
CHI 2008 Exertion Interfaces: A Flexible approach

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Abstract

The development of novel exertion interfaces offers real potential for improving health through cardiovascular fitness among individuals who previously found conventional approaches inaccessible or less than engaging. Furthermore, such development offers real benefits which could be suitably applied for augmenting rehabilitation strategies. In addition however, we propose that interfaces that offer rehabilitation potential, or those whose intention is to improve the health and fitness of targeted sections of the community, also have an inherent responsibility to ensure that participants are adequately prepared to safely engage in their activity. Fortunately the nature of exertion interfaces allows modifications for the development of such warming up and preparation to both be readily incorporated, actively encouraged and practically realised, to ensure that health benefits aren't simply compromised instead by precipitating injury.

Keywords

Virtual Reality, rehabilitation, exertion interface,

ACM Classification Keywords

H5.2. [Information interfaces and presentation (e.g., HCI)] J3 Health

Introduction

The concept of virtual reality and exertion interfaces is still, in many respects, in its early infancy yet already demonstrating great potential. This innovative field is beginning to find real applications for improving health and even exploring the realms of furthering rehabilitation. However the focus, understandably, has been largely on stimulating physiologically demanding engagement with the interface. This by its very nature has crossed over many areas pertinent to both sports performance and rehabilitation, addressing many key issues such as motivation or compliance. Both sports performance and rehabilitative exercises have many commonalities which can be addressed by such systems and by such a research driven focus. Nevertheless, some wider aspects from other disciplines have yet to be drawn upon to add to the broader picture that this new and exciting field encompasses. One such area of exertion which needs to be addressed in our quest for promoting greater endurance and faster times is the underlying suppleness of the individual's joints. Far from being just a cautionary factor in the use of such interfaces, this is an area which is fundamental to the success and health of the future users of such interfaces, from everyday recreational users, to those aspiring to gymnastic or athletic excellence or even those trying to restore functional mobility to injured or otherwise impaired limbs.

With this in mind then, interfaces which promote physical exertion to pursue the development of greater flexibility or restore range of motion to a level appropriate to the specific behavioural and occupational needs of the individual, require due consideration in

order to augment the already diversifying exertion interface designs.

Exertion interfaces as a Rehabilitation modality

One of the major goals of rehabilitation is to make quantitative and qualitative improvements in daily activities in order to improve the quality of independent living. Three determinants of motor recovery are:

- **Early intervention,**
- **Task-oriented training**
- **Repetition intensity** [1]

Exertion interfaces constructed with a rehabilitation strategy outcome in mind could readily address issues of task orientated training and repetition intensity. Within this wider context, the study being currently undertaken is primarily concerned with utilizing an exertion interface with electromagnetic motion tracking to restore effective range of motion and flexibility to the shoulder joint for those whose movements are impaired or restricted in some sense that denies them the opportunity to carry out their sports orientated or everyday tasks. The same interface should also offer a suitable environment for encouraging pre event sports stretching routines both for flexibility and reducing the propensity for injury.

We propose a concept for a form of virtual tennis where the warm up and cool down phases of stretching are built into the game at intervals, with the stretching motions also simulating effective motions associated with the sporting activity e.g. serving in tennis. The game would promote adequate preparation with bonus rewards for duration, completion etc. Position on court,

the position of the “racket,” its velocity on impact with the “ball” as well as the stretching routine can all be followed using magnetic tracking. Furthermore this electromagnetic tracking can be used to objectively monitor and review progress and serve as a means of providing quantitative data on rehabilitation outcomes, removing any subjectivity. Previous studies [4] concluded that the Ascension Technology “Flock of Birds” magnetic tracking system was sufficiently sensitive to detect clinical improvements, and it is therefore proposed for use in this study.

Exertion interfaces, an injury prevention strategy.

Notwithstanding the healthy influence of sporting activities on reducing potential risk factors, in particular those of cardiovascular disease, it is also apparent that sports, particularly among the inexperienced or those trying a new sports activity, can present a danger to health in the form of physical injuries. This is a real danger even among the experienced when placed in surroundings that are unfamiliar, e.g. with a new sporting environment, for example unusual terrain, conditions or perhaps even novel interfaces. Good preparation is essential as is warming up and stretching appropriately before the event. Unfortunately particularly among the amateur and recreational sportsman such preparation is often neglected.

Recently the efficacy of pre sports stretching has been challenged. Intermittent use of short duration stretching regimens are of questionable benefit and a number of studies have suggested that there is not sufficient evidence to endorse or discontinue routine stretching before or after exercise to prevent injury among competitive or recreational athletes [3]. But

alternatively some studies suggest this needs to be considered in a long term perspective specific to certain activity types where duration and commitment to stretching do become significant [2,5]. This then, as in rehabilitation contexts, becomes an issue of compliance and motivation, an arena for which exertion interfaces and VR are ideally suited.

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