

---

# Exertion Interfaces

**Florian 'Floyd' Mueller**

Interaction Design Group  
The University of Melbourne  
111 Barry St  
Carlton, VIC 3010  
Australia  
floyd@exertioninterfaces.com

& Distance Lab  
Horizon Scotland  
The Enterprise Park  
Forres, Moray  
IV36 2AB  
UK

**Stefan Agamanolis**

Distance Lab  
Horizon Scotland  
The Enterprise Park  
Forres, Moray  
IV36 2AB  
UK  
stefan@distancelab.org

**Abstract**

Exertion as an interface for computing technology has generated increased attention recently due to the belief that it can address health issues such as obesity, contribute to social benefits, and open new markets for entertainment industries. We are proposing a workshop on this topic to bring researchers and industry participants from related areas together to strengthen the scientific influence on this field and promote a multidisciplinary agenda. The workshop will support the development of future collaborative efforts in this rapidly growing area.

**Keywords**

Exertion, physical, activity, natural, interaction, pervasive, ubiquitous, sports, videogames, obesity

**ACM Classification Keywords**

H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

**Introduction**

We have defined an Exertion Interface as an interface that deliberately requires intense physical effort at CHI 2003 [7]. Exertion Interfaces can be expected to be physically exhausting when used for an extended period of time. In short, if the interface is physically demanding and hard to use, it does not necessarily

hinder, but can positively support the experience. This experience is often not of task-oriented nature, but touches the realms of fun, human rapport and social interaction.

By 2007, this area had gained significant momentum along with a workshop we organized to establish the conceptual position of Exertion Interfaces in the HCI domain. We established bounding axes to focus the topic and gathered experts to promote a theoretical framework. Furthermore, we gathered relevant studies and work as well as relevant researchers' biographies on a Wiki. In addition, there is already a special journal issue [9], and we are working on a survey paper for journal submission.

However, many significant developments have appeared subsequently which have pushed the field further, unfortunately these have mainly been without academic influence. We realized during last year's workshop, through participants from industry, especially those from the non-HCI community, that the field's success is very dependant on a multitude of influencing areas. For example, Exertion Interfaces can contribute positively to increased fitness, and therefore provide a health effect, however, HCI researchers generally do not possess enough medical background to adequately assess and leverage this potential in their analysis. In last year's workshop, a medical practitioner contributed valuable insights from his perspective; a perspective that is, in practice, not very often leveraged by HCI experts, possibly because of the lack of reciprocal awareness of common activities in the area. In last year's workshop, we have identified additional domains that should have a contributing role in the design and analysis of Exertion Interfaces, such

as CSCW for networked instances, pervasive and ubiquitous computing for context-awareness, gaming theory, rehabilitation, coaching, learning and sports sciences. Unfortunately, a multidisciplinary approach towards this topic is rarely taking place in practice, which provides a significant opportunity for HCI to shape this field, especially considering its multidisciplinary roots.

### **Recent Developments**

What we have observed during last year's remarkable shift in developments is that users discovered the encompassing benefits of Exertion Interfaces, but have appropriated existing devices, initially designed for single specific purposes, to their multi-faceted needs.

The most prominent and widely reported example concerns Nintendo's Wii, which was designed and advertised as entertainment game, but users have appropriated it rapidly and use it as exercise tool for weight loss, turning their living room into a gym [14] [16], and even medical research has confirmed the validity of this approach [15]. However, it has not yet been investigated how developers can most effectively optimize these benefits, and the lack of incorporating expertise from relevant other disciplines has already lead to undesired side effects, such as the "Wiiitis" tennis arm [17]. Other examples are the users' appropriation of Google Maps and pedometer data to exchange running routes over the Internet [11], the creation of exercise games using mobile blogging technology by retired cross country skiers [18], and cyclists' use of GPS data to describe hill climbs to compete in asynchronous events [19].

Interestingly, many of these developments evolved without involvement of a multidisciplinary oriented lead by HCI. Moreover, this rapid development seemed to have outrun the academic understanding of the phenomena. With the workshop, we want to re-utilize HCI's multidisciplinary roots and gather its strengths to invite participants from the various communities that should influence the trend identified above to approach the analysis and investigation of Exertion Interfaces from the various perspectives that affect the user to contribute to the fast paced developments in the field.

### **Related Work**

*Breakout for Two* is a soccer-like game that uses augmented virtual game play with physical soccer balls to demonstrate the concept of Exertion Interfaces and an empirical investigation showed its benefit in terms of social connectedness in comparison to keyboard interfaces [7]. *Shakra* [20] supports physical activity awareness in a mobile setting, and the authors report on the beneficial aspect of competitive progress exchange as encouragement to exercise more. *Virku* is a *Virtual Fitness Center* that uses physical movements conducted on exercise bicycles to modify the representation of a 3D virtual environment [6]. *Push 'N' Pull* [8] is a networked exercise machine that focuses on a cooperative game to encourage rapport and a workout at the same time. Other HCI research has combined social science theories with exercise tracking technology to encourage a more active lifestyle [12] [3]. The *Dance Dance Revolution* project [10] concluded with the installation of computer dance games in every public school in the state of Virginia. Conceptually, research has been investigating the applicability of two different frameworks ([1] and [2]) especially the interaction with the webcam *Eyeto* gets

attention [5]. Other work has emerged that is conceptualizing a more general theoretical framework around the topic, for example Dourish [4] developed foundations of embodied interactions. Finland's national research lab has established a research initiative on "Exergames" [13].

### **Workshop Goals**

- One workshop goal is to share information and experiences among researchers in the area of Exertion Interfaces with regard to findings in related fields such as ubiquitous computing, CSCW, medical research, sports science, games theory, education, rehabilitation and social science. Based on the very informative feedback from last year's workshop participants who came from the medical research and entertainment industry, we will exchange findings about how our domains can benefit from one another and if HCI should take a leading role in this.
- The workshop organizers will leverage their prior industry experience to involve practitioners from the gaming industry, the sports field and education domains to enable a discussion extending the current field's view beyond an HCI perspective. Workshop participants can exchange experiences and ideas to leverage one another's expertise and form collaborations to advance the field further in a multidisciplinary manner.
- Another goal is to raise awareness of the challenges and opportunities of this emerging area and promote the field as distinct entity. This will be achieved by organizing an edited book with participants from diverse backgrounds, proposing a special issue demonstration area in the interactivity chamber at next year's CHI, and organizing a symposium on the topic.

## Conclusion

Interfaces that require physical exertion can be beneficial for users by contributing to an active lifestyle, facilitating social connectedness between participants and enhancing a gaming experience. A workshop on this topic that exclusively focuses on this topic will bring researchers and industry partners from various disciplines together to discuss how each partner can benefit from one another. We will discuss future directions of the field, in particular in regard to multi-disciplinary approaches lead by HCI, and use the forum as an excellent networking opportunity, which will result in new collaborative projects that aim towards the promotion of the field as distinctive topic.

## References

- [1] Bellotti V., Back M., Edwards W., Grinter R., Henderson A., Lopes C. Making Sense of Sensing Systems: Five Questions for Designers and Researchers, CHI '02, ACM Press, Minneapolis, USA, pp. 415-422
- [2] Benford S., Schnadelbach H., Koleva B., Gaver B., Schmidt A., Boucher A., Steed A., Anastasi R., Greenhalgh C., Rodden T. and Gellersen H. Sensible, Sensable and Desirable: a Framework for Designing Physical Interfaces, Technical Report Equator-03-003, Equator, February 2003.
- [3] Consolvo, S., Everitt, K., Smith, I., and Landay, J. A. Design requirements for technologies that encourage physical activity. In CHI '06, ACM Press, New York, 457-466.
- [4] Dourish, P. Where the Action is: the Foundations of Embodied Interaction. MIT Press, Cambridge, Mass., 2001.
- [5] Larssen A., Loke L., Robertson T., Edwards, J. Understanding Movement as Input for Interaction – A Study of Two Eyetoy™ Games. Proc. of OzCHI 2004, Wollongong, Australia.
- [6] Mokka S., Väättänen A., Väikkynen P. Fitness Computer Games with a Bodily User Interface. Proc. Entertainment Computing, USA, 2003. ACM, pp 1-3.
- [7] Mueller F., Agamanolis S., Picard R. Exertion Interfaces: Sports over a Distance for Social Bonding and Fun, CHI '03, ACM Press.
- [8] Mueller, F., Stevens, G., Thorogood, A., O'Brien, S., Wulf, V. Sports over a Distance. Journal of Personal and Ubiquitous Computing, Special Issue on Movement Based Interaction, 2006.
- [9] Special Issue of Personal and Ubiquitous Computing on Movement-Based Interaction. [http://research.it.uts.edu.au/idwop/aarhus/special\\_issu es.html](http://research.it.uts.edu.au/idwop/aarhus/special_issu es.html)
- [10] US pupils to dance themselves fit. BBC news. <http://news.bbc.co.uk/2/hi/technology/4653434.stm>
- [11] Gmaps-pedometer. [www.gmap-pedometer.com](http://www.gmap-pedometer.com)
- [12] Lin, J., Mamykina, L., Lindtner, S., Delajoux, G., Strub, H. Fish'n'Steps: Encouraging Physical Activity with an Interactive Computer Game, Ubicomp '05. LNCS 4206, pp. 261 – 278.
- [13] <http://www.vtt.fi/exergame/>
- [14] <http://wiinintendo.net/2007/01/15/wii-sports-experiment-results/>
- [15] <http://news.bbc.co.uk/2/hi/health/6376637.stm>
- [16] <http://wiiweightlossplan.com/>
- [17] If it's not tennis elbow, it may be Wiiitis, doctor diagnoses. China Daily. Vol. 27, No. 8463. June 8, 2007.
- [18] <http://lawine.at>
- [19] Hill climbs. <http://www.cycle2max.com>
- [20] Barkhuus, L., Maitland, J., Anderson, I., Sherwood, S., Hall, M., Chalmers, M. Shakra: Sharing and Motivating Awareness of Everyday Activity. In Ubicomp 2006, ACM Press (2006).