Interactive Dramaturgy by Generating Acousmêtre in a Virtual Environment

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Abstract. Acousmêtre, or the use of offscreen sounds and visual media to stimulate the imagination of the viewers was explored by Fritz Lang or Alfred Hitchcock in cinema. However, it's full potential is still waiting to be explored in interactive virtual environments. Based on the initial investigation, the inclusion of acousmêtre in a virtual environment effectively elicits suspense and increases the viewer's engagement. This paper further presents an approach on generating acousmêtre in a virtual storytelling application.

Keywords: Interactive Dramaturgy, Acousmêtre, Virtual Storytelling Environments, Experimentation.

1 Introduction

Interactive dramaturgy presents new forms of narration that move beyond the rules and conventions of narration and work to stimulate the sensations of the receiver. Interactive dramaturgy aims at creating binding effects in the listener and viewer [4]. To capture dramaturgy is often hard in virtual environments; oftentimes creating realistic visual setting is not enough. Current digital storytelling literature has given considerable attention to the importance of realism from the core of the visual medium (the eye and reason) but very little on the potentials of a medium's absence to reality. It is this very absence that gives a medium its illusion of depth. In cinema, the unique fusion of sound and images that creates an effect in the user is most effective when acousmêtre is employed.

Acousmêtre is a character hidden behind a curtain; the mysterious man talking on the phone; an offscreen sound that either speaks over the image or augments the sound naturally expected from the image. Visually, it is the silent character whose imaginary voice[1] is waiting to be heard. In other words, relative to what is shown on the screen, temporary or not, it is the offscreen character whose source is invisible [2]. Acousmatic sounds are also referred to as active offscreen sounds that engage the

[1] The discussions on cinema according to Chion [2] rarely use the term voice but instead use the word "soundtrack" which he sees as a deceptive notion. He argues that the aural elements in film do not exist as autonomous units. Instead they are received and analysed by the viewers relative to what is shown onscreen.

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spectator's anticipation to see the real source of the sound. In the movie *Psycho* by Alfred Hitchcock, the inability to see the image of the mother that can always be heard onscreen entirely builds up the curiosity of the viewer. On the other side, those that do not inspire the spectator to look for the source such as sounds that create an atmosphere (ambient sounds) are considered passive offscreen sounds [3].

Since antiquity, man has been in continuous search for ways to represent invisible forms, gods and fantasy. To express natural forms that cannot be explained, man created ways to represent obscurity. Through art and aesthetics ancient man was able to implicitly relate his life and touch the emotion of another. Dramaturgy is not new. What is new is the increasing demand to experience and interact with a fictional drama in real-time. The concept of acousmêtre is a powerful instrument in cinema that hasn't been fully realised in the interactive virtual entertainment arena to date. Perhaps this low popularity can be attributed to the hesitation on how an offscreen phenomenon can stimulate the creativity, aesthetics and real-life tension in virtual environments.

2 Suspense and Acousmêtre

According to Zillman [11], suspense and enjoyment are the essential emotional elements for viewers to judge the story as well formed. Brewer and Lichtenstein [1] supported this position, noting that suspense significantly contributes to the enjoyment of a narrative. Suspense is experienced when one fears a negative outcome, hopes for a positive outcome, and is uncertain about which outcome is going to happen [10]. According to Chion [3], sound controls human attention, unifies images, which would otherwise appear to be unrelated, and creates a sense of anticipation about what will follow in the story. In psychology, emotional responses to sound or music were found to have measurable effects on the autonomic nervous system and causes physiological changes in listeners, which are consistent with the emotions they report [7]. Thus, sounds can evoke emotional states. In addition, several studies also support the cognitivist position that uncertainty is one of the essential elements to achieve suspense [7, 10].

Murphy and Pitt [9] found that the inclusion of sound in a virtual environment conveys a sense of immersion. They noted that the use of spatial sound can affect the perception of an environment, the context of communication and meaning of the message. Theoretical and research literature suggests that acousmatic sounds integrated in the narrative add suspense and increase viewer's engagement in the virtual storytelling environment. These arguments led to the development of an application scenario called "Virtual Acousmatic Storytelling Environment" (VASE).

3 Audio-Visual Design

VASE simulates a doctor-patient conflict scenario. By evoking suspense it aims to represent the real-life drama and dilemma in the medical world using a virtual interactive environment [8]. VASE follows the three-act structure, composed of exposition (Act I), confrontation (Act II), and resolution (Act III). It also uses three typical

forms of acousmêtre: "acousmatic mechanisms in motion"[2], "voiceless", and "bodiless". The three acts are subdivided into seven scenes (3 scenes for Act I, 3 for Act II and 1 for Act III) each being associated with one instance of acousmêtre. Scenes are explored through interaction points (e.g. navigational command options) or decision choices (in the form of multiple text descriptions of the next possible scenario). The decision made by the participant triggers the visual presentation (visual setting and virtual character reactions). Decision choices are hierarchical; each choice corresponds to some predefined visual presentations and branches to another set of decision choices. There are up to three possible choices shown after each scene completes. Each possible scenario leads the viewer to a new scene, each of which has variations in the introductory presentation and unfolds to the same plot and next set of choices.

The first act provides exposition, an introduction to the environment and the main plot. There are three occurrences of acousmêtre that result in acousmatic mechanisms in motion in this act. They may appear in any order depending on the scene chosen by the user. All of these relate to the unresolved anxieties of the protagonist. Act I uses acousmatic voices that have no real-life relationship to the core of the image such as a hand holding an emerging syringe associated with the sound of an ambulance siren slowly getting closer to almost appear touching the camera from offscreen.

Act II shows the protagonist confronting obstacles. To heighten conflict and emotion in the story, there are two forms of acousmatic voices in this act. The acousmatic character of an injured boy and his mute character meet in two extremes. One extreme is the bodiless voice played by the acousmatic voice of the crying child accompanied by other offscreen sounds that fill the child's world. Another extreme is the child's voiceless body. It is the body without a voice in cinema that preserves the mystery of the character and serves as a conscience, a doubt, or a lack [2]. Finally, Act III, the resolution, reveals the acousmatic characters in the previous scenes. The offscreen sounds in this act consist only of flashback voices.

VASE uses five sounds: (1) access sounds, (2) ambient sounds, (3) visualised sounds, (4) offscreen sounds, and (5) silence. Once the user triggers an interaction point in the environment, the access sounds follow. Access sounds are representations of the virtual objects explored by the user. When the participant enters a new scene, the system plays ambient sounds that provide an atmosphere (e.g. people talking or distant noises) followed by visualised sounds (e.g. dialogues of the virtual character), if any. Acousmatic voices follow. An acousmatic voice in VASE is a combination of other aural elements – active offscreen sounds followed by *silence* or vice-versa. Silence refers to the transition of sounds to ambient silence (removal of other sounds except ambient); or to intimate and subtle sounds naturally associated with calmness (e.g. clocks in the nearby room, drops of water); or absolute silence. In VASE, silence plays in between two or more acousmatic voices or when the user moves back to the previous scene.

[2] Chion [2] used the term "acousmatic mechanisms in motion" to refer to the use of acousmatic voices that have relationships with each other. It is similar to Hitchcock's movie *Psycho* where parallel situations of offscreen discussions between the character (Norman) and his mother were shown.

4 Evaluation

An experiment was conducted in the current study consisting of 26 subjects (using an equal number of male and female subjects for each experiment) aged between 20 and 40 years from 8 nationalities, half of them being laymen and familiar with film and sound principles. The first and second experiments involve a continuous response measurement and self-report. A group of 10 subjects participated in an interactive application called AVP [6] having the same discourse transcripts as VASE's Act II (see Fig. 1b) but using only occasional background sounds. Another group consisting of 10 subjects participated with VASE. The third experiment involves a non-continuous response measurement consisting of 10 subjects (4 of which participated in AVP). Subjects were presented with series of offscreen sound samples together with a visual presentation (VASE as a series of movie excerpts).

The first and second experiments were administered in a laboratory room equipped with a computer terminal with electrodermal response (EDR) measurement software and device. Another computer terminal provided the subject with an AVP or VASE application. The experimenter recorded and monitored the interaction of the subject with the application. This data is used to track interactions such as the time when the participant enters a new scene or location. To verify the measured EDR, after the interaction, the subjects fill-out a questionnaire containing a descriptive summary of each major scene. Subjects were asked to rate (from 0-5) the feelings of hope and fear and perception of uncertainty for each scene. The experimenter also confirmed the subject's feeling of uncertainty through an interview based on Ortony, Clore, and Collins' (OOC)[3] appraisal of prospective event. Other questions include the subject's empathy for the character and understanding of the meaning of the scenes.

The third experiment was composed of 12 sound samples (consisting of either acousmatic voices, ambient sounds or visualised sounds). The materials are presented in the same linear sequence to each participant, with pauses for each sample, and are presented according to their possible appearance in VASE. Each sound sample classified as acousmatic voices may contain up to 4 offscreen sounds plus silence (combined to form a single meaning). The subjects were asked to scale their feelings of hope and fear and perception of uncertainty after each sample using the same rating scale method used in experiments 1 & 2.

A previous study by Hubert & de Jong-Meyer [5] suggests that suspense-evoking material results in greater changes in bodily sensations and increasing EDR. On the other side, materials that induce an amused state are marked by very few changes in bodily sensations, and a rapid decrease in EDR. These results are consistent in VASE, thus suggesting that the existence of acousmêtre adds suspense to an interactive narrative system. The EDR measured in AVP has lower and more clustered values of EDR compared to the data gathered with VASE (Fig 1a). The results correlate to the emotions reported by the viewers, suggesting that increasing EDR is consistent with the

[3] In the OOC emotion model [10], suspense is composed of fear, hope (emotivist response) and uncertainty (cognitivist response). Fear is classified as displeasure about the prospect of an undesirable event; hope as pleasure about the prospect of a desirable event. In addition, they also stated that, fear and hope as prospect emotions depend on the desirability and the likelihood that the prospective outcome will occur.

reported emotion of fear, hope and anticipation of an event. The results of experiment 3 also suggest that an increase in occurrence of offscreen sounds results in higher response (experiment 3) and this correlates to measured EDR (experiment 1). Data shows an increasing EDR response (Act I scene 2) on scenes with most offscreen sounds compared to Act II scene 1 when acousmêtre is reduced (Fig. 1c).

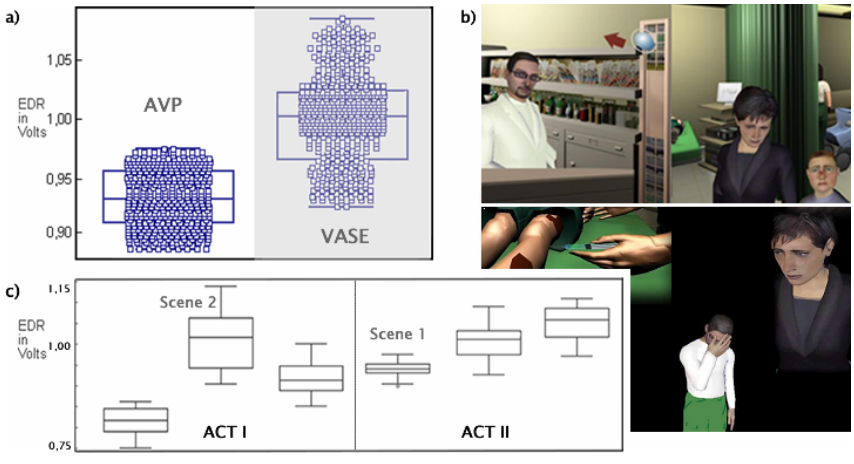

Fig. 1. VASE application scenario and experimental results plot **(a)** A dot plot comparison between the average mean EDR distributions of AVP and VASE in Act II. There is a significant difference between the standard deviations (SD) at 95,0% confidence level The ratio of the variances: 0,28 to 0,45 at P-value 0,0001 (SD of AVP: 0,023 and SD of VASE: 0,039). **(b)** Snapshot of Act II (top) and Act III (bottom) in VASE. **(c)** A box-and-whiskers plot comparison between the mean EDR distributions decomposed into 6 segments for Act I and Act II.

5 Conclusions and Future Work

This paper has presented the potentials of using acousmêtre in an interactive virtual environment. The results obtained through the preliminary investigation of VASE suggest that suspense sensations occur when the viewer is presented with the right succession and combination of audio and visual stimulants that follow the principles of acousmêtre. The results also suggest that an increase in occurrence of offscreen sounds produces a correlated emotional effect to the participant.

Future work includes verifying the variables (e.g. length, succession, or delay of offscreen sounds in relation to the image) influencing the impact of acousmêtre to the viewer's state using more data samples. Although the participants in VASE came from different cultural backgrounds, no significant variations on the results were seen. A higher sample will also be helpful to verify if acousmêtre is independent of individual.

The process of generating acousmêtre in VASE is also presented in this paper. It attempts to combine visual scenes shown to the user and sounds played by tracking the level of interactivity of the user. The use of acousmêtre at the most relevant points in the story has the potential to greatly augment the user's engagement in the story and to create much more powerful feelings of suspense and emotion.

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