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# Biometric Storyboards: visualising meaningful gameplay events

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**Abstract**

Due to the specific characteristics of video games most of the established HCI methods of user research cannot be used the same way for video games. One of the challenges is to gain insight into how players feel and behave when playing a game. This paper explores a technique on using Biometrics measure and Storyboards where we graph the player's experience journey over a longer period. The graph could visualise a meaningful relationship between the changes in a player's biometric signal and game events. This would enable game developers to have a better understanding of players' gameplay behaviour and eventually help them optimise the experience of their game.

**Keywords**

Biometrics, Storyboards, Video Games, User experience (UX), Visualisation

**ACM Classification Keywords**

H5.2. Information interfaces and presentation

**General Terms**

Human Factors

**Introduction**

Although Human-Computer Interaction (HCI) methods have made progress in understanding the usability of productive applications, due to the specific

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characteristics (such as emotion and challenge) of video games most of the well established HCI methods of user research cannot be used the same way for video games. Biometric technology is being increasingly used to enable UX researchers to capture physiological measurements for analysis.

### Biometric in video games HCI

Researchers have used physiological measurements to evaluate emotional experience in video games. Hazlett describes the use of facial Electromyography (EMG) as a measure of positive and negative emotional valence during interactive experiences [2]. Ravaja measured facial EMG and cardiac interbeat intervals (IBIs) in addition to self-report ratings to index physiological arousal and emotional valence [9]. Mandryk et al have used HR, GSR and EMG to create a modelled emotion for interactive play environments [3] and [4]. Nacke and Lindley have created a real-time emotional profile (flow and immersion) of gameplay by using facial EMG and GSR [7]. In their work with Grimshaw they looked at effects of sound and music in a video game on players' EMG and GSR [6]. Drachen et al reported a case study on GSR and HR correlations with player gameplay experience in First-Person Shooter game [1].

### Biometric Storyboards

In this paper we are reporting our current work on introducing a new technique called 'Biometric Storyboards'. Narratives have always been part of user experience process to communicate how and why a design would work [8]. We are promoting a new approach based on using stories (or storyboards), where we graph the player's gameplay experience over a longer period (e.g. a level of a game).

Sometimes the limitations of stories are that they are a personal and subjective experience, from the perspective of the consumer. Thus, they become a fairly intangible experience to record. Using our proposed approach of the biometric storyboards, the seemingly elusive narrative experience becomes a data-supported recorded asset.

The graph itself is calculated based on (1) player's biometric responses (2) player post-session interviews to explain 'why' the change in their signal occurred (3) players' self-drawn diagrams of their gameplay experience and (4) coding player gameplay behaviour (or context).

### Biometrics and post-session interview

By utilising measurements of arousal in players' galvanic skin response (GSR) and heart rate (HR) during video game playtesting, specific events with higher impact on the players' feeling are identified as potential usability or UX issues, generating a log of issues for analysis. In the post-session interview immediately after the gameplay session, each player was asked to recall these specific moments and to inform the experimenter of their thoughts and most importantly 'why they felt that way', with the video footage available for playback if the player did not recall fully [5]. This approach help us to identify not only the negative usability and user experience issues but also the events in the game, which have a positive impact on player experience.

### Players' self-drawn diagrams

Player drawn diagrams (Figure 1) enable us to capture a player's overall experience of each level. It also shows that players can mostly recall details from the

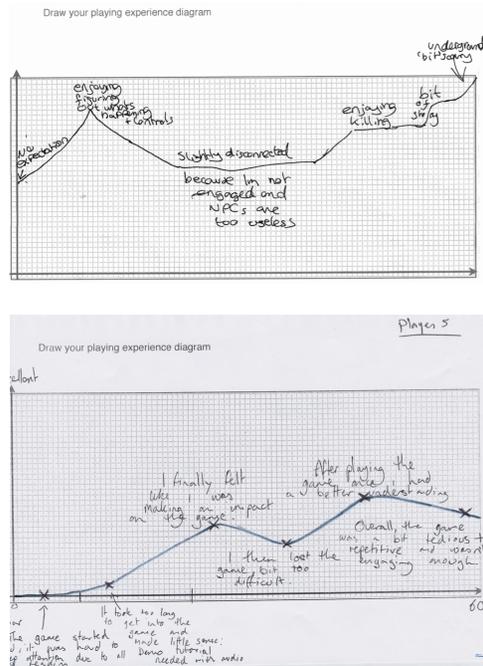


Figure 1. Examples of player drawn diagrams of their gameplay experience

beginning and end of their gameplay session (serial position effect). Combining the player's drawing and biometrics with post-session interview helps us to address this problem.

### Coding player gameplay behaviour

To help us better represent an accurate reflection of the player's gameplay experience, we include the player's gameplay behaviour when generating the biometric storyboards. This would also help us to be able to explain 'why' the player experienced certain emotions.

### First Experiment

An unreleased commercial single player first person shooter console game was subjected to single player user testing for approximately one hour per player, and with 9 players: 5 self-identified mainstream gamers and 5 core gamers. Only a portion of the game was complete to a level of quality indicative of the final product, and only these sections were tested. Testing was conducted over 3 days in laboratory conditions. Participants played the game on an Xbox 360 connected to a HD television. Video cameras recorded the player, biometrics kit capturing players GSR and realtime footage from the game console was simultaneously streamed to the observation room next door. All feeds were composited together on a single display, and recorded for later analysis. The game's producer, and experiment conductors monitored the participants' play from the observation room. The experiment conductors had spent some time familiarising themselves with the game before the test sessions, and the producer was able to identify when players were not playing the game as intended. Following the user test sessions, a biometric storyboard was produced of each levels for a casual and core

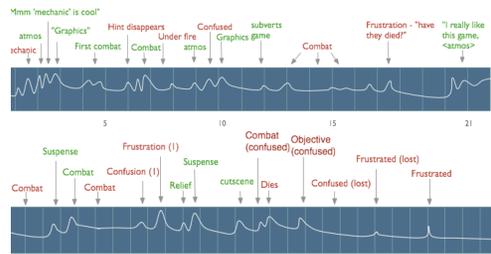
player. Figure 2 shows two selected diagrams. Each vertical line is one minute of gameplay, positive comments are in green and negative are in red. It shows in both levels minute 10-20 are offering a poor experience, and gamers are experiencing frustration and lack of enjoyment.

### Second Experiment and Future Work

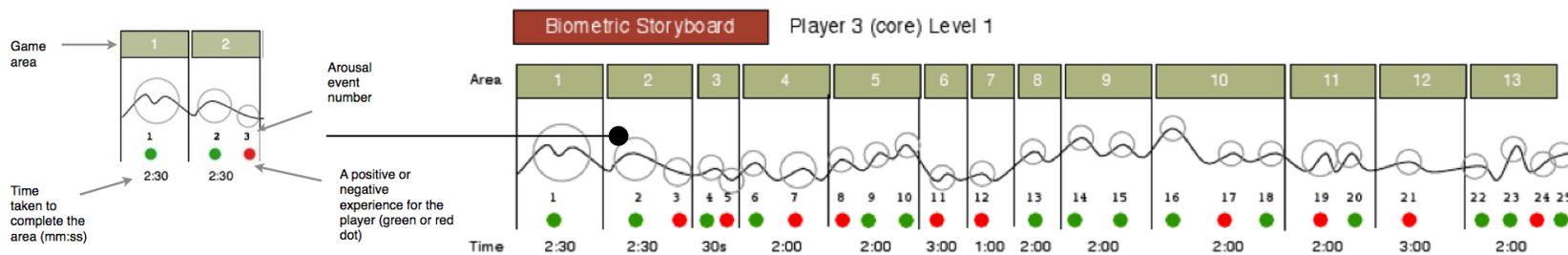
The second experiment was conducted under similar conditions to the first experiment, but with a different set of 9 participants. The new version of biometric storyboards were refined based on the feedback from the game's producer. The feedback suggested that the first design of biometric storyboards was difficult to compare between players.

Figure 3 (following page) shows the new design of the biometric storyboards from the second experiment. The following are the main differences in the new design: 1) each level was divided into thematic areas, this would make the key sections easier to compare; it also shows the time it took the player to complete that area. Also, it makes it easier for game designers to see where the issues are exactly. 2) Brief text explanation on player's experience story (with reference to arousal events). 3) Green or red dots shows the positive or negative experience (mainly from the player's drawing and interview). 4) Screenshot of game events (removed from the diagram since the game is unreleased).

Once we've plotted a series of these, we can compare the gameplay journey of users and employ them to spot key trends. Our primary result shows that the players' background profiles and 'psychographics' (motivations) reflect a regular pattern in their corresponding biometric storyboards.



**Figure 2.** Biometric Storyboards: first level (top), second level (bottom).



**Figure 3.** Biometric storyboards (new design)

Examples of arousal explanation: 1: player interacts with objects. "Nice being able to move these objects." 2: first open space. 3: too much text instruction bored the player.

Example of Player gameplay story: "The biometrics measures and player diagram shows that our core player enjoyed the beginning of the first level. He enjoyed being able to interact with objects (1,15). His biometrics shows a positive reaction in moving toward different environments in this level (2, 14, 22)..."

We are constantly evaluating this approach on commercial FPS console games that are still under development. We iterate this approach based on feedback from game producers. We had positive feedback on how biometric storyboards helped the developer to have a better understanding of how players interact with their game. This ultimately enhances their ability to effectively optimise the experience of the final release.

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