brake pedal plate, Audi campaign code FR. Unpublished recall campaign. Cited in Casey and Rogter (1987).

39. Osborne, D.J. (1982). Ergonomics At Work, Chapter 6, John Wiley and Sons, New York, USA.

40. Roebuck, J.A., Kroemer, K.H. and Thomson, W.G. (1975). Engineering Anthropometric Methods, John Wiley & Sons, N.Y., USA.

41. Pheasant, S. (1986). Body Space, Anthropometry, Ergonomics, and Design, Chapter 2, Taylor and Francis, London, U.K.

42. Radwin, R.G. (1990). A method for evaluating head-controlled computer input device. Human Factors, 32, 423-438.

43. Scout, H., Damon, A. and Farland, H. (1965). Weight, Heights and selected Body Dimensions of Adults, National Center for Health Statistics Series, 11, 8.

44. Snyder, H. (1976). Braking Movement time and accelerator brake separation. Human Factors, 18, 201-204.

45. Stoudt, H.W. (1981). The anthropometry of the elderly. Human Factors, 23(1), 29-37.

46. Van Cott, H.P. and Kinkade, R.G. (1972). Design of Influencing Control Position.

47. Welford, A.T. (1960). The measurement of sensory-motor performance: Survey and reappraisal of twelve years' progress. Ergonomics, 3, p189-230.

48. Wargo, M., Kibler, A. and Topmiller, D. (1965). Response time to unexpected stimuli. Human Factors, 7(1), p81-86.

49. Welford, A.T. (1968). Fundamentals of skill. London: Methuen.