Emotional Requirements in Video Games

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Abstract

Requirements engineering for video games must address a wide range of functional and non-functional requirements. Video game designers are most concerned with capturing and representing the player experience: the means by which the player's consciousness is cognitively engaged while simultaneously inducing emotional responses. We show that emotional requirements can be expressed in two parts: as the emotional intent of the designer and the means by which the designer expects to induce the target emotional state. Spatial and temporal qualifiers on intent and means may also be required.

We introduce emotional terrain maps, emotional intensity maps, and emotion timelines as visual mechanisms for capturing and expressing emotional requirements. Using a first-person shooter example, we show that these mechanisms can express the desired emotional requirements while providing support for spatial and temporal qualifiers.

Keywords: Non-functional requirements, emotion, emotional requirements, video game.

1. Introduction

In prior work [4] we showed that the most probable source of failures in video game development is in the transition from pre-production (capturing the game designer's vision in a game design document) to production (implementation). The game design document is often mis-used as a system design document even though it is principally a set of requirements that the software artifacts and media assets must meet in order to capture the game designer's vision.

Video games are unique among software artifacts in the breadth of their requirements. The software implementation of a video game has a set of functional requirements. The "game" within the video game also has a set of functional requirements governing the rules that create the player's cognitive engagement. Finally, there is a set of non-functional requirements for the emotions that are to be induced in the player at each stage of the game or by each game element.

Emotions and emotional impact are not generally considered critical to the implementation of a software artifact. Their highly subjective nature resists quantification; yet, from the player's perspective, the induced emotional state is the most important deliverable requirement. Any functionality that exists, exists only to further that emotional goal: player acceptance, and market success, is driven by the realization of this set of non-functional requirements.

This paper investigates the application of requirements engineering techniques to emotions in video game design. We characterize emotional requirements and, using examples, we investigate issues associated with representing emotional requirements. We identify mechanisms for expressing emotional requirements in context and conclude with a summary and directions for future work.

2. Related Work

There has been relatively little work on emotion in the requirements engineering literature [3, 6, 9]. The fields of HCI [10], industrial design [11] and emotionally intelligent software agents [2] have pursued emotion more aggressively.

Representing or specifying non-functional requirements is challenging. Ekman's Facial Action Coding System (FACS) [7] is exemplary of a visual approach to representing emotion. The Cognitive Affinity project at the University of Birmingham [8] presents an ontological and architectural alternative.

3. Emotional Requirements

The subjective nature of emotions makes identifying, specifying, and representing them inherently difficult. Providing appropriate support for emotional requirements

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means we must understand what the game designer needs to capture and represent. Figures 1(a) and 1(b) are game design working drawings illustrative of the design process used at Far Vista Studios[1]. Figure 1(a) is a floor plan view of a portion of a virtual world. An internal room, in the lower left, contains two enemy characters, a directional sound source, and a lighting source that varies with time. A window to the outside world (labeled EXT) provides spatial orientation clues and ambient light for the scene. Figure 1(b) is a fragment of an aerial view of a racing track.

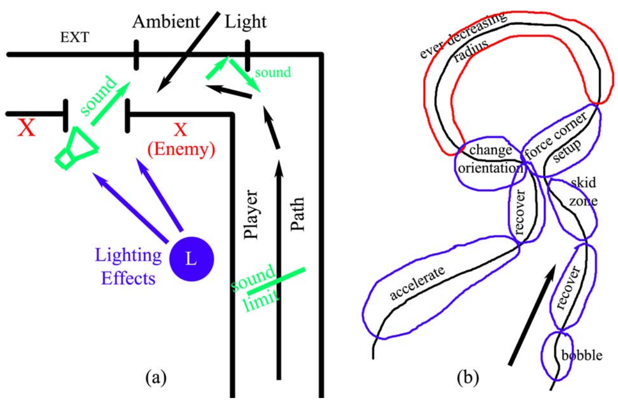

Figure 1. First-Person Shooter (a) and Racing Game (b) designs, *used with permission*

Note the high degree of abstraction in both diagrams: significant domain knowledge is assumed. In fact, both diagrams are more detailed than those usually used – many of the annotations were only added by the game designer in response to our questions.

To be useful to the game designer, we assert that an emotional requirement must capture:

1. the intent of the designer: *I want the player to feel apprehensive as they approach the entry to this room.*

2. the means by which the designer expects to induce the target emotional state, the artistic context: *The player will feel apprehensive because the lighting is very dim and throbbing slowly. A soft, but deep and menacing sound fades in and out as the player nears the entrance to the room.*

3.1. Designer Intent

The designer's intent expresses a target emotional state to be induced in the player; this is the primary goal, the reason for the existence of this scenario. The intent may also express a (physical) location in virtual reality (a spatial qualifier) and/or a temporal qualifier of some form. In the example of Figure 1(a), the target emotional state is apprehension, with a spatial qualifier of "the entry to the specified room"; no temporal qualifier is provided.

Temporal qualifiers could be provided: *If the player reaches the entry to this room within 5 minutes of the start of gameplay, the player is obviously very skilled so increase the intensity.* However, this is still not a traditional software requirement. We can, however, restructure the combined statement of the designer's intent in a more traditional manner: *If the player reaches the entry to this room within 5 minutes of starting the game, induce a highly apprehensive emotional state in the player. Otherwise, induce a state of mild apprehension in the player.*

The emotional requirement has now been stated in a relatively quantitative manner. However, there are still qualitative descriptors for the intensity of the emotional state. In production, the design and development team can replace the qualitative descriptors with quantitative constraints. For example, the team could use well-established techniques for focus group testing as a replacement metric. *During focus group post-gameplay interviews, a minimum of 70% of the players that reach the room within five minutes of starting the game must indicate that either their emotional state was "scared" with a minimum rating of five on a scale of one to 10, or that their tension level exceeded five on the same scale.* However, this level of precision may be more than required and simpler metrics may be sufficient.

Using requirements engineering techniques, we have translated the game designer's intent for the emotional experience into a traditional functional software requirement. From this example we may conclude that capturing the designer's intent requires a mechanism for representing the induced emotional state. We should also be able to express spatial and temporal qualifiers.

3.2. Artistic Context

The designer must also be able to express the means by which the emotional state is induced as part of the emotional requirements. Traditionally, this might be viewed as a design or implementation detail that has no place in the requirements engineering process. However, within this context, we are capturing the game designer's vision. As such, the means by which a specific emotion is to be induced is a requirement and not a design or implementation detail.

Temporal and spatial qualifiers also apply to artistic context. In Figure 1(a), when asked about immersion in the context of the sound source, the game designer added the rebound path for the sound in the top right corner of the figure and indicated an approximate limit for the distance the sound could travel (and, therefore, be detected by the player). The designer was indicating an experiential re-

[1]These diagrams have been redrawn for publication

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quirement (here, a spatial qualifier on the intensity of the sound source), a means of capturing their vision, and not an implementation detail.

In contrast, Figure 1(b) is a portion of a race track for a racing game. The game designer began by tracing the path of the racetrack as shown and concluded the design as soon as the heavy black line was drawn. Discussion indicated that the designer felt that this particular geometry would be greatly enjoyed by the game player. There was no indication of direction of travel or purpose for any of the geometric elements. When asked, the designer indicated the direction of travel and seemed to feel that the purpose of each of the regions was obvious. Upon request, the designer added the annotations visible in the figure. For this segment of the race track the designer had, by implication, created eight separate experiential regions.

The game designer was then asked to assign an intensity level to each of the experiential regions. The results are shown in Figure 2, where the raw data is presented as a smoothed curve. The game designer explained that, in his opinion, it was very important to provide periods of increasing intensity followed by recovery periods: "…you can only stay on the edge of your seat for so long." The overall design of this segment of the race track clearly follows this philosophy – brief periods of tension followed by recovery periods with an overall trend toward ever increasing levels of tension.

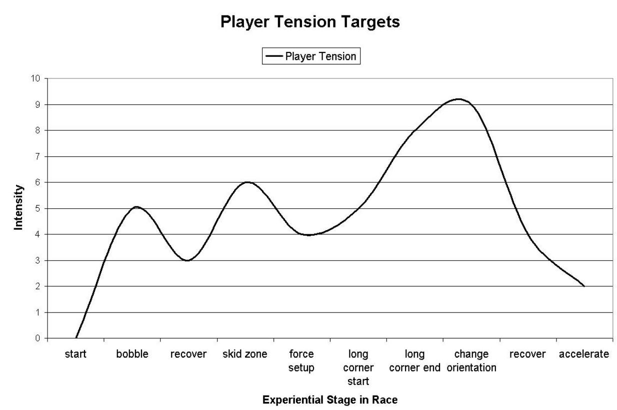

Figure 2. Emotional intensity timeline

Temporal qualifiers are very important in this racing game design: the purpose of the game is to complete the traversal of the virtual world in the minimum time. The intent of the designer is to control the intensity of the induced emotion (tension) as the player proceeds around the track. The means by which the designer controls the intensity of the emotional experience is through the nature of the challenges in each experiential region.

A first-person shooter and a racing game are fundamentally different constructs. In a first-person shooter, the player has much greater control over the time spent in each section of the world. Therefore, the spatial qualifiers tend to have greater relevance to the emotional requirements - it is only once a player enters a given experiential region that the rate at which the player's interactions with the game world unfold can be locally controlled. However, it may not be possible to force the player to enter an experiential region without irreparably damaging the sense of immersion. As noted above, in a racing game the temporal qualifiers tend to dominate the emotional requirements – the player has very little choice over where they travel within the virtual world.

4. Representing Emotional Requirements

Applying requirements engineering techniques to video game design can lead to significant resistance from game designers. From their perspective, we propose to take a essentially artistic activity and convert it to an engineering process. However, we can take advantage of the intensely graphical nature of the final software artifact to overcome this resistance by building on the familiar scenario [12] and storyboard [1] paradigms.

We initially proposed the *emotional terrain* (Figure 3(a)) for requirements whose artistic expression is strongly affected by spatial qualifiers. In an emotional terrain, the target emotion is linked to a spatial representation of the world, the emotion is color-coded, and the intensity of the emotion is associated with the luminance or perceived intensity of that color. Stereotypically, red can be used for danger, green for safety, and black or gray for neutral. In practice, color alone was insufficient to capture the necessary information.

As an alternative, we then proposed the *emotional intensity map* (Figure 3(b)). Luminance (rather than color) is used to quantify intensity while the identity of the local emotion is indicated via a graphic symbol like an emoticon, a Chernoff face [5], or some derivative of Ekman's Facial Action Coding System [7]. The addition of the facial icon allows the artist to quickly express the desired emotion in a way that transcends typical societal barriers since most facial expressions are (effectively) universal [7].

For both emotional terrains and emotional intensity maps, spatial regions are quickly sketched and intensity can be quickly approximated with an airbrush style graphics tool. The graphic symbol for the emotion can be sketched or instantiated as text from a special symbol set.

We can also draw upon the film industry paradigm of the video editing timeline as an alternative for games that are dominated by their temporal qualifiers. Rather than applying audio tracks to a filmstrip, we can apply *emotion tracks* to an *emotion timeline* instead. Each track can capture the

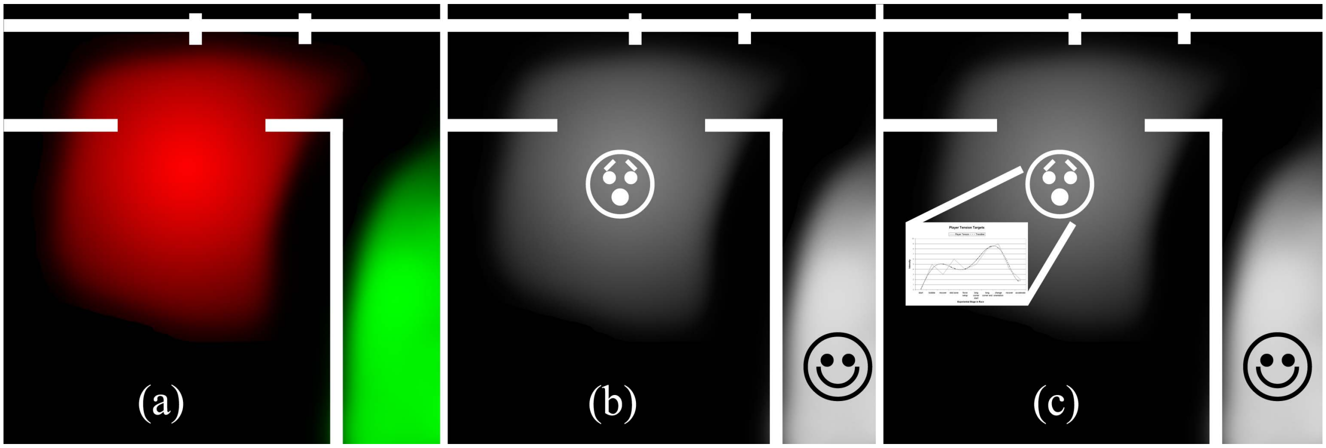

Figure 3. Representing emotional requirements

designers intent for a given emotion. For example, emotion tracks for tension, frustration, fear, relief, accomplishment, etc. could be associated with progress through the game. The timeline can be sketched as a simple graph within an experiential region, as shown in Figure 3(c). In a special-purpose software tool, a timeline editor could be accessed by interacting with the symbol and overlays could be used for display purposes.

5. Summary and Future Work

We have shown that video game design requires the capture and expression of emotional requirements: how the player is supposed to feel while playing the game. Emotional requirements express the emotional intent of the designer and the means by which the designer expects to induce the target emotional state. Analyzing game design fragments illustrated the further need for spatial and temporal qualifiers on both intent and means.

We introduced emotional terrain maps, emotional intensity maps, and emotion timelines as in-context visual mechanisms for capturing and expressing emotional requirements. Using a first-person shooter example, we showed that emotional requirements for intent can be readily expressed, including spatial and temporal qualifiers, using this low-fidelity mechanism.

In the future, we plan to evaluate the proposed techniques with a larger body of game designers. We shall continue our efforts to apply requirements engineering techniques to all aspects of video game design and the pre-production phase of video game development. Techniques for capturing artistic context, such as an artistic "look and feel" are still needed, as is their integration with emotional intensity maps.

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