Exploring the Cause of Game (Derived) Arousal

What biometric accounts of player experience revealed

Gareth Schott & Raphaël Marczak

Introduction

The wider research project from which this paper's findings are drawn seeks to address what Moscovici (1998) would term an instance of 'the scandal of social thought.' This is a phrase he uses to describe humans tendency for accepting non-logical and non-rational thinking. According to Moscovici, it is this kind of thinking has led to "illusionary correlations which [even] objective facts are incapable of correcting" (p. 210). The enduring and habitual belief under consideration here is, of course, the popular notion that digital games constitute injurious and harmful content involving players in actions that lead to a transmutation from games to the real world. This proposal or belief has given 'effects research' purpose, stimulated public concerns, and has triggered the intervention of regulation (as a legal issue in some parts of the globe). The treatment of games *as* violence is a position that game studies has intentionally, and for good reason (see Schott et al., 2013b), avoided since its inception. Yet, the implications of our disciplines' seeming disinterest is that it leaves classification systems in a position where they are still required to protect against the possibility of the putative effects of games. This, in turn, further reinforces the beliefs that first necessitated caution. While this represents a 'well-worn' debate, and while the notion of games *as* violent media no longer troubles the creators and players of games with the same vigor that it did over a decade ago, it does nevertheless remain an area of debate that our discipline has much to offer. We propose that there is benefit to be gained from re-examining the value of some of our more familiar deliberations, for example, as to whether games primarily constitute ludic space and time generators (Aarseth, 2013) that are experienced as, and defined by, their operational systems, or whether they represent complex narrative forms that seek to persuade players that they are indexical (drawn from, related to real life).

By reflecting on scholarly tensions that have divided game studies since its formative years (e.g. the ailing yet still animate ludology vs. narratology debate), disciplinary-centric contests have failed to create an impression in the 'effect debate,' or give the more formal constituents of games a greater role within regulation judgments. Game studies has missed an opportunity to highlight how players might be pitting themselves against the particular logics of game systems in order to stimulate recognition that a non-pejorative or defensible form of 'violence' is in operation within games. Our research has explored the nature of gamic realism for *the player* and suggests that there is an argument to be made that player experiences entail a phenomenological shift away from the affect and inferences connected to mimetic representation and visual verisimilitude that constitutes the game's façade, and closer to the underlying logics on which games function (Marczak et al., 2012; Vught et al., 2012, Schott et al., 2013). That is, the experience of games is recognized as an activity of conscious engagement with a rule system. This leads us to seek acknowledgment for the 'entrancement' of non-fictional content and activities, that also serve to challenge and redefine popular misconceptions of immersion (as a process of losing oneself in the text; see also Calleja, 2011).

This paper came about as a response to the theme and call for papers for the DiGRA 2014 international conference. The call encouraged submissions that revisited old themes from new perspectives, describing our interest in examining the *impression* left on players by games. Our research to-date has foregrounded game play as a configurative activity, more so than a more traditionally conceived interpretive activity (see Vught & Schott, 2012). However, this approach to understanding games left us in a position of not being able to assert with confidence what constitutes a violent experience to be able to examine it empirically. Indeed, this point is connected to a larger problem relating to the woefully under-developed nature of the philosophy of violence (Bufacci, 2005). In the context of its relationship with games, violence has long been conceived as a universal and homogenous concept. For instance, within ‘effects research’ an operational definition of violence exists as “extreme forms of aggression, such as physical assault and murder“ (Anderson & Bushman, 2001, p. 354). Such a definition of violence has been applied, without challenge, to the categorization of games as violent media. In order to begin to articulate the role violence plays in the relationship and interaction that occurs between games and players, we argue that it is necessary to acknowledge the dualistic ‘meaning’ produced by games that coexist and operate simultaneously.

Part of the challenge in discussing game violence comes from the manner in which game structure is contextualized and context is ‘gamified’. That is, a game’s formal elements are (partly) concealed within the expressive frame of a fictional world and narrative context. At the same time, encounters typically fraught with moral implications and consequence, should they occur in the real world, are abridged and simplified as one uncomplicated move in a series of game moves. During active play, the player’s attention is often divided between layers of representational and symbolic information, allowing the fictional world of the game space that holds the core diegetic experience of the game world to be reconfigured and overridden. For example, sitting on top of its ‘world of concern’ (Veale, 2012), are Heads Up Displays (HUD) and interface layers that convey information on a player’s status and gamic activity (e.g. health bar), thus possessing a declarative function that suggests actions, conveys their urgency, and/or forecast likely outcomes (e.g. screen death). As communication and feedback devices, the latter represent a powerful and commanding driver that guides player behavior and actions (Marczak et al., 2013). So while violent themes may cloak games, the way games function demands that they are understood as “penetrat[ing] elements of reality only to re-appropriate them and reproduce them in fragmentary modes assembled under new codes and laws” (Schott et al., 2013).

The nature of games does not permit us to assume that players automatically process violent content, at a representational level, or that the presence of violent themes produces an experience of violence, so that we might then simply assess its impact. Should we opt to approach the impact of violence by interrogating sections of game play, pre-selected for how they are deemed to correspond with more traditional notions of what constitutes violence, we are then working to the assumption that violence is a device that remains unaffected by its presence within a game system.

Capturing Experience

Through the implementation of a mixed methodological approach in the context of our research project, we have sought to capture the multi-dimensional nature of the experience of play by counterbalancing conscious reflections on game-play with bodily responses and summaries of within-game behavioral activity. The research design employed is located at an intersection between humanities, social sciences, and computer sciences and aims to report on the way games function as structural objects that determine and explain the nature of players' engagement. Over the course of our study, our research design is predicated on requiring individual players (participants) to play a single First Person Shooter or Action Adventure PC game over a period of five to six weeks. During these periods, we sought to engage with participants on the subject of their play experience on a number of levels. The first level of our analysis is focused on measurement of the game (audio visual output) together with an understanding of the player's role in its production. Player's engagement is variously represented by a novel form of game-play metrics (see Marczak et al., 2013) that maps players' within-game behaviors via the audio-visual feedback (screen and sound outputs) produced by the game, and assessing players' physiological responsiveness (indicating levels of arousal) to gaming events. Accounts of bodily responses are then translated into biometric storyboards (see Mirza-Babaei & McAllister, 2011) that visualize any commonality or co-occurrence of a player's biometric signals and game events. Extending beyond capturing and measuring the activation of game texts during play, we also ask participants to engage in retrospective player commentaries in response to footage of their own game-play sessions. Finally, and completely beyond the confines of our research set up, participants also complete diary entries that capture their accounts of their game-play experiences away from the study.

While a mixed method approach provides different layers of information, it also serves to validate or contextualize what the different individual measures present us with. In addition to these advantages, this paper focuses on how our research design permitted the study to approach post-session analysis of player experience from different angles. For example, core to the development of our method for gathering feedback-based game metrics (see Marczak et al., 2013) was 1) a desire to abstract and summarize player experience using a technique that did not require researchers to view and manually code hours of game footage in real time, and 2) provide a method for gathering metrics that did not require access to game source code. When confronted with hours of captured game play footage generated with a commercially available off-the-shelf game title we get a player's distinct approach or playing style, determined by his/her individual differences in learning style, comprehension, and perception, to name but a few variables. The task of understanding player experience in the context of a broader sample of participants, therefore, constitutes a highly complex task. In the first instance, the application of feedback-based game-metrics to footage captured of game play sessions is designed to allow us to *segment* a game session into sections of play with defined meaning breaks, creating manageable portions of game-play activity in which player behavior is assessed. As outlined below in more detail, segmentation of play works with the structure of the game, but does not constitute an assumption as to what constitutes the most salient qualities of a game experience within that structure. One method employed in the examination of segments of game play is how it can be guided by a player's physiological response to the game. Thus, biometric measures permitted the player to signal which aspects of the game play experience we might examine as salient aspects of the game play experience. The question then turns to what those events represent and whether they shed any light on debates that fail to examine violence for the manner in which it is re-purposed by games.

Segmentation of Game Play

Performance

Before discussing how the use of biometric data led to the consideration of an alternative set of activities that hold significance for players, it is first necessary to briefly outline the filtering process that employed GSR in conjunction with game-metrics to reveal a number of associations. The process under consideration here is segmentation of game-play performance. Segmentation is employed in the context of our work as a means of determining the homogeneity of sections of play divided by meaning breaks within the play experience (e.g. at its simplest level new missions, levels, information or plot updates). Based on Reynar's (1998) foundational work in this area, we employ his definition of segmentation as "the process of dividing lengthy documents in topically coherent sections." It is necessary to acknowledge that the concept of gameplay segmentation is not new to game studies, as it has already formed a key component of the Game Ontology Project (Zagal *et al.*, 2008). However, a key difference between the way Zagal *et al.* (2008) employ the term and how it has been employed in the context of our study is based on how we attempt to incorporate 'performance' into the logic of a game segmentation. Performance is a critical concept for us as it emphasizes the unfolding nature and relevance of player input, highlighting the role of the player as something more than just a necessary component to activate the game system (Aarseth, 2007). While Zagal *et al*. are clear to define the role of 'segmentation' as an exploration of the structure of gameplay that supports the analysis of the role of 'design elements,' we claim to segment based on how players engage with the game structure and the possibilities offered by it.

Zagal *et al*. (2008) opt to segment 'gameplay' on the basis of their temporal, spatial, and challenge characteristics. Yet, in illustrating their approach, they apply their framework to vintage arcade games that foreground the rule system by virtue of their simplicity. This inevitably leads them to concede that contemporary games are likely to include "multiple type[s] of segmentation, that are interrelated, or even co-occur," with novel game design also likely to require further ways of segmenting gameplay that may in turn call for a re-examination of any existing segmentation principles. In this way, Zagal *et al*. acknowledge how such processes are required to evolve, or demand a more open-ended approach. By incorporating player performance into our segmentation process we aim to achieve this, in doing so, by utilizing structure to achieve a segmentation that isolates relevant player experience. Meaning breaks are defined by the detection of various elements that carry information on structural properties such as changes in scene (e.g. shift to cut-scene), participant orientation (e.g. perceptual shifts, for instance from 3rd person perspective to bullet cam in *Max Payne 3*), or chronology (e.g. screen death) (Grimes, 1976). On the one hand, we identify a need to understand and characterize the structure of a game as a multimedia document (segmentation), while on the other, there is also a need to acknowledge and understand what comprises the content (indexing) or conditions of play. We therefore delineate further in order to incorporate 'indexing' as a process that determines where, in the structure of the system, the player is active (e.g. in-game verses menus), the nature of the player's involvement and the degree of interactivity (e.g. fully, semi or non-interactive). When applied to gameplay, segmentation is therefore the determination of the boundaries (time stamps) of a coherent section of play that is comprised of a set of indexical properties. For example, the beginning and end of a cut-scene can often represent a significant plot point and change in a game (segment), but also can denote a distinction between ludic and narrative involvement and degree of interactivity of the player (index).

Segmentation Layers

In order to reach more fine-grained aspects of a play experience, it has been useful to make the segmentation process a multi-layered approach. The layers, listed below, are employed in two different ways. The first is relating to the *process* of segmentation in which audio-visual footage of a game play-session is processed or 'deconstructed'. And the second is relating to aspects of player experience that are 'reconstructed' using the layers to discern the meaning of a section of game play. The five layers proposed are:

- Game System
- Game World
- Spatial-Temporal
- Degree of Freedom
- Interaction

Each gameplay session produces an audio-video file of game play footage that is then analyzed, which makes the game metric and segmentation approach a post-processing method. This differs from more typical gameplay metric processes that exploit the game-source code, directly logging and saving, in real-time, different metrics — or sending them (in the case of telemetry) for further processing. The first step in our process is to acknowledge and treat the game system as a whole. That is, the initiation of game-play, as the diegetic experience of playing in a fiction world, only occurs once players move from splash screens and reach the higher order 'main menu' where they are able to activate play and enter to the game world. Only when play is initiated does the player move from the *game system* layer to the *game world* layer, the 3D space in which the game is situated and play is realized. From that point onward, play in *Battlefield 3,* for instance, is either broken or paused by the player, exiting play through higher order menus. The game world layer contains what we term 'instances' of game play (that permit segmentation). During audio-visual analysis of such 'instances', the player is present only as the entity behind, and responsible for generating and triggering the game footage under examination. The first key task in this process is to distinguish between in/out game and active/inactive and what this entails in terms of audio-visual design coherence between two consecutive frames. After this, we begin to distinguish the *spatial-temporal* layer nested within the game world layer as we identify pausing or detachments from the game world by the player, or the results of the terrain traversed or activities completed by the player triggering cut-scenes or progression to new missions via a loading screen. These elements constitute identifiable nodes that map the progress and journey of the player and also the timing of when players experience core events in the game (useful for cross-player comparisons). Related to player progression through a game is the *degrees of freedom* and *interactivity* layers that constitute the manner in which the logic and rule system of the game is conveyed to the player and the degree to which the player is required to engage with the information provided by the game, or is permitted to ignore cues provided by the system.

To provide a simple example of how this might work in a game like *Battlefield 3*, and also to work back through the layers in the opposite direction, the game contains Quick Time Events (QTEs) that force the player to complete a series of rote-based actions (e.g. press E, left click mouse, then right click mouse, etc.). These prompts from the system are not presented to the player in a diegetic form, but remain procedural, only really acknowledging the nature of player input. In the context of QTEs, the player temporarily loses all other agency possibilities (i.e. they are unable to move freely or use strategy or weapons of choice). The degree of freedom becomes highly prescriptive, as the system (which is always in control of such conditions) is much more explicit in its treatment of the player as providing the necessary input to activate content and progress game-play. Each interaction is preceded by an on-screen prompt (or video feedback stream from the perspective of our metric method), that indicates the action required (e.g. a blue icon matching the expected player input, E, mouse icon with left or right highlighted). Should the player follow this prompt with the correct input, the icon will then blink in blue in response as means of validating the player's action. Failure to follow the prompt will lead to red icon, indicating that a response was either incorrect or absent. The interactions defined by their degrees of freedom are built into the game system as a form of mini-game (a task outside what one might expect in an FPS game environment) that is defined by success or failure, upon which progression is conditional and non-negotiable. As a marker of player progression, when a QTE occurs for the player is also indicative of space and time. That is, specific QTEs (like missions or levels) are conditional on players' ability to reach specific locations on a game map, but also indicative of how long it takes a player to reach these nodes within the game system (see Figure 3). A QTE will therefore be triggered only once a player has reached a pre-defined point in the game, and should the player succeed, the same QTE will not reappear in that version of the game again. To this degree, the time taken to activate different QTEs provide a marker of pace and rate of progression attributable to the levels of mastery possessed by the player, or nature and style of game-playing (e.g. exploratory and/or thorough verses action and/or goal oriented). Lastly, whilst an obvious statement, QTEs are part of the game world and therefore cannot appear should a player activates a pause or opts to manage the conditions of play through engaging in higher order menus. This provides a clear indicator for automatic processing of a game's audio-visual feedback as to when QTEs materialize for the player and the nature and degree of player activity that the player experiencing when QTEs occur.

GSR Steered Analysis

As described above, the segmentation process is designed to reduce footage of lengthy periods of game play activity into more manageable segments. This permits play to be located by where it occurs in terms of key structural components of the game, 'advancement' within/throughout the game, whilst indicating the nature of player activity, the level of demand being placed on players, and player response. While this method is capable of functioning unaided to map the actions and nature of the experience that a game offers, the aim of the wider-project responsible for producing this method addresses the nature of a player experience. Thus, in this context, the study not only sought to document play, but also what play means to the player. This has required us to revisit footage of play with the player to ask them to reflect on different aspects of the game experience. Contributing to the process of engaging the player on their play is the physiological response of the players themselves. We have, therefore, used the biofeedback provided by participants during play to guide our selection of material for further discussion with players. Additionally, we have also sought to use biometric data to present a reading of the game 'as an experience,' one that generates arousal in players that we can then also compare with how well it corresponds to the different feedback-based metrics that are being put into action. That is, we ask if what we are collecting as game-metrics corresponds to a player's significant experiences within gameplay, thus improving the relevance of the metrics gathered as an indicator of player performance. It is during this process that biometric data also registered player arousal in aspect of the game that were not being registered by the feedback-based game metric system – indicating that there are aspects of play that may not be as readily, or logically identified as a source of excitement. It is these findings that might otherwise be disregarded that we seek to devote the remainder of this paper to discussing.

In our application of biometric data, we have utilized Galvanic Skin Response (GSR) as a measure of the conductivity of human skin. Typically GSR has been used in human-computer interaction (HCI) research settings to examine the degree of users' psycho-physiological investments, such as the level of mental effort or stress/anxiety incurred (Lin *et al*. 2005). Put more simply, physiological measurement attempts to explore the relationship between mind and body. A common application of physiological measures in HCI research is found in experimental studies that are seeking to determine the value of GSR as an objective measure of user experience. This means that GSR has been examined for its presence/value in assessments of pre-identified contexts with games (Lin *et al.*, 2005), network applications (Wilson & Sasse, 2000), and webpages (Ward & Marsden, 2003) where the experience is pre-selected for its expected response from the user. Our use of GSR is non-experimental and exploratory in nature in the sense that games such as *Battlefield 3* were played by participants at their own pace without interruption, at one session per week (1-1.5 hrs. in duration) over a 6-week period. By contrast, Lin *et al.* (2005) asked players to complete three tasks in *Super Mario 64* (Nintendo) as quickly and correctly as possible with their performance compared to performance estimates of what a skilled player could achieve in those selected tasks. While the results of the above study revealed a strong relationship between subjective (stress rating scale) and objective measures (GSR), the conditions under which 'users' were assessed were pre-determined by experimental design and therefore, not necessarily a good representation of the player's experience of play or wider conditions under which GSR is registered.

To begin working through the process of utilizing GSR, Figure 1 (below) presents raw data from two different data sources taken during play sessions of our pilot study with *Dead Island* (*Author et al.,* 2012). GSR and the player's health values, as captured using feedback-based metrics from the on-screen health bar, are displayed separately. As a measure of avatar health, a health bar drop to zero represents avatar death while its disappearance denotes detachment from the game world instance. Health was examined as a useful metric, from an interactivity and player experience perspective, as sudden drops in health are often the result challenging moments in game play that can carry stress and the possibilities of losing achievements and an impediment to progress. We postulated that increases in GSR might co-occur with loss of health in parts of the game allowing us to account for a high proportion of the GSR readings produced by players. Significant challenges were faced in order to be able to link the information that was gathered and analyse them concurrently. Plotting GSR and health onto a single graph did not produce any meaningful interpretations as Figure 1 shows. The raw data sets of GSR and health are quite different to each other on a number of levels. Each measure contained a different level of precision thus requiring some form of standardization in order to enable meaningful analysis. GSR values change slowly and occur only after an eliciting event, resulting in non-simultaneous time stamps between GSR and game events, and, in doing so, inhibiting correlation analysis. Also, GSR and health status measures were recorded at different levels of precision: health status values were recorded each second, while GSR values were recorded on average once per second, resulting in more GSR values than health status values.

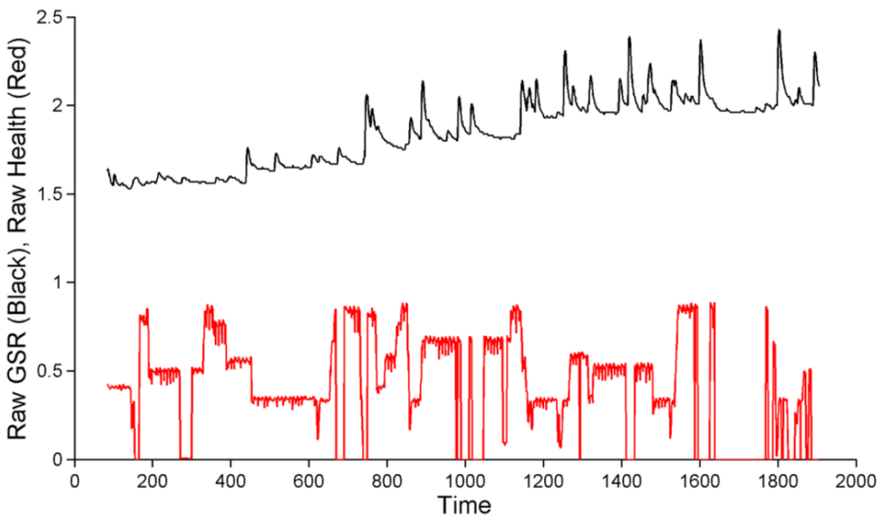

Figure 1. Raw GSR (black) and raw avatar health (red) for one game session (Dead Island).

While a number of moments of high physiological arousal (large GSR ‘spikes’) are observable, with GSR also generally increasing over time, plotting both GSR and health status reveals no meaningful information. Health status has no apparent visible consistencies, and has very large variations in value. Overall, there was too much variation in both data sets to make any statements or conclusions about either or to draw any links between them. Summarizing both data sets provided a solution. First, the differences between scores two seconds apart were calculated; thus, changes in the measure were calculated over short intervals (two seconds), and for each data point. Next, these difference values were summed over a slightly larger interval (six seconds), with the criteria that only positive GSR difference values, and negative health status difference values, were included. Summarized data was then assigned a bin label: a time stamp relevant to the interval of which the summarized data was gathered. Bin labels always start at zero and increase in consistent intervals. The advantage of binning data was that each data set now contained identical time stamps with corresponding data that represented a particular moment in time. Thus, the data has been simplified and standardized while retaining meaningful information, thereby allowing for meaningful analyses.

Figure 2 displays summarised GSR and health status measures illustrating visible links that can now be observed between the two measures. It is interesting to note that the majority of large GSR spikes correspond closely in time to large health decreases:

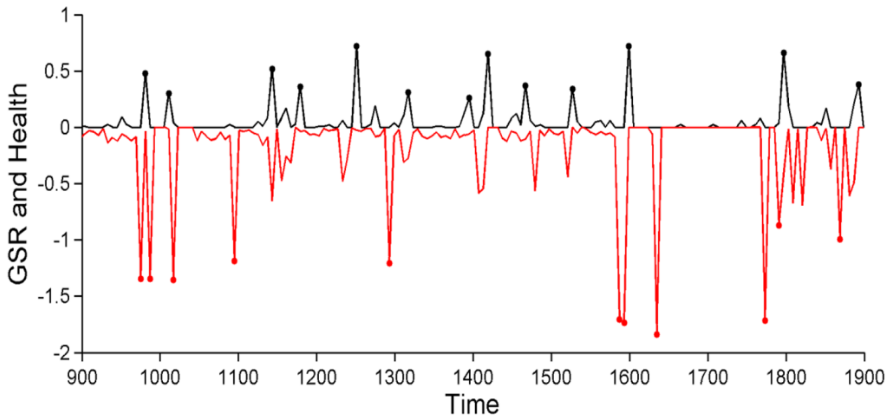

Figure 2. GSR (black) and avatar health status (red) of *Dead Island* are shown as summarized data. Filled circles within the GSR data set represent the largest 5% of summarized values, and filled circles within the avatar health data set represent 5% of the lowest values.

With the data summarized in this way, selecting points of analysis based on significant GSR values became viable. We then selected the largest 5% of summarised GSR values (indicated by a black filled circles, Figure 2) to direct further analysis. Because bin values represented time during game play, these GSR values could be used to pinpoint particular moments in the game on which more data could be collected – game content and player commentary. Thus, further details and links between particular game events or content could be gathered, and even interpreted by the player themselves. The lowest 5% of health status values were also selected and highlighted (using filled circles) to determine a visual level of correspondence between the two measures.

Having established a visual association between GSR spikes and loss of health, we sought to examine a similar relationship with *Battlefield 3*. While *Dead Island* displays continuous health values on screen, *Battlefield 3* did not display health bar information and so required total health loss or screen death, signified by a 'mission failed' logo (see Marczak *et al.*, 2012), to be processed. While this procedure was equally successful (see Figure 3) it did not account for all the GSR spikes generated by players. This suggested that confining our study to the relationship between the measures drawn from the feedback-based game metric process alone was insufficient. As a post-processing method, the feedback-based metric approach is an ongoing approach thanks to the considerable amount of data that remains available for processing once game play has been captured. Therefore, in order to fully account for players experience and advance the feedback-based game metric approach, unaccounted GSR activity was also examined to assess what other metrics could be measured from the audio-visual feedback. Therefore, in cases where no observable correlation occurred between health metrics and GSR, storyboards were automatically generated for GSR spikes so that the activities of game-play could be examined. Each storyboard comprised of images taken over a 10 second period, centered on the bin relevant to the summarized GSR value. If a GSR spike was observed at 123 seconds (the summarized bin value) with no visibly associated health decrease, images were collected from 118 seconds to 128 seconds, extending 2 seconds either side of the bin (bins consisted of six seconds worth of data, i.e. 0 to 5.99 seconds). The generated storyboards were then manually analyzed to determine a) what was happening in the game and b) any commonality across the participants. Should any commonalities be identified, then it would be possible to consider how such events could be captured automatically in the future via the feedback-based game metric method.

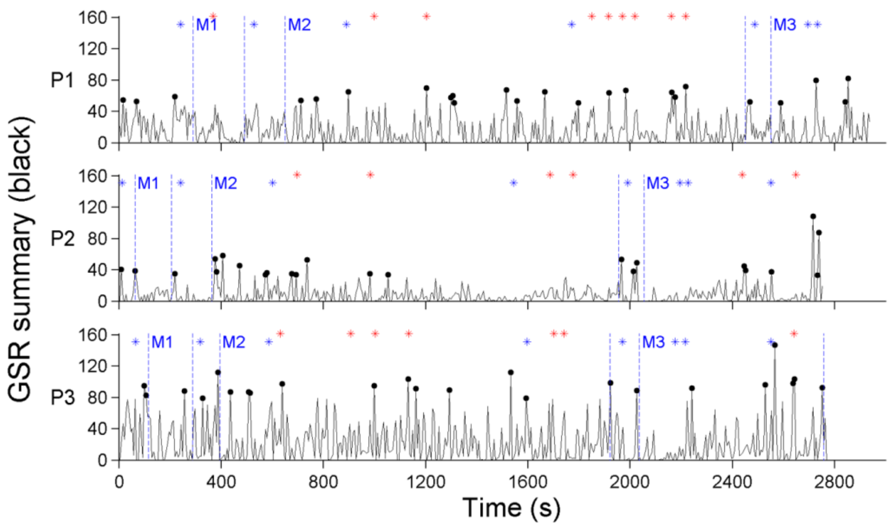

Figure 3: Summarised GSR for three participants.

Figure 3 (above) is annotated for cross comparison between participants, deleniating the three different missions (M) that participants played through in a single session. Mission start and end times are indicated by vertical dashed lines. Avatar death is noted with a red astrix, while a blue astrix more generally denotes the occurrence of key moments in the game (that can be assessed in terms of 'time and space' comparisons). Typically a new mission is preceded by a cut-scene (*) explaining the astix before each mission start (–), otherwise within M2, the first astrix indicates when a squadron member is shot (discussed below and seen in Figure 4) and the second a quick time event. The first and second astrix within M3 also represent quick time events, while the last astrix in the section denotes a scene in which the player is surprised by the appearance of an NPC that turns out to be a 'friendly'.

The unresolved GSR-spikes for ten participants were examined by manually coding the core elements in each scene depicted by the sequence of automatically generated screen shots. For each participant the ‘time stamp’ is noted, together with the presence or absence of variables such as injury (e.g. sustained to self or NPC squadron member), environmental conditions (e.g. day/night, qualities of the terrain, space, etc.), the nature of the player’s movement (e.g. stealth, running, in transit, etc.), combat, directives (e.g. “let’s go”, “follow me”). In total, each storyboard scene was examined for the presence or absence of 32 variables. Prior confirmation of the co-occurrence of death and GSR had a significant impact on what remained as unresolved GSR. For example, in order for the player to end a sequence of play with screen death, they are, by necessity, typically engaged in direct conflict with the enemy. Thus, co-occurrence of death and GSR accounted for the majority of player arousal associated with combat-scenarios, in which GSR spiked around the moment of failure. Equally significant, unresolved GSR rarely involved the player actively engaged in acts that come under the rubric of violence (i.e. shooting or fighting). The majority of enemy related scenarios associated with GSR spikes, were either anticipatory in nature or situations in which the player is under attack from the enemy. Such attacks were typically from a distance where the enemy was not easily visible or identifiable. Key GSR-triggered storyboards, taken from a single session with *Battlefield 3*, are outlined below for the way that they highlight significant moments in players’ game-play experiences.

Figure 4: Automatically Generated Screen Shots of Events that occur with GSR Spike

Figure 4 illustrates a consistent and salient scene for participants, which is indicative of anticipation and suspense that punctures play and experience of *Battlefield 3*. The players playing this scene emerge with their battalion from a dark interior into a bright exterior. This action requires a quick visual adjustment and sudden exposure to an expansive outdoor urban area. The player is directed to “Follow”, requiring them to keep pace with NPCs ahead rather than approach the scene with any caution. At the same time a fellow marine declares “Not a single civie. I don’t like this shit”. The interior is also populated with metal shelving preventing the player from a obtaining a clear and unobstructed view of what lies immediately ahead. As they emerge from the interior space the battalion quickly comes under fire and an NPC battalion member is shot requiring the player to drag the character back to the safety of cover. Such a scene does not portray enemies of old, that provide the player with opportunities to indulge in the slaying of waves of adversaries, placed in front of the player to mow down indiscriminately. Instead, the enemy remains aloof and invisible.

A similar scene (see Figure 5) that also proved to be prominent as a GSR-triggered moment in players’ experience saw players under fire on a building roof top. Again, the scene is characterized by the similar elements as Figure 4 as an unseen adversary has opened fire on the battalion, causing the player and NPCs to crouch and crawl around the roof top location. The key difference in this section of play is the pressure placed on the player to locate the enemy and return fire on the building from where the shots emanate. While this scene is actually identified (via the metric system) and coded as both a form of engagement that also typically involves player failure (screen death), it is noteworthy for the manner in which player actions are managed by the system and resolved in an action whose in-game consequences are far-removed from the player.

Figure 5: Automatically Generated Screen Shots of Events that Occur with GSR Spike

While such distinctions relating to the nature of play with *Battlefield 3*, via moments revealed by GSR activity, might not appear overtly momentous as a commentary on the experience of game-play, such examples nevertheless deserve to sit alongside judgments delivered by watchdogs as to what a game experience entails. Such examples serve to present game play experiences with greater breadth. They also further collapse the experience of play as violence, disclosing the role and forms that violence take in specific game contexts. Indeed, the dynamism of the game system is evident in both examples outlined above, presenting a clearer representation of the role of the player in such moments of play. Both examples show how the player had been asked to perform a particular task having been maneuvered into position by the conditions of the game and had their degree of freedom reduced and restricted. In such contexts the influence of rule system is unequivocal.

Additionally, other unaccounted for GSR-identified extracts of game-play contained many examples of otherwise trivial or negligible content that are unlikely to attract consideration in the context of classification, but offer a more balanced account of where excitement and investment resides for the individual experiencing play. To highlight but a few examples, Figure 6 depicts a scene in *Battlefield 3* in which the battalion is on the move, running and jumping across rooftops. In this section of game play, the battalion pause to craft a makeshift gangplank between two buildings, before leaping off roofs until they eventually reach ground level. Likewise, mission briefings, anticipatory moments in transit and loading screens for new levels all generated responses that drew consideration away from the more obvious dimensions of the game.

Figure 6: Automatically Generated Screen Shots of Events that Occur with GSR Spike

Conclusion

While a paper of this nature would ordinarily seek to conclude by stating the value and performance of the methods presented, in this case 1) feedback-based game metrics and 2) the method of processing biometric data, the theme of DiGRA 2014 has given us an opportunity to shift our attention to aspects of the data that otherwise would clutter such an academic process. That is, while our study remains focused on seeking to establish a strong relationship between metrics and GSR in order to characterize a player's performance, the results of players' bio-feedback also suggests that the range of associations that can be taken from a game experience are much wider and more diverse than our processes currently account for. Furthermore, in allowing the player to guide our analysis of their game-play experience, via their GSR, it was possible to avoid simply asserting player responses to pre-determined sections of game play that have been identified for the content. Instead, examining unresolved GSR data required us to explain the relevance of sections of play that would not typically feature in deliberations as to the focal impact that a game will have on its player. A picture emerges of the value of intermittent or irregular moments, the significance of achievements and advancement (e.g. mission loading screens, mission briefings), and the pressures and challenges that games present players as a rule system.

ACKNOWLEDGMENTS

We would like to acknowledge the role of Jasper van Vught and Leanne Nehausen who, as research associates on the project, also contributed to the data collection process. We would also like to acknowledge the input of Dr. Lennart Nacke, who as Associate Investigator on the project provided valuable advice to us during the early stages of the paper.

BIBLIOGRAPHY

Aarseth, E. “I Fought the Law: Transgressive Play and the Implied Player,” in Proceedings of Digital Game Research Association Conference: Situated Play (2007). Available at http://www.digra.org/dl (accessed Feb. 2014)

Aarseth, E., “Ludo-Narratives vs the Meta-Chronotope,” DeFragging Game Studies: DiGRA 2013, Atlanta, Georgia, (2013).

Anderson, C.A. and Bushman, B.J., “effects of Violent Videogames on Aggressive Behavior, Aggressive Cognition, Aggressive Affect, Physiological Arousal, and Prosocial Behavior: A meta-analytic review of the scientific literature, in Psychological Science, vol. 12, no. 5, (Sept. 2001), pp. 353-359.

Bufacchi, V., “Two Concepts of Violence,” in Political Studies Review, vol. 3, no. 2, (2005), pp. 193–204.

Calleja. G., In-Game: From immersion to incorporation, MIT Press: Cambridge, MA, (2011).

Grimes, J. E., The Thread of Discourse, Mouton: The Hague (1976).

Lin, T and Hu, W., “Do Physiological Data Relate to Traditional

Usability Indexes?” in Proceedings of OZCHI 2005, (2005), ACM Press.

Marczak, R., Vught, J., Schott, G. & Nacke, L. E. ,“Feedback-Based Gameplay Metrics: Measuring Player Experience Via Automatic Visual Analysis,” Proceedings Of The 8th Australasian Conference On Interactive Entertainment: Playing The System. ACM Press, (2012).

Marczak, R., Schott, G., Hannah, P. & Rouas, J., “Feedback Based Gameplay Metrics,” Proceedings of Foundations of Digital Games, pp. 71-78, (2013).

Mirza Babaei, P. & McAllister, G., “Biometric Storyboards: Visualizing meaningful gameplay events,” in Proceedings of CHI 2011, (2011), ACM Press.

Moscovici, S. “The History of Actuality of Social Representations,” in U. Flick (ed.) The Psychology of the Social, Cambridge University Press: Cambridge, (1998), pp. 209-47.

Office of Film and Literature Classification, Public Perceptions of a Violent Videogame: X-Men Origins: Wolverine, OFLC: Wellington, (2009).

Reynar J.C., “Topic Segmentation: Algorithm and Applications,” PhD Thesis, University of Pennsylvania, (1998).

Schott, G., Marczak, R. & Mäyrä, F., “DeFragging Regulation: From putative effects to ‘researched’ accounts of player experience”, Defragging Game Studies: DiGRA 2013 Peer Reviewed Proceedings, (2013a).

Schott, G. Vught, J. & Marczak, R., “The ‘Dominant Effect’ of Games: Content vs. Medium,” Journal of Creative Technologies, Vol 1(3), (2013b). Available from http://journal.colab.org.nz/article/25 (accessed Feb. 2014).

Smith, T., “Watch You Watching ‘There Will Be Blood,’” in K. Thompson & D. Bordwell (eds.) Observations on Film Art, (2011). Available at http://www.davidbordwell.net (accessed Feb. 2014)

Veale, K., “‘Interactive Cinema’ Is an Oxymoron, but May Not Always Be,” in Game Studies, vol. 12, no. 1, (Sept. 2012). Available at http://gamestudies.org/1201/articles/veale (accessed Feb. 2014)

Vught, J., Schott, G., Marczak, R., “Understanding Player Experience Finding a Usable Model for Game Classification,” Proceedings Of The 8th Australasian Conference On Interactive Entertainment: Playing The System, ACM Press (2012).

Ward, R.D. and Marsden, P.H., “Physiological Responses to Different WEB Page Designs,” in International Journal of Human-Computer Studies, vol. 59, no. 1, (2003), pp. 199-212.

Wilson, G.M. and Sasse, M.A., “Do Users Always Know What’s Good For Them? Utilizing physiological responses to assess media quality,” Proceedings of HCI 2000: People and Computers XIV – Usability of Else! Springer: Sunderland (2000), pp. 327-339.

Zagal, J. P., Fernandez-Vara, C. And Mateas, M, “Rounds, Levels, And Waves: The Early Evolution Of Gameplay Segmentation,” In Games And Culture, Vol. 3, No. 2, (2008). Pp. 175-198.