Eliciting Emotions in Design of Games – a Theory Driven Approach

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ABSTRACT
As technology becomes more powerful, computer software and game designers have ever-expanding tools available to create immersive, emotional experiences. Until recently, designing emotional experiences was achieved by veteran designers relying on insights from film theory and intuitions developed through years of practice. We propose another approach: leveraging scientific knowledge of emotions to guide the design process. The approach can serve as a resource for fledgling designers trying to break into the field, but will hopefully provide a few new insights for veterans as well. In addition, it may interest emotion researchers and psychologists looking to expand their stimulus repertoire. As a necessary underpinning for the design process, we will discuss several theoretical psychological models of emotions. Classical theories largely treat emotions as basic, universal states that are invariantly evoked by specific stimuli. While intuitive and popular, these theories are not well supported by current evidence. In contrast, a psychological constructionist theory, called the Conceptual Act Theory [6] proposes that emotions are constructed when conceptual knowledge is applied to ever changing affective experiences. The CAT proposes that emotional states can exhibit strong variation across instances and individuals due to differences in situational factors, learning histories and cultural backgrounds. This theory better fits available data, and also provides a framework for modeling emotional changes that vary by situation, person, and culture. The CAT also fits better with the game design process, since it treats users holistically as individuals. During the course of a game, similar to real life, emotions emerge from evaluations of situations and can therefore not be deterministically dictated by a single stimulus. Using the CAT framework, we developed a process to create affective digital game scenarios. Our goal is to give game designers, a scientific framework to better guide the design process.

CCS Concepts

• Human-centered computing → Interaction design → Interaction design process and methods → Scenario-based design

Keywords
Emotion elicitation; Affect; Game design; Personalization; Psychology of affect; Conceptual Act Theory.

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1. INTRODUCTION
Creating emotionally engaging experiences is an important goal of game design. Game designers and developers use many different design techniques to evoke emotions. The Mechanics, Dynamics, Aesthetics (MDA) model, for example, advocates for the development of mechanics (game rules) that lead to game dynamics (game systems) that achieve aesthetic goals. The goals are defined as states that include: sensation (games as sense-pleasure), fantasy (game as make-believe), narrative (game as drama), challenge (game as obstacle course), fellowship (game as social framework), discovery (game as uncharted territory), expression (game as self-discovery) and submission (game as pastime) [74]. Several game design authors have proposed principles that describe the role of visual design, environment design and other physical properties of games and how they change over time as a way to evoke affect and a general sense of pleasure [75, 76]. The use of writing techniques to develop character and narrative in games that have emotional impact has received attention as well [28]. There have also been several works discussing the development of reward systems to encourage player achievement, competition or collaboration as a way to evoke emotions and sustain engagement (e.g. [78]). Virtual environment researchers have also acknowledged the potential and utility of adopting psychological theories of affect and emotions. One area where emotion theory has been used is in developing computational models of emotion elicitation for creating believable characters. Examples of this work include the Oz project, where the research group used scientific "appraisal" models of emotions [79] to develop expressive believable agents that can inhabit a virtual narrative world [50].

However, top designers see the game experience holistically. Thus the process of evoking emotions arises not just from characters that are expressive or believable, but from the complex interaction of all game elements: lighting, movement, sequences of events and user choices, and from the overall feel of the environment [70].This necessitates a different kind of theory to guide the design process – an approach that treats the user experience as a whole rather than as separate components (as classical theories of emotion do). The formal research cited above is in many ways the exception; more often than not, designers develop techniques and make choices based on their experience and intuitions. Experience and intuition are difficult to codify. Thus we pose the question: *can a psychological theory of emotion be used in the game design process to enhance the players' emotional experience in a game? If so, how, and what is an optimal emotion theory for this purpose?* We propose that the Conceptual Act Theory [6] can be usefully employed by designers. Taking a holistic view, the theory builds on strong evidence that emotions are not hardwired or invariant entities that can be triggered by specific stimuli. Rather, the CAT proposes that emotional instances are newly created each time they occur from the sum of all stimuli, and vary as a person's internal (i.e., the person's bodily state) and external context changes. The instances also vary across individuals who have different emotion concepts, learning histories and cultural backgrounds. We first outline different psychological theories of emotion and their limitations. We then describe in more detail the CAT, emphasizing in particular features of the theory that are critical to our game design and iterative tuning process, and describing how the theory is different from others currently used by game researchers. Second, we review previous work in creating gaming experiences using emotions. Third, we describe a design process from concept inception to realization, through the example of a game created for research purposes. We conclude the paper briefly discussing our evaluation of the game's usability and playability as well as describing an initial study where we compare the self-reported and peripheral physiological responses of the initial pool of subjects. Last, we discuss our contribution to the game design process, as well as the effectiveness of a new theory of emotions that has not previously been used in the domain of affective computing. We believe the paper will provide promising evidence of the utility of the approach, which may open new research directions in the design of emotional experiences.

2. THEORETICAL FOUNDATION – PSYCHOLOGICAL THEORY OF EMOTIONS AND AFFECT

2.1 Emotions and Affect

A commonly held view of emotions is that there exists a set of discrete, innate and universal emotional states [25, 26, 41, 42, 45, 63]. This set of emotions is often referred to by such English words as anger, sadness, and fear, and are viewed as a natural kind [6]. When boiled down to their fundamental assumptions, basic emotion models make up the dominant scientific paradigm in the psychological study of emotion. Different models emphasize different parts of the process. For instance, one family of theories called "appraisal models", focus on the set of necessary events that trigger emotions [30, 37]. Once an emotion is triggered, the presumed result is an automated set of synchronized changes in response systems that produce the signature emotional response. This view predicts that the experience and perception of emotions are fairly universal, so little variability within or between people would be observed. While intuitive, the 'basic' emotion view is not well supported by the data, variability is the rule rather than the exception. Quantitative reviews of the research have failed to find signatures of emotions in the body [16] or brain [48]. Additionally, evidence is emerging that people from different cultures perceive emotions differently [29] and people within a culture have varied emotional lives [8]. While a complete review of this research is beyond the scope of this chapter, interested readers can consult Barrett et al. [9].

Another way of characterizing emotional states is in terms of their underlying affective dimensions. Two important affective dimensions are valence, the degree of pleasure or displeasure, and activation, the degree of arousal [7, 8, 65, 67]. Together, valence and activation form a unified affective state (Figure 1). Affect is grounded in the physical fluctuations of the body: somatovisceral, kinesthetic, proprioceptive, and neurochemical [7, 59]. Affect is also a central feature in many psychological phenomena, including emotion [7, 8, 20, 65], anticipating the future [31, 32], psychopathology [18, 19], and morality [36, 38]. Affective changes are crucial to the conscious experience of the world around us [24]. People in all cultures around the world seem to have affective experiences [53]. Unlike emotions, affect can be clearly measured in the facial expressions [16], in the voice [66], and in the peripheral nervous system [15, 16]. As a consequence, affect can be thought of as a neurophysiologic barometer of the individual's relationship to an environment at a given point in time, with self-reported feelings as the barometer readings.

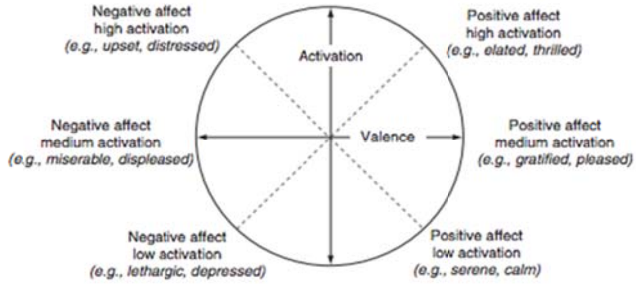

Figure 1. Circumplex model of affect.

2.2 Conceptual Act Model

Using affect as its foundation, the CAT [6] hypothesizes that affective experience becomes a 'real' emotion (fear, anger, etc.) when categorized as such using the emotion concept knowledge of a perceiver. These concepts have been learned from language, socialization, and other cultural artifacts within the person's day-to-day experience. The process of combining incoming sensory input (from the body and from the surroundings) with learned, category knowledge within the perceiver's brain is a normal part of what it means to be conscious. This conceptualizing is instantaneous, ongoing, obligatory, and automatic (meaning, a person will normally not have a sense of agency, effort or control in constructing an emotion). Conceptualizing is rarely due to a deliberate, conscious goal to figure things out. Thus to a person, emotions feel like they just happen. The CAT emphasizes the importance of situations. The conceptual system for emotion is constituted out of past experience, and past experience is largely structured by people within a cultural context. Therefore, the vocabulary of emotion categories that is developed, as well as the population of instances within each category are culturally relative. Such properties integrate the CAT with social construction approaches, positing that interpersonal situations "afford" certain emotions (or certain varieties of an emotion category). As a result, in the CAT emotions (like all mental states) are not assumed to be Platonic, physical types, but instead are treated as abstract, conceptual categories that are populated with variable instances optimized for a particular situation or context.

According to the CAT ,there are at least five sources for the variations that occur in emotional episodes: (1) the behavioral adaptations that serve as initial, affective predictions about how to best act in a particular situation (e.g., it is possible to freeze, flee, fight or faint during fear), (2) the concepts that develop for emotion, (3) the vocabulary used for emotions, (4) the variation in the types of situations that arise in different cultures, and (5) stochastic processes. As a result, there is variation within emotion categories, both within individuals and across people and cultures. Not everyone will experience the same emotion to the same stimulus, and even the same stimulus/person pairing can create different emotions at two different times.

2.3 Utility of the Conceptual Act Model to the game design process

Modern games contain complex, dynamic worlds that are well-suited to the application of the CAT for creating emotional experiences. Several key features of the CAT model are particularly relevant for game design:

1) There is variability in how people will respond to stimuli. This can be due to participants' past experiences, or contextual elements present in the situation that can be interpreted differently by different participants.

2) The context is critical for the experience users will have. A snake may elicit fear in one context, but amusement in another.

3) The sequence of events that lead to a specific situation is important when developing an emotional scenario.

A user's response is not solely determined by current conditions; it is also influenced by the preceding sequence of events. This is an important element of game design. Designers often use a "beat chart" to signify the sequencing of events or beats (single units of action) and their effect on the participant as they go through an experience. Using these three constructs, we will discuss in Section 4 a framework to guide the design process and show how these ideas can aid in developing and designing emotionally engaging scenarios. First, however, we briefly review current theory on designing for emotions.

3. PREVIOUS WORK ON EMOTIONS IN DESIGN

3.1 Computational Models of Emotions

Computer scientists have attempted to model how emotions are elicited by modeling them using digital environments. Marsella, Gratch and Petta [51] summarized several computational models of emotions. Most of these models use classical appraisal theories as the theoretical foundation, with the goal of developing 'emotional' virtual characters used in games and simulation. Computationally-based appraisal models assess events in the surrounding environment, compare them to an internal belief system, and change their emotional state accordingly. For example, the EDA model [33, 35] parameterizes external events in terms of desirability and likelihood of happening, which are then used to map to specific emotions. For example, positive desirability with likelihood < 1 yields hope, while negative desirability with likelihood $= 1$ yields distress. A good example of customized internal beliefs is the bully agent in the FearNot! system [21], which interprets as desirable another agent having fallen on the floor and crying (having been pushed by the bully); accordingly, a gloating response is produced. Besides appraisal models, three other categories of affective modeling are dimensional, anatomical and rational. Dimensional models do not implement discrete emotional categories, but rather treat emotions as continuous variables (i.e. affect; see Figure 1). For example, WASABI [11] defines different emotions as ranges in arousal-valence-dominance space, appraises the current situation in the same space, and uses the distance between the two to calculate a likelihood of a given facial expression. Anatomical models [4] are built from the ground up based on neuroanatomical data and processes. As such, they tend to be focused on a single emotion (e.g., fear) and have received only limited attention from the computational community. Finally, rational models are in many ways the opposite of anatomical, eschewing psychology almost entirely in favor of a pure artificial-intelligence approach. A good example is Scheutz and Sloman [68], who use the simple affect "hunger" to modify the behavior of intelligent, sensing agents in a world populated by other agents, food and various lethal entities.

Computational models of emotions are often put to use in the broader context of believable characters. Indeed, if computer-controlled agents are ever to appear "human", their ability to realistically express emotion is almost a requirement [10]. Once an agent has selected the appropriate emotion via an affective model, the agent needs to behave accordingly. An agent's emotional state can be conveyed visually by head position and facial expression [5, 22, 23] as well as body posture and movement [1, 3, 17, 60, 61]. The link to cognitively-driven behavior was recognized and exploited early on by the Oz project [72, 73], which developed an expressive artificial intelligence informed by emotional state. More recently, Hudlicka and colleagues [39, 40] modeled affect-induced changes in cognition, such as an increased threat response if the agent is anxious. Many of the researchers computationally modeling emotions use appraisal theory as a theoretical foundation for good reason. Appraisal theories focus on emotion elicitation - exactly what the researchers are attempting to model. For designers, such projects are interesting but leave out an important element: the actual experience of an emotion. Games seek to provide a holistic experience to the player, and since the above models do not include subjective experience they are of limited use to designers. Many game designers have therefore abandoned the use of emotion theory and instead adopted an alternative approach, either (a) creative methods that borrow techniques from other disciplines (e.g., film theory) and rely heavily on intuition, or (b) a more scientific approach where the design is still creative, but is tuned through the iterative process of testing, evaluating outcomes and modifying game variables as needed [2, 55, 54].

3.2 Creating Emotions in Interactive Experiences

Artists, designers, directors and other content creators often seek to evoke or manipulate the emotions of those who experience their work. They are interested in the holistic experience of the user. Many design techniques were documented in the 1960s and 70s, with the rise of film theory as an academic discipline. In films and television [13] as well as advertising [64], visual scenery and ambient light and color play a particularly important role. For example, according to Western cultural norms the color red often evokes violence or passion, while blue is methodical and cold [12]. Games are no exception [62], and may be even more effective conductors of emotion since they provide levels of control and immersion that are impossible using classic techniques [34, 56, 69]. One study [27] asked participants to navigate through versions of a virtual environment that differed only in some visual dimension (color, saturation, brightness or contrast). It found a measurable effect on physiological signals such as heart rate and body temperature. Aside from visuals, other sensory stimuli such as music and sound [58] and even scent and vibration [56, 69] can also enhance the gameplay experience.

Optimizing a user's sensory experience is not sufficient, however – there are also the underlying story and gameplay itself. There are many narrative techniques that increase the player's emotional connection to the story, such as creating deeper relationships with one or more non-player characters (NPCs), including interesting and multilayered plot elements, and allowing the player to influence the story arc [28]. Even simple, scripted plot elements are sufficient to evoke emotions like joy or anger [71]. NPCs with emotional depth can be implemented using the affective computing methods surveyed earlier (section 3.1). Technical agency, such as giving players control of the game camera, is critical for avoiding frustration in certain games [52]. Even subtle distinctions are important: Leino [46] argues that players are more likely to experience emotions from game content that is integral to play ("undeniable") than purely superficial or aesthetic ("deniable"). Finally, the experience of players can be altered even before they start the game, by priming them to expect a fun or serious simulation for example [49].

Overall, it's necessary to view a game as a gestalt, with visuals and other stimuli, narrative, mechanics, characters and context all working in synergy to maximize the intensity of the user experience [56, 57, 69]. Much of the previous work admirably attempts to codify the intuitions of designers, but is still not driven by psychological theory. This is partly due to the fact that for designers, most theories have focused on stimulus and response while omitting user experience. Furthermore, many psychological theories have assumed that a specific stimulus invariantly causes a specific emotion in all people. This isn't the case - as designers intuitively know. Because CAT does not have the same limitations it can be used to inform design, as we demonstrate in the next section.

4. NEW DESIGN APPROACH USING CAT

We now describe a general method for applying insights from the CAT to the creative design process. To illustrate the method, we concurrently describe how we applied it to develop a short video game that had the explicit purpose of evoking different, robust affective experiences in players. The game was part of a larger project to study individual differences in affective experience and was developed jointly by affective scientists and video game researchers. The game was constructed using the engine, assets and editing tools provided by Fallout New Vegas (Bethesda Softworks). It consisted of four scenarios designed to elicit different affective states, along with a recurring neutral space designed to allow players to return to a relatively quiescent state. The four affective states were chosen to sample the different quadrants of the affective circumplex (see Figure 1). Specific emotions within each quadrant were chosen as target emotions for elicitation. Each scenario included a task for the player to perform and included timing constraints to make the game suitable under restrictive experimental conditions (e.g., fMRI). Navigation paths and player speed were tuned so that each scenario took a minimum of 90 seconds to complete, and a three minute timeout provided an upper bound in case the player did not complete the task. The four scenarios were:

- The Fear Cave (Figure 2A) was a dark, ominous environment with threatening giant insects and rumbling earthquakes. Players were instructed to retrieve a shovel and escape the cave.
- The Calm Valley (Figure 2B) was a peaceful, natural area with trees, flowers and a lake. Players were instructed to retrieve a flower and place it in the middle of the pond.
- The Exciting Casino (Figure 2C) had upbeat music and many lively characters. Players were instructed to pick up a lucky chip and play a slot machine that caused prizes to fall from the ceiling and non-player characters to cheer.
- The Sad Hotel (Figure 2D) was a run-down and somber interior. Players were instructed to fulfill the last wish of a dying man.

The rest area was the Hub (Figure 2E), appearing between each scenario as well as at the beginning and end of the play session. The hub was virtually empty and featured a character in a lab coat ("Doc") that interviewed the player after they completed each area. Doc served as an in-game survey, questioning the player on their affective state. He also led the player through simple psychological tasks, such as counting the number of vowels in a sentence or identifying the item in a picture. Such tasks are frequently used in physiology experiments to bring the subject's signal levels back to baseline.

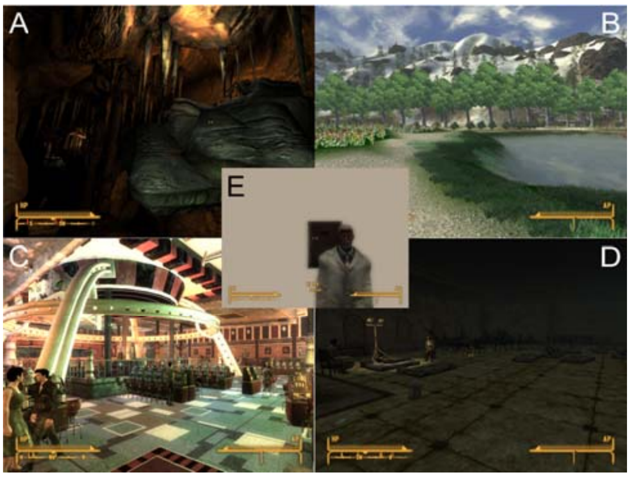

Figure 2. The five scenarios of the emotion-evoking game.

We developed the game by implementing the following methodology for designing affective experiences. It is an iterative, theory-driven process consisting of two phases: A) Affective States Definition and B) Scenario Design and Implementation. At each step the design is evaluated and tuned based on multiple iterations of internal experts' feedback and external testers' validation (Figure 3). The process draws upon the three primary design implications of the CAT (Section 2.3): 1) individual variability, 2) environmental context and 3) sequence of events.

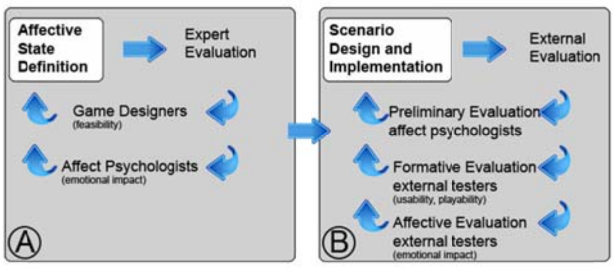

Figure 3. Iterative process for affective state definition and scenario design, implementation and tuning.

A) *Affective State Definition:* In the first phase of the process, the Circumplex model (see Section 2) is used to understand and define the affective design space for the game. At the simplest level, the desired emotions to evoke are simply represented as regions in activation-valence space, which need to be sufficiently large to accommodate individual variability. However, recalling the importance of event sequence, emotions are best plotted as trajectories across the space. In a normal game, the story arc will define the trajectory (Figure 4A) and can be modified as appropriate during this step. For our application, we wanted emotions that were as unambiguous as possible. Therefore, for each scenario we chose a single emotion towards the center of one quadrant (Figure 4B). Each scenario begins after an interval in the neutral center space, transitions to the target emotion, gradually increases in intensity to counteract habituation effects and provide variation, then transitions back to the neutral center to allow a "cool-down" establish a baseline before the next scenario and collecting subjective affective assessment using a five point Likert scale for valence and arousal.

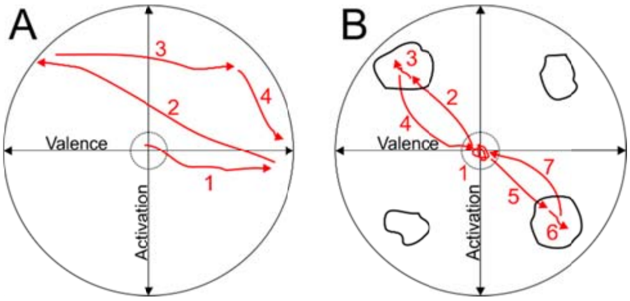

Figure 4. Trajectories in activation-valence space developed during the Affective State Definition phase. A, a typical story arc: 1-exposition, 2-crisis, 3-climax followed by resolution, 4-denouement. B, the first half of our affect game: 1-hub, 3-fear cave, 6-calm valley, 2,4,5,7-transitions. Representations of our four affect targets are also indicated.

Expert evaluation: the evaluation stage assures that all individuals involved in the design process are on the same page with regard to emotional definitions. Given individual variability, it's important that (e.g.) lead designers and level designers share the same goals. Technical limitations of the game engine also need to be accounted for at this stage, since a flawed implementation of an affective state is unlikely to achieve its goal. In our case, we initially selected eight emotional states spread over the four quadrants of activation-valence space, then drafted scenario outlines that targeted each one. The game designers evaluated the scenarios for development feasibility in terms of technology and resources available, while the affective psychologists focused on emotional impact and focus. After several iterations, four final states were selected: Excitement (positive valence, high arousal), Calm (positive valence, low arousal), Sadness (negative valence, low arousal) and Fear (negative valence, high arousal).

B) *Scenario Design and Implementation*: in the second phase of the overall design process, the game is fleshed out based on the states previously identified. The preliminary outlines from the previous phase are expanded into storyboards, then used to construct fully-elaborated scenarios. Appropriate emotional imagery is specified and incorporated into the narrative and game environment with the aid of audiovisual elements used by affective science research: IAPS (International Affective Picture System) [44] and IADS (International Affective Digital Sounds) [14]. These are large sets of standardized, internationally accessible photographs and sounds that include contents from a wide range of semantic categories, developed to provide a set of normative emotional stimuli for experimental investigation of emotion. Since emotional imagery is a continuum of experience to which players will adapt over time, it is important to incorporate narrative and audiovisual variability.

External evaluation: As the game components and levels are transformed from storyboards to fully-realized digital environments, three types of evaluation need to take place. First, the designers and/or affect psychologists need to verify that the constructed environments actually convey the correct emotion, at least for the majority of observers. Only the full, dynamic environment contains the context and event sequence that critically contribute to emotional impact. As an example from our own development process, the team agreed on an initial casino model based on static screenshots, but an early demonstration revealed certain subtle textures that detracted from the overall excitement. The textures were not feasible to replace, so we ended up changing to a different casino model for the final version. The second and third types of evaluation are both conducted by external testers. Playability testing is already familiar to designers, but is particularly important for an emotion-based game because technical issues (e.g., unclear tasks or difficult controls) can frustrate players and completely obliterate any desired emotional impact. In addition, given individual variability, it's vital to assess emotional impact on a number of people as well. Surveys or physiological measurements can be used; for our scenarios we employed both. More details on our formative and affective evaluations will be given in Section 4.1.

Previous work on emotional design (Section 3.2), as well as the CAT theory itself, underscore the necessity of a holistic approach. That is, a game and each contiguous segment within it must be seen as a whole: ambient sounds, music, light properties, colors, tasks to be performed, navigation patterns and shapes collectively contribute to emotion elicitation. The iterative steps of our design process help ensure that as many of the above properties as possible are incorporated, and can act in synergy, as the game is built up from basic emotional states. As mentioned previously, meeting the requirements imposed by our experimental research setup meant a certain degree of compromise, in particular the self-contained scenarios designed to allow for random shuffling and isolate particular affects. However, within each scenario we utilized the CAT-based model, carefully composing the visuals and audio stimuli over time and integrating them with story elements to achieve the targeted affective state results. Visual elements can be glimpsed in Figure 2: the Fear Cave is dark and sinister, the Exciting Casino is bright and active, etc. Audio elements also matched; the Calm Valley featured slow-paced, relaxing music while the Sad Hotel had a much darker soundtrack and pattering rain sounds. Dynamic features were used to counteract adaptation and habituation; for example, the lighting in the Fear Cave becomes progressively more saturated and shifts from a yellow orange tint to red, while the insects progress from large ants to giant scorpions and the earth progressively shakes and rumbles more and more. Two narrative examples are the Casino, with the story arc Enter, Get chip, Play slot machine, Win jackpot, Prizes fall from ceiling, and the Hotel, with arc Enter, See sad people, Find sick man, Bring sick man his diary, Discover sick man is dead before he has a chance to see it.

5. FORMATIVE AND AFFECTIVE EVALUATION

In order to validate our four scenarios, we performed two rounds of testing. The first battery of tests (with 3 subjects, two females, aged 20 and 21 and one male aged 20) was intended as a formative evaluation to assess usability and playability of the experience. Testers were recruited among students enrolled in the Game Design program at Northeastern University. After playing, they were assessed as to how well they could form a mental map of the locations and orient themselves in the designed worlds, as well as whether they could perform the actions required by the scenario. They were also informally queried on their emotional impressions. After testing, the design team made several modifications. For example, the Fear Cave had proved particularly difficult to navigate due to the dim lighting and slightly non-intuitive layout, so to avoid disorientation the floor plan was adjusted and unique light emitters were placed at key junctions.

For the second testing phase, our goal was to assess the effectiveness of the game at evoking affective responses. As mentioned above, there is no biological signature of emotions, though affect is much more reliably measured. Thus we used a multi-measurement approach, with both psychophysiology and retrospective verbal reports. While playing the four scenarios electrodermal activity (EDA) was measured as an index of arousal. EDA and other physiological signals are often used to evaluate some aspect of a user's experience during gameplay [43, 47, 58]. The testers were three subjects (one female/ two male) from the Interdisciplinary Affect Science Lab at Northeastern University who were not familiar with the project and had a variety of experience with video games. The subjects played the game in the physiology experiment space while their EDA was recorded. After completing play, they were asked to report their affective state during the game, questioned about their actions in-game and asked to describe the atmosphere of each scenario.

Although three subjects is too few to provide a reliable analysis of EDA data, the qualitative trends were nonetheless promising: the Fear Cave signals were consistently above baseline, while the Calm Valley and Sad Hotel were consistently below. These findings are consistent with our goal of the Fear Cave eliciting higher arousal and the latter scenario eliciting low arousal. The Exciting Casino was more variable, probably due to the fact that two of the three subjects had trouble executing the scenario task (we have since revised the in-game instructions) causing the onset of frustration that took precedence over any other affective state. Individual differences in game play were also visible in the data; the most striking example was a subject who accidentally removed the clothes from the dead refugee in the Sad Hotel and began laughing uncontrollably, yielding an EDA spike that persisted even after the scenario ended.

Such examples illustrate that subjects who do not successfully complete the task at hand are likely to report very different emotional experiences. They also highlight the fact that aesthetic features alone are not sufficient to guarantee the desired affective state. The tasks to be performed and the action possibilities in each scenario are not just additional elements of the design that can be treated separately, but are a fundamental layer of the whole experience. Additionally, the critical importance of players' interactions with their environment shows how game scenarios rather than video or audio stimuli can achieve deeper emotional impact, an observation of particular interest to affective scientists who wish to study powerful emotions in the lab. During the post-play reports, all of the subjects gave descriptive adjectives that almost exactly matched the development targets. Thus "scary" or "creepy" were used to describe the cave, "calm" or "relaxing" were used for the valley, "exciting" or "fun" the casino, and "depressing" or "sad" the hotel. Our goal is to use these scenarios in future research, modulating both the targeted affect and its intensity to explore individual differences in affective reactivity.

6. CONCLUSIONS

In this paper we discussed a theory driven approach to develop interactive experiences, especially games, which evoke affective responses from users. In particular, we argue for the holistic nature of designing emotional experiences, and thus propose using the CAT as a psychological model of emotions. The CAT acknowledges that individual differences, situational context, past experiences, mindset, and sequence of stimuli jointly influence participants' affect and behavior. Based on the model we developed a generalized, systematic process for designing game scenarios to evoke emotional experiences, and used it to develop our own research tool. We hope this novel approach facilitates a new perspective on theory-driven design and leads to interactive experiences with more varied and vivid emotions within.

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