EVALUATING THE DESIGN AND OPERATION OF COMPUTER MOUSE

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ABSTRACT

THE PRESENT STUDY IS PROCEEDED WITH AN EXPERIMENT TO INVESTIGATE THE DIFFERENCE UNDER DIFFERENT TASK TYPES (POINTING TASK AND DRAGGING TASK) IN MUSCULAR LOADS, FINGER STRENGTH, WORKING POSTURES, TASK PERFORMANCE AND SUBJECTIVE RATING WITH THE DIFFERENT HEIGHT, SIZE OF MOUSE, AND USING THE ARM SUPPORT OR NOT, THEN FIND THE MAIN REASON WHICH CAUSE THESE DIFFERENCES. THE OTHER IS TO EVALUATE THE INFLUENCE OF DESCRIBED RATING PERFORMANCES BETWEEN POINTING AND DRAGGING, WHICH ARE TWO KINDS OF ESSENTIAL MOTIONS WHEN USING A MOUSE, TO PERFORM A TASK WITH THE SAME CONTENT. AND TO DISCUSS THE DIFFERENCE OF PALM SIZE IN ADDITION, THEN INVESTIGATES THE SUITABLE TYPE FOR PEOPLE USE, IN ORDER TO REDUCE INJURIES TO USERS. THE RESULTS INDICATE THAT THE HEIGHT OF MOUSE ABOUT 3.5CM HAVE LEAST MUSCULAR LOADS ON ARMS AMONG THREE VARIOUS HEIGHT. DRAGGING TASK IS BIGGER THAN POINTING TASK ON FLEXOR DIGITORUM SUPERFICIALIS EMG SIGNALS AND FINGER STRENGTH, IT MEANS THAT PERFORMING TASK WITH DRAGGING BIGGER THAN POINTING ON ARMS MUSCULAR LOADS. AND USING ARM SUPPORT INSTEAD INCREASES THE PERFORMANCE TIME.

Keywords : MOUSE, ELECTROMYOGRAPHY (EMG), MUSCULAR LOAD, FINGER STRENGTH, WRIST DEVIATION

Table of Contents

REFERENCES

1.李正隆，民85。「電腦工作站之健康危害及預防對策探討」，勞工安全衛生簡訊，第19期，頁1-5。 2.李永輝，民86。「軀幹肌群於軸向動作之共作用模式」，行政院國家科學委員會專題研究計畫成果 報告。 3.沈清良，民84。「實用解剖學」，華杏出版股份有限公司，台北，頁133-135。 4.徐延之，民86。「長期使用滑鼠，小心危機四伏」，PC OFFICE，第6期，頁174-175。 5.徐彬偉，民88。「不同種類軌跡球在不同作業下之評估比較」，清華大學工業工程研究所碩士論文。 6.麥麗敏，民88。「臨床解剖學」，合記圖書出版社，台北，頁428-433。 7.黃証柳，民87。「滑鼠之人因工程與績效評估」，台灣科技大學管理技術研究所工業管理學程碩士 論文。 8.陳圳卿，民87。「電腦桌的設計與研究-滑鼠操作型態之探討」，大同工學院工業設計研究所碩士論 文。 9.陳松林，民82。「單指與雙指最大屈力之生物力學分析」，台灣工業技術學院工程技術研究所碩士 論文。 10.AARAS, A., FOSTERVOLD, K. I., RO, O., AND THORESEN, M., 1997, "POSTURAL LOAD DURING VDU WORK: A COMPARISON BETWEEN VARIOUS WORK POSTURE", ERGONOMICS, VOL. 40, NO. 11, PP. 1255 -1268. 11.ANTII, C. J., BJORKSTEN, M., ERICSON, B. E., AND JONSSON, B., 1976, "RELATIONSHIP BETW -EEN WORK AND INTERGRATED MYOELECTRIC ACTIVITY IN LONG-TERM VOCATIONAL STUDIES", BIOMEC -HANICS, PP. 515-519. 12.ARMSTRONG, T. J., 1986, "ERGONOMICS AND CUMULATIVE TRAUMA DISORDERS", HAND CLINICS, VOL . 2, NO. 3, PP. 553-565. 13.ARMSTRONG, T. J., MARTIN, B. J., FRANZBLAU, A., REMPEL, D. M. AND JOHNSON, P. W., 1995, "MOUSE INPUT DEVICES AND WORK-RELATED UPPER LIMB DISORDER", PROCEEDINGS OF

WWDU 1994, EDS A. GRIECO, G. MOLTENI, E. OCCHIPINTI AND B. PICCOLI ELSEVIER SCIENCE, AMSTERDAM, PP . 375-380. 14.ARNDT, R., 1983, "WORKING POSTURE AND MUSCULOSKELETAL PROBLEMS OF VDT OPERATORS:REVIEW AND REAPPRAISAL", AMERICAN INDUSTRIAL HYGIENE ASSOCIATION JOURNAL, VOL. 44, PP. 437-446. 15.ATTWOOD, D., 1989, "COMPARISON OF DISCOMFORT EXPERIENCED AT CADD, WORD PROCESSING AND TRADITIONAL DRAFTING WORKSTATIONS", INTERNATIONAL JOURNAL OF INDUSTRIAL ERGONOMICS, VOL . 4, NO. 1, PP. 39-50. 16.BERGMAN, T., 1980, "HEALTH EFFECTS OF VIDEO DISPLAY TERMINALS", OCCUPATIONAL HEALTH AND SAFETY, VOL. 49, PP. 24-55. 17.BERGQVIST, U., 1984, "VIDEO DISPLAY TERMINALS AND HEALTH", SCANDINAVIAN JOURNAL OF WORK , ENVIRONMENT, AND HEALTH, PP. 10, SUPPLEMENT 2. 18.BOONE, D. C. AND AZEN, S. P., 1979, "NORMAL RANGE OF MOTION IN JOINT OF MALE SUBJECTS", JOURNAL OF BONE AND JOINT SURGERY, VOL. 61, PP. 756-759. 19.BRUMFIELD, R., NICKEL, V., AND NICKEL, E., 1996, "JOINT MOTION IN WRIST FLEXION AND EXT -ENSION", SOUTH MED. J., VOL. 59, PP. 909-910. 20.CATHERINE J. COOK AND KAMAL KOTHIYAL, 1998, "INFLUENCE OF MOUSE POSITION ON MUSCULAR ACTIVITY IN THE NECK, SHOULDER AND ARM IN COMPUTER USERS", APPLIED ERGONOMICS, VOL. 29 , PP. 439-443. 21.COOPER, A. AND STRAKER, L., 1998, "MOUSE VERSUS KEYBOARD USE: A COMPARISON OF SHOULDER MUSCLE LOAD", INTERNATIONAL JOURNAL OF INDUSTRIAL ERGONOMICS, NO. 22, PP. 351-357. 22.COOK C., BURGESS-LIMERICK R. AND CHANG S., 2000, "THE PREVALENCE OF NECK AND UPPER EXTR -EMITY MUSCULOSKELETAL SYMPTOMS IN COMPUTER MOUSE USERS", INTERNATIONAL JOURNAL OF IND -USTRIAL ERGONOMICS, NO. 26, PP.347-356. 23.CHARLES N. ABERNETHY AND DIANE G. HODES, 1987, "ERGONOMICALLY DETERMINED POINTING DEVIC -E(MOUSE) DESIGN", BEHAVIOR AND INFORMATION TECHNOLOGY, VOL. 6, NO. 3, PP. 311-314. 24.FERNSTROM, E. A. AND ERICSON, M. O., 1997, "COMPUTER MOUSE OR TRACKPOINT-EFFECTS ON MUS -CULAR LOAD AND OPERATOR EXPERIENCE", APPLIED ERGONOMICS, VOL. 28, NO. 5/6, PP. 347-354. 25.FOGLEMAN, M. AND BROGMUS, G., 1995, "COMPUTER MOUSE USE AND CUMULATIVE TRAUMA DISORDERS OF THE UPPER EXTREMITIES", ERGONOMICS, VOL. 38, NO. 12, PP. 2465-2475. 26.HAGBERG, M., 1981, "ON EVALUATION OF LOCAL MUSCULAR LOAD AND FATIGUE BY ELECTROMYOGRAPH -Y", ARBETE OCH HALSA, VOL. 24, PP.1-53. 27.HAGBERG, M. AND JONSSON, B., 1975, "THE RELATIONSHIP BETWEEN MYOELECTRIC ACTIVITY AND MUSCLE WORK IN INTERMITTENT STATICAL CONTRACTIONS", ELECTROMYOGR CLIN NEUROPHYSIOL, VOL . 15, PP. 253-258. 28.HARVEY, R. AND PEPER, E., 1997, "SURFACE ELECTROMYOGRAPHY AND MOUSE USE POSITION", ERGO -NOMICS, VOL. 40, NO. 8, PP. 781-789. 29.HUNTING, W., LAUBLI, TH. AND GRANDJEAN, E., 1981, "POSTURAL AND VISUAL LOADS AT VDT WOR -KPLACE:I. CONSTRAINED POSTURE", ERGONOMICS, VOL. 124, PP. 917-931. 30.JOHNSON, P. E., DROPKIN, J. J., HEWS, J. AND REMPLE, D., 1993, "OFFICE ERGONOMICS: MOT -ION ANALYSIS OF COMPUTER MOUSE USAGE", PROCEEDING OF THE AMERICAN INDUSTRIAL HYGIENE CONFERENCE AND EXPOSITION, PP.12-13. 31.JOHNSON, P. W., TAL, R., SMUTZ, W. P. AND REMPEL, D. M., 1994, "FINGERTIP FORCES MEASU -RED DURING COMPUTER MOUSE OPERATION:A COMPARISON OF POINTED AND DRAGGING", PROCEEDIN -GS OF THE INTERNATIONAL ERGONOMICS ASSOCIATION 1994 MEETINGS, VOL. 2, OCCUPATIONAL HE -ALTH SAFETY, PP. 208-210. 32.KAMIENSKA-ZYTA, M., 1993, "ERGONOMICS EVALUATION OF THE WORK OF VDT OPERATORS IN POLAN -D", APPLIED ERGONOMICS, VOL. 24, NO. 6, PP. 432-433. 33.KARLQVIST, L., BERNMARK, E., EKENVALL, L., HAGBERG, M., ISAKSSON, A., ROSTO, T., 1999, "COMPUTER MOUSE AND TRACK-BALL OPERATION: SIMILARITIES AND DIFFERENCE IN POSTURE, MUSC -ULAR LOAD AND PERCEIVED EXERTION", INTERNATIONAL JOURNAL OF INDUSTRIAL ERGONOMICS, NO . 23, PP. 157-169. 34.KARLQVIST, L., HAGBERG, M., SELIN. K., 1994, "VARIATION IN UPPER LIMB POSTURE AND MOVE -MENT DURING WORD PROCESSING WITH AND WITHOUT MOUSE USE", ERGONOMICS, VOL. 37, NO. 7, PP. 1261-1267. 35.MIDDAUGH, S. J., KEE, W. G., NICHOLSON, J. A., 1994, "MUSCLE OVERUSE AND POSTURE AS FACTORS IN THE DEVELOPMENT AND MAINTENANCE OF CHRONIC MUSCULOSKELETAL PAIN", PSYCHOLOG -ICAL VULNERABILITY TO CHRONIC PAIN (SPRINGER, NEW YORK), PP. 55-89. 36.MUGGLETON, J. M., ALLEN R. AND CHAPPELL, P. H., 1999, "HAND AND ARM INJURIES ASSOCIATED WITH REPETITIVE MANUAL WORK IN INDUSTRY:A REVIEW OF DISORDERS, RISK FACTORS AND PREVE -NTIVE MEASURES", ERGONOMICS, VOL. 42, NO. 5, PP. 714-739. 37.PEPER, E. AND TIBBETTS, V., 1994, "ILLNESS AT THE COMPUTER KEYBOARD:PART Ⅰ:WORKSTAT -ION/ERGONOMICS ASSESSMENT AND MODIFICATION", PROCEEDING OF THE 25TH ANNUAL MEETING OF THE ASSOCIATION FOR APPLIED PSYCHOPHYSIOLOGY AND BIOFEEDBACK, PP. 93-96. 38.PEPER, E. WILSON V. S., TAYLOR, W., PIERCE, A., BENDER, K. AND TIBBETTS, V., 1994, "REP -ETITIVE STRAIN INJURY, ELECTROMYOGRAPHY:APPLICATION IN PHYSICAL THERAPY", PHYSICAL THERAPY PRODUCTS, VOL. 5, NO. 5, PP. 17-22. 39.PUTZ-ANDERSON, V., 1992, "CUMULATIVE TRAUMA DISORDERS, A MANUAL FOR MUSCULOSKELETAL DIS -EASE OF THE UPPER LIMBS", NIOSH: TAYLOR AND FRANCIS, OH. 40.REMPEL, D., JOHNSON, P., SMUTZ, O. AND TAI, R., 1994, "FINGER FORCES MEASURE DURING COM -PUTER MOUSE USE", PROCEEDINGS OF THE FOURTH INTERNATIONAL SCIENTIFIC CONFERENCE: WORK WITH DISPLAY UNITS CONFERENCE, PP. 28-29. 41.RIZZO, T., 1994, "NEW WORKPLACE SAFETY STANDARDS COMING", STANFORD MEDICINE, VOL. 9, PP. 9-13. 42.RYU, J., PALMER, A. K., AND COONEY, W. P., 1991, "WRIST JOINT MOTION, BIOMECHANICS OF THE WRIST JOINT", SPRINGER-VERLAG, PP. 37-60.

43.ROSE, M. J., 1991, "KEYBOARD OPERATING POSTURE AND ACTUATION FORCE: IMPLICATIONS FOR MUSCLE OVER-USE", APPLIED ERGONOMICS, VOL. 22, NO. 3, PP. 198-203. 44.SAUTER, S. L., CHAPMAN, L. J. AND KNUSTON, S. J., 1984, "IMPROVING VDT WORK:CAUSES AND CONTROL OF HEALTH CONCERNS IN VDT USE", REPORT PREPARED FOR THE DEPARTMENT OF ADMINIST -RATION, STATE OF WISCONSIN. 45.SAUTER, S. L., SCHLEIFER, L. M., AND KNUTSON, S. J., 1991, "WORK POSTURE, WORKSTATION DESIGN, AND MUSCULOSKELETAL DISCOMFORT IN A VDT DATA ENTRY TASK", HUMAN FACTORS, VOL. 33, NO. 2, PP. 151-167. 46.SILVERSTEIN, B. A., FINE, L. J., ARMSTRONG, T. J., 1986, "HAND WRIST CUMULATIVE TRAUMA DISORDERS IN INDUSTRY", BRITISH J. OF INDUSTRIAL MEDICINE, VOL. 43, PP. 779-784. 47.SMITH, M. J., COHEN, B. C. F., STAMMERJOHN, L. W. AND HAPP, A., 1981, "AN INVESTIGATION OF HEALTH COMPLAINTS AND JOB STRESS IN VIDEO DISPLAY OPERATIONS", HUMAN FACTORS, VOL. 23, PP. 387-400. 48.SNOOK, S. H., 1995, "VAILLANCOURT PSYCHOPHYSICAL STUDIES OF REPETITIVE WRIST FLEXION AND EXTENSION", ERGONOMICS, VOL. 38, NO. 7, PP. 1488-1507. 49.STOCK, S. R., 1991, "WORKPLACE ERGONOMIC FACTORS AND DEVELOPMENT OF MUSCULOSKELETAL DISORDERS OF THE NECK AND UPPER LIMBS: A META- ANALYSIS", AMERICAN JOURNAL OF INDUSTRI -AL MEDICINE, VOL. 19, PP. 87-107. 50.TOM BENDIX AND FLEMMING JESSEN, 1986, "WRIST SUPPORT DURING TYPING-A CONTROLLED, ELECT -ROMYOGRAPHIC STUDY", APPLIED ERGONOMICS, VOL. 17, NO. 3, PP. 162-168. 51.WANDA SMITH, BOB EDMISTON AND DAN CRONIN, 1997, "ERGONOMIC TEST OF TWO HAND-CONOURED MICE", GLOBAL ERGONOMIC TECHNOLOGIES, INC. 52.WESTGANRD, R. H., 1988, "MEASUREMENT AND EVALUATION OF POSTURE LOAD IN OCCUPATIONAL WORK SITUATIONS", EUR. J APPL PHYSICAL, VOL. 57, PP. 291-304. 53.WISE, N., 1995, "IS YOUR PC KILLING YOU? TIPS FOR PAIN-FREE COMPUTING", COMPUTER CURREN -TS, VOL. 13, NO. 2, PP. 38-48.