Bucking Bronco:
Adaptive Ride Experiment No. 1

Brendan Walker
Aerial UK
info@aerial.fm

Joe Marshall,
Duncan Rowland,
Stefan Egglestone
Mixed Reality Lab
Department of Computer Science
University of Nottingham
Jubilee Campus
NG8 1BB
UK
{jqm},{dar},{sre}@cs.nott.ac.uk

Revital Cohen,
Tuur Van Balen,
Steve Ounanian
Aerial UK
info@aerial.fm

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Abstract
This video presents an early experiment into the construction of amusement park rides which adapt themselves to those who are riding them. In this experiment, an actor is fitted with a set of sensors, and mounts a Bucking Bronco, a popular small-scale fairground ride. Information from these sensors is relayed live to a member of the public who operates the ride based on sensor data alone. Future experiments will remove the human operator and replace them with an automated control system. This early experiment has explored the possibility of running the ride based on sensor data and potential strategies which may be applied when automating this process.

Keywords
Biosensing, wireless, ride, thrill,

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Early work within ubiquitous computing has emphasized the integration of computing into the environment and in particular the development of applications that could sense details of this environment and tune it to the needs of those within it. Such work involves a conceptualization of the computer as a “quiet, invisible servant” [4], which requires little explicit interaction with users. A wide variety of scenarios have been developed within this paradigm, with a substantial number of application domains. A specific example of the testing and construction of ubicomp systems can be found in the development of “smart homes”. Here, researchers have tried to construct systems that can learn about individual preferences for environmental conditions, and which can make automatic adjustments to the home environment where necessary.

Traditionally, this kind of adaptive computing has relied primarily on sensors external to the body, such as building based sensors and objects carried by the users. A more recent trend is the use of bio-sensors, electronic devices which are worn by a user, and sense the wearer’s bodily signals, such as heart-rate, skin temperature etc. These can be used to create systems which adapt directly to the bodily responses of a user. The work described in this paper explores the creation of a bio-sensing adaptive system in a novel and interesting environment, that of the fairground or theme park. In particular, we explore the idea of creating a ride which adapts itself to data collected from its participants. The video presents initial experiments into the feasibility of producing an adaptive ride, which took place at Pioneers 2009, an event organized by a U.K. research council, in the Spring of 2009.

This work is based around a bucking bronco, a type of small, relatively inexpensive and mobile ride which is often to be found in smaller fairgrounds or hired for events such as weddings. This initial prototype makes use of wearable technologies to capture a variety of data channels from participants, which is relayed, live, to a ride operator, who then makes judgments as to the operation of the ride based on this data. This “Wizard of Oz”[1] approach is designed to assess the feasibility of operating the ride based on sensed data alone and has allowed us to explore issues relating to the operation of the ride and tactics that are necessary to produce an interesting and enjoyable experience for the rider. In the future, we aim to fully automate the ride, removing the human operator from the loop.

Technology setup

Figure 1 below illustrates the ride as setup for this experiment. The large red spheroid (“the egg”) is mounted on a drive unit, which is controlled by the console shown in the foreground of Figure 1. A rider sits on top of the egg and a ride operator manipulates the control console. This allows the operator to control the speed and direction of spinning and bucking movements in the egg. The ride continues until the rider is thrown off the mount, whereupon they land safely on a large inflatable mat that surrounds the ride. This ride is a difficult, full body challenge, which means differences in strength, fitness and agility alter how easy it is to stay on. The controller adapts the ride, in order to avoid weaker riders having a very short and unsatisfying ride, or stronger riders finding it unchallenging.

Figure 1 Bucking bronco ride with control console

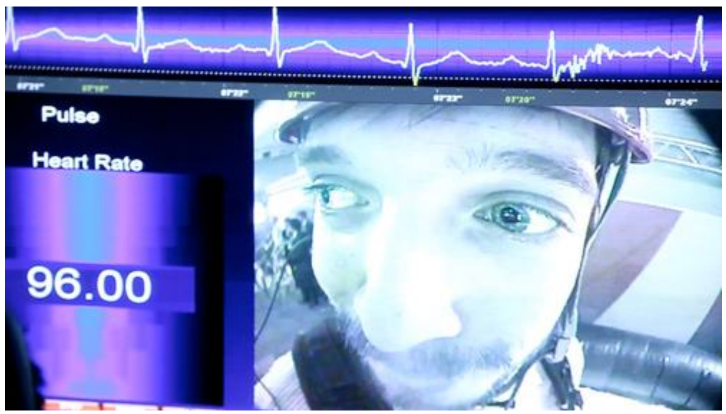

Figure 2 Close up of display

The rider in Figure 1 has been fitted with the wearable data capture system that is used to adapt the ride. This system has evolved through a number of previous projects involving recording bio-sensing data on fairground rides [2,3]. This system consists of a wireless video-camera and microphone, mounted on a climbing helmet, and pointed back towards the face, alongside a set of sensing equipment that is used to capture and transmit physiological data from the rider's body (in this case, heart-rate). Information gathered from the wearable system is wirelessly transmitted to a base-station, where a real-time visualization of this data is generated, to aid the operator in controlling the ride. Figure 2 shows a close-up of this visualization; this emphasizes the presentation of facial expressions (as an indicator of emotion) and heart-rate (as an indicator of arousal).

Deployment

At Pioneers 2009, the bronco was ridden by three actors, with people selected from the event audience asked to control the ride. A number of crew members were present to organize the event; these consisted of a technician, who fitted and tested the wearable system, a professionally-trained ride operator, who ensured safe operation of the ride, a showman who controlled the proceedings, and a custodian, who shepherded the riders around the stage. The three actors were labeled with different thrill-seeking tendencies – high, medium and low – with participants being given a choice of which actor to work with.

When a participant started, they were first given a chance to experiment with the bronco before it was mounted by the chosen actor. Once they were happy, the bronco was hidden by a screen, and the participant was asked to control it by observing the live data only. The showman specified tasks for them to perform. In the first task, participants were asked to "please" the actor, detectable by facial expressions of pleasure. In the second task, they were asked to "scare" them, until a facial expression of fear was seen, and in the final task, they were asked to "excite" them by raising their heart-beat as high as possible. Performance in these tasks was monitored by the showman and technician, and participants were given feedback when they had successfully completed the task. These tasks proved possible for all the 20 volunteer controllers.

Feedback

Interviews with volunteer controllers were conducted to assess their opinion of the use of heart-rate and facial video data to adapt; all but one agreed that they had been able to use this data to an extent in deciding how to control the ride, though a number of interesting issues came up. It took some time for controllers to learn to 'read' the rider: "*to start with I would say it was kind of a marginal link … as the ride went on, then certainly you could match up his facial expressions, they contorted at one point with either fear or excitement, with quite strong emotion, … I saw the heart rate go up from about 90 to about 120*." The majority of ride controllers felt that facial expression data was most useful in performing their tasks; this may relate to the expressiveness and quick response of the human face, and human ability to interpret facial expressions. Participants found heart-rate data useful, though they had more difficulty interpreting it; this may relate to a lack of knowledge of heart-rate response. Clearly it is important that our future automated systems embed knowledge about heart rate response.

Discussion

This current, early experiment has provided evidence on the basic concept of adapting rides to create a good experience for riders irrespective of their particular abilities, and proven the suitability of bio-sensing data for this purpose. The next step in the process is to automate control of the ride, removing the human controller. This will involve development of algorithms to automatically process the data streams, learning about participant responses and adapting as the ride progresses. As well as this obvious step, the current system relies on bulky wearable technology for data capture. It is hoped to embed much of the data capture into rides themselves. For example, many larger rides already capture facial video throughout the ride, which may be interpreted to extract expressions. It may also be possible to sense physiological data by embedding sensors into the ride, for example sensing grip strength or sweat levels by monitoring the handle the rider holds onto. On many rides it may even be possible to detect heart-rate using sensors on handlebars or restraints.

Conclusions

This video documents a scenario that deploys ubiquitous computing technology to create an adaptive fairground ride. Future work aims to remove the human from the loop, to create bespoke visceral experiences tailored to an individual's own biological responses.

References

[1] Kelley, J.F. "An iterative design methodology for user-friendly natural language office information applications". ACM Trans. Office Information Systems, March 1984, 2,1, 26–41

[2] Schnädelbach, H. et al. Performing thrill: designing telemetry systems and spectator interfaces for amusement rides

[3] Walker, B. Punters: Auto-Portraits of Fairground Thrill. http://www.aerial.fm/

[4] Weiser, M. "Software Engineering and People" http://sandbox.parc.com/weiser/10year/sld040.htm