An Investigation of User Acceptance and Flow Experience Using Video-Capture Gaming Technology for Exercise.

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Abstract—**The aims of this study were to investigate the user acceptance of exercise using the IREX™ Interactive Rehabilitation and Exercise system (a video-capture gaming environment) in comparison with exercise in a gym-based environment; and to compare users' flow experience – absorption in the activity - using the two exercise environments. A convenience sample of 18 healthy men and 20 healthy women, mean age 34 (1SD 12.8) years, with sedentary lifestyles were recruited from university staff and students. Participants were randomised into two groups - IREX™ (n = 19) or gym-based exercise (n=19). Both groups took part in three exercise sessions over two weeks. Apart from a greater Performance Expectancy with IREX, there were no significant differences in user acceptance and flow experience between the two environments. These results show IREX™ to be an acceptable alternative to gym-based exercise.**

Keywords-component; Virtual Reality; Exercise and VR; IREX; and sedentary.

Introduction

The increasing demand in technology can be seen in rehabilitation and health care. A recent development in rehabilitation research is exercising in a gaming environment incorporating virtual reality technology. Such gaming environments for exercising have been reported in studies with people with neurological problems [1], cerebral palsy [2], children with learning difficulties [3] and older people, [4 & 5]. Within this field video capture systems are becoming readily available. This study investigated user perceptions of a video capture system for exercise (IREX™). The two main aims of the study were to compare the user acceptance of exercise using IREX™ with exercise in a gym-based environment; and to compare users' flow experience – absorption in the activity - using the two exercise environments.

I. METHOD

An experimental design was used with two factors. Factor 1, between subjects, was exercise group with two levels – IREX™ and gym-based. Factor 2, within-subjects, was time with two levels – the start (baseline) and end (post-programme) of the two week programme. Ethical approval was granted by Teesside University School of Health and Social Care Research and Governance Committee.

A. Participants

Convenience sampling was used to recruit staff or students at Teesside University aged between 18-65 years, who were able to follow instructions in English, and who led a predominantly sedentary lifestyle as classed by ASCM guidelines [6]. Exclusion criteria ruled out people with musculoskeletal injury, other major health problems, physiotherapy students, and anyone with an inability to provide informed consent. The participants were equally randomised into the IREX™ (n=19) or gym-based group (n=19). Table 1 displays demographic characteristics of participants.

Table 1. Demographic Characteristics of Participants.

Demographic	Mean	SD
Age (Years)	34.2	12.80
Height (m)	1.7	0.17
Weight (kg)	72.3	15.23

B. Instrumentation

Two questionnaires were used in this study. To assess participants' acceptance towards technology we used a questionnaire based on the *Unified Theory of Acceptance and Use of Technology (UTAUT)* [7]. The UTAUT has 22 questions which are sub-divided into; performance expectancy (PE), effort expectancy (EE), social influences (SI), facilitating conditions (FC), self- efficacy (SE) and behaviour intention (BI).

The second questionnaire, the Flow State Scale [8], assessed participants' Flow experience. The Flow State Scale consists of a 36 items grouped in 9 sub-scales: Autotelic Experience (AE), Clear Goals (CG), Challenge-Skill Balance (CB), Concentration of Task (CT), Paradox of Control (PC), Unambiguous Feedback (UF), Action-Awareness Merging (AM), Transformation of Time (TT), and Loss of Self-Consciousness (LS).

C. Prcedure

All participants completed three exercise session lasting 30 minutes each. The sessions were conducted on a one-to-one basis in a university laboratory over a two week period. The questionnaires were completed pre exercise (baseline) and at the end (post-programme) of the two week programme.

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II. STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for the Social Sciences Version 16 for Windows (SPSS, Chicago, IL, USA). Separate analyses of co-variance (ANCOVA) were performed for each subscale of the two questionnaires to investigate post-programme differences between the groups: baseline scores acted as the covariates. A mixed analysis of variance (ANOVA) was performed to determine within-subject differences between baseline and post-programme scores, for each subscale. UTAUT Questionnaire.

III. RESULTS

A. UTAUT

Post-treatment there was a statistically significant difference between groups for PE (p=0.03), reflecting a within-subject increase from baseline to post-programme in the IREX group but not the gym-based group, no significant differences were established between the other variable (see table 2). No statistically significant within-subject changes in these variables from baseline to post-programme.

Table 2. ANCOVA results for UTUAT.

Variable	*Significance*
performance expectancy *PE*	*P = 0.03**
effort expectancy *EE*	*P = 0.15*
social influences *SI*	*P = 0.98*
facilitating conditions *FC*	*P = 0.31*
self- efficacy *SE*	*P = 0.27*
behaviour intention *BI*	*P = 0.89*

**statistically significant at alpha=0.05.*

B. Flow State Scale

Post-treatment there were no statistically significant differences between exercise groups in any of the variables (p > 0.05).

Statistically significant within-subject changes over time were found for AE (p=0.01), CG (p=0.04) and TT (p<0.01), all of which showed an increase in both groups from baseline to post-programme. There were no interaction effects. There were no significant within-subject changes for the remaining Flow variables (see table 3).

Table 3. Mixed ANOVA Results for Flow State Scale.

Variable	Significance
Autotelic Experience AE	P = 0.01*
Clear Goals CG	P =0.04*
Challenge-Skill Balance CB	P = 0.39
Concentration of Task CT	P = 0.46
Paradox of Control PC	P = 0.64
Unambiguous Feedback UF	P = 0.13
Action-Awareness Merging AM	P = 0.35
Transformation of Time TT	P <0.01**
Loss of Self-Consciousness LS	P = 0.56

*p < 0.05, **p< 0.01.

IV. DISCUSSION

Both the IREX and gym- based exercise environment were rated positively on the UTAUT subscales showing both to be useful and easy ways to perform exercise. Performance Expectancy was the only variable to demonstrate a significant difference: PE increased with the use of the IREX but not gym- based exercise. No other variables in the UTAUT showed any significant differences between groups. Neither environment was rated higher than the other for flow experience. The results show IREX as an acceptable alternative to gym-based exercise for this particular population. Having observed these findings in a relatively light (rated as a mean of 3/10 for intensity by the participants) and short programme, further insight into user acceptance and flow experience could be gained by investigating longer duration for the programme and/or more challenging games. This would form a strong basis for future investigation with clinical populations.

REFERENCES

[1] Betkler, A.L., Szturm, at., Moussavi, Z.K., & Nett, C.N. (2006). Video Game – Based Exercises for Balance Rehabilitation: A Single – Subject Design, *Arch Phys Med Rehabilitation*, (87), 1141- 1149

[2] Bryanton, C., Bosse, J., Brien, M., Mclean, J., Mccormick, A., & Sveistrup, H. (2006). Feasibility, Motivation, and Selective Motor Control: Virtual Reality Compared to Conventional Home Exercise in Children with Cerebral Palsy, *Journal of Cyber Psychology & Behaviour*, 9 (2): 123-

[3] Weiss, P.L., Bialik, P., & Kizony, R. (2003). Virtual Reality Provides Leisure Time Opportunities for Young Adults with Physical and Intellectual Disabilities, *Journal of Cyber Psychology & Behaviour,* 6 (3), 335-342.

[4] Rand, D., Kizony, R., & Weiss, P.L. (2004). Virtual reality rehabilitation for all: Vidid GX versus Sony Play Station II Eye Toy. *Proc. 5TH International Conference. Disability, Virtual reality & Assoc. Tech., Oxford.*

[5] Van Schaik, P., Blake, J., Pernet, F., Spears, I., & Fencott, C. (2008). Virtual Augmented Exercise Gaming for Older Adults, *Journal of Cyber Psychology and Behaviour,* 11 (1), 103 -106.

[6] ACSM (2005). Guidelines for exercise testing and prescription, 7th edn. Philiadelphia: Lippincott Williams & Wilkins., ISBN 0-7917-4506-3.

[7] Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. (2003). User Acceptance of information technology: toward a unified view, *MIS Quarterly*, 27 (3), 425- 478.

[8] Jackson, S.A., and Marsh, H.W. (1996). Development of validation of a scale to measure optimal experience: The Flow State Scale, *Journal of Sport and Exercise Psychology*, 18, 17-35.