Biometric Storyboards: toward a better understanding of player experience

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Abstract
Player experience is difficult to evaluate and report, especially using quantitative methodologies in addition to observations and interviews. One step towards tying quantitative physiological measures of player arousal to player experience reports are Biometric Storyboards (BioSt). They can visualise meaningful relationships between a player's physiological changes and game events. Our paper illustrates (1) how we developed the BioSt idea iteratively by running three case studies with game design studios and (2) interviewed game developers about BioSt's advantages and disadvantages. We also briefly outline our next steps to further develop BioSt technique.

Keywords
Biometrics, Games, User experience, Visualisation.

Introduction
Most classical user experience (UX) and human-computer interaction (HCI) evaluation techniques do not simply map to player experience (PX) evaluation in games due to the engaging and fluid nature of games. One of the challenges in quantitative player evaluation is to be able to collect data from users (in our case players) without interrupting their gameplay (continuous and unconscious). Since games also thrive on emotional experiences, physiological evaluation is becoming a more popular method together with

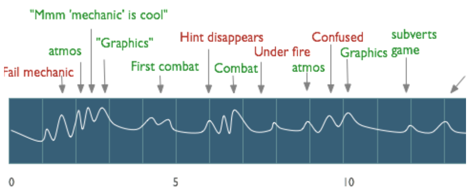

Figure 1. Biometric Storyboards (1st iteration)

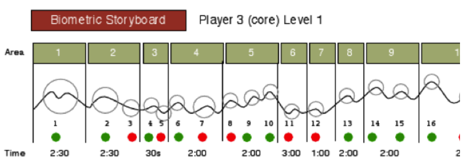

Figure 2. Biometric storyboards (2nd iteration)

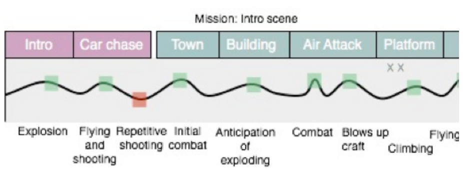

Figure 3. Biometric storyboards (3rd iteration)

traditional methods for player evaluation [2, 3, 5, 10]. Game user research (GUR) is an emerging field that has always borrowed methods from HCI and psychology. Within GUR, physiological methods are becoming more popular and major companies such as Valve are investigating physiological measures [1]. Common physiological measures include galvanic skin response (GSR), facial electromyography (EMG), cardiac interbeat intervals (IBIs), and electroencephalography (EEG) [4, 6, 11].

One of the challenges is making the interpretation of physiological and player evaluation data meaningful in terms of facilitating design decisions for developers. Steps in this direction are necessary to facilitate the interpretation of these large datasets, possibly creating visual aids for faster navigation and easier interpretation of physiological game engagement. To answer this we are developing a player evaluation approach called Biometric Storyboards (BioSt). Following user-centred design (UCD) approach, we are developing BioSt in four phases: 1) Develop the initial idea by various iterations through conducting three case studies with game design studios. 2) Present the BioSt technique to game developers and interview them about advantages and disadvantages of this technique. 3) Prototype an improved design based on the feedback. 4) Establish construct validity of the BioSt technique.

In this paper, we discuss our results from the first and second phases in our design process. We also discuss a prototype using an improved design and highlight our future study in developing this visualisation tool.

Iterations of Biometric Storyboards

So far our BioSt design went through three iterations based on research conducted with two game design studios and the feedback from two producers where they used this technique on their unreleased game. The graph itself is drawn based on (1) player's biometric (GSR) responses, (2) player post-session interviews to explain 'why' the change in their GSR occurred [6], (3) players' self-drawn diagrams of their gameplay experience and (4) observation of player gameplay behaviour (or context). These datasets and the three iterations have been explained in our previous publications [7, 8].

Based on feedback from three case studies, we are now on our third iteration of BioSt. The first version was divided up by time (Fig. 1). However, time is not always meaningful for some games, and beats (or thematic areas) were considered more representative, as in version 2 (Fig. 2). The current version (Fig. 3) makes the diagram easier to read and couples behaviour (the text along the bottom) with the associated player experience.

Interviewing Game Developers

We conducted semi-structured interviews to evaluate our three prototypes and better understand our requirements and target groups for future development of BioSt. We interviewed six game development professionals from midsize game design studios. We discussed advantages and disadvantages of this technique while they saw all three iterations. Our results [9] highlighted areas for improvement for the future study:

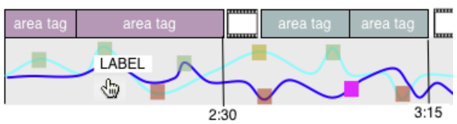

Figure 4. Prototype of our next iteration of BioSt.

Iterations: after seeing all the three iterations the developers overall feedback on them was: a) All interviewees preferred the third iteration. b) Positive feedback for adding level areas (beats) in second and third iterations. c) Positive feedback for having graph annotation and area descriptions. d) Negative comments on second iteration as they experienced problems with finding areas and arousal explanations. This was fixed for the third iteration. e) Negative feedback for removing time player spent in each area from third iteration. We will bring this back.

Composite graph instead of individual: Our current design of BioSt visualises how each individual player experienced a game. Based on our interview result this can lead to two problems: (1) too many individual graphs and (2) showing how one individual player experiences a game does not convince developers to act on the issues. To improve these we could generalise the individual graphs into a composite graph, showing the correlation of results among players.

Severity: The developers want a tool to help them to prioritise the issues to fix. While BioSt facilitates this in some ways (e.g., location of issue), it could also indicate the severity of each issue. For example, this can be achieved by measuring the mean value of skin conductance level among participants at the specific event.

Graph comparison: Developers want to see their intended experience graph in the BioSt.

Measurement of different experience: Our interviewees suggested the current design just shows green and red points, as high and low arousal experiences. Since these do not actually depict emotional valence, we will add facial muscle measures (EMG).

Figure 4 shows a possible example prototype of our next iteration. We can generate two experience graphs to facilitate the comparison between them as explained above. For example, the two graphs can be a comparison between core and casual players, or designer-intended and actual experience graph or co-located players. Possible different experience types can be visualised by using colour boxes. A BioSt can also be interactive, for example, we can enable a mouseover, or a click for zooming-in or displaying more data.

Discussion

Visualising physiological responses in these storyboards has made previously difficult-to-interpret physiological UX approaches more accessible to a wider game industry audience. To summarise, here are the key strengths of our BioSt approach:

Correlation between Biometrics and Gameplay Events: Visualisations were helpful to understand and explore correlations between changes in players' physiological responses and the corresponding events or behaviours.

Whole Session Overview: By visualising the whole gameplay session, BioSt were able to provide an efficient overview across all events, levels, and missions, enabling the developers to quickly scan for key elements in level design, player performance and experience.

Simplicity: BioSt have been formed and iterated based on the demands of our target users to deliver tools that are simple, easy to understand and interpret with an immediately apparent benefit.

User-Centred Design: Our understanding of the game development process and the relevant needs in the working environment has helped us to design visualisations which closely match the requirements and language of our target users, and the subsequent level of detail necessary for the task.

Familiarity: Our target users (game developers and producers) are familiar with various data representation techniques and visualisations of game metrics.

Support Collaboration: BioSt enabled increased collaboration between game user researchers, game designers, game developers and producers.

Conclusion

Overall, the recommendations generated from our three iterations and interviews, together with a UCD process, has helped us to design and improve a tool that has provided game developers with an increased understanding and enhanced communication opportunity, leading to a better understanding of player's gameplay experience. Deployment of our BioSt technique resulted from (a) the approach's simplicity, (b) strong user involvement throughout the entire design process, and (c), an integration of the target users' existing tools (storyboards have been widely used in the video game and movie industries). The improved BioSt prototype generates biometric-based visualisations, which provide better support to problem-solving and communication, greater insight into player experience, and fits better into the work process of video game development.

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