Unspoken Emotions in Movies

The Basis of Emotion-Driven Storytelling Systems

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Introduction

Stories are the core of many types of entertainment. Although developers and designers strive to develop new forms of entertainment that deliver richer audiovisual experiences to the audience, one of the key elements – a good story – remains the same. Storytelling is intertwined in people's lives and has deeply influenced human societies for generations. It ranges from the simplest forms, such as bedtime stories for children, to more complex forms such as plays, movies, and games. Just as children love often-told bedtime stories, sometimes adults enjoy watching classic movies over and over again and never tire of them. Storytelling is not only a matter of how well the stories are memorized but also the overall emotional experience over the course of the storyline. The link between the story and the corresponding emotions is an intriguing topic for developing new interactive storytelling systems.

The scope of storytelling systems is remarkably broad in the domain of entertainment applications. Depending on the level of interaction, storytelling systems range from passive forms, such as movies, to active forms, such as video games. Traditional storytelling, as exemplified by movies and plays, follows a linear arc to construct a storyline in which the audience passively receives the stories that are presented on the screen or stage. In order to enhance the interactivity, new types of digital entertainment encourage the audience to become involved in the stories in different ways. The audience is invited to create or influence the storyline in real time by acting as the protagonist or the director of the narrative. This mechanism has been adopted in many video games, particularly role-playing games.
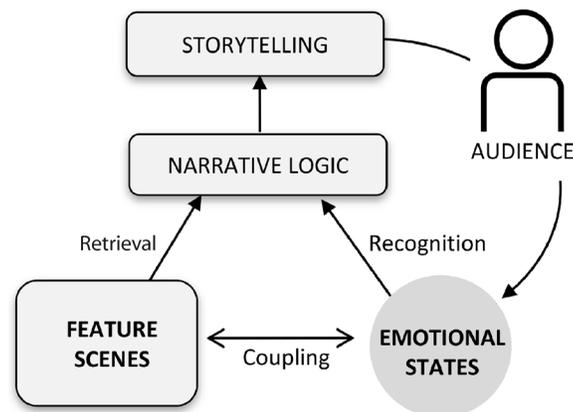
Fig. 1 A conceptual framework of an emotion-driven storytelling system

Today, more and more new forms of interactive storytelling are being invented. One promising direction is toward interaction with the storytelling system by providing emotional feedback in real time. This is known as emotion-driven storytelling (see Fig. 1). Other, similar ideas have also been proposed, e. g., enactive cinema [22]. Enactive cinema plays different sections of a pre-made story based on real-time emotional responses. In that case,

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the chronological order of the storyline may depend on changes in the audience's emotions. This concept involves the audience as participants in the storytelling process through its expression of emotional responses. This new genre of storytelling considerably enhances interactivity in lieu of telling a story exclusively in a linear manner. Although interactive storytelling, with its inclusion of real-time emotional responses, appears to be a promising direction, it raises many challenges for developers. First, how can the audience provide real-time emotional responses without being disturbed? Inquiry into emotional responses through questionnaires requires additional mental effort and introspection. For entertainment purposes, this approach is interruptive and distracting. Physiological measurement has been suggested as a means of retrieving real-time emotional responses from the audience in a more implicit manner [21], so that the audience can be fully immersed in the story and at the same time provides emotional responses as input into the storytelling system. But besides the technical difficulty of emotion recognition, a more critical challenge to developers is how to decompose stories into separate scenes in a meaningful way. This leads to a fundamental question: Are there universal patterns that transcend different stories?

In this paper, we will begin by reviewing the origin of storytelling and introduce the theory of archetypes and archetypal symbolism. These theories provide useful references for analyzing universal patterns in different stories, which allow us to extract similar scenes from different modern movies. Next we will explain a psychophysiological study that we conducted by using affective computing methodologies to build a mathematical model for emotional recognition of the feature scenes. Finally, we will discuss the implication of our findings for developing emotion-driven storytelling systems and draw a conclusion.

Storytelling and Archetypes

The history of storytelling can be dated back to ancient times. Myth is probably the oldest form of storytelling, yet some myths are still being presented in various modern forms of entertainment. These stories seem to encompass attractions that universally fascinate people across time and space. The nature of myth differs from the fiction we read today. A myth is a sacred narrative, usually explaining how

the world or humankind came to be in their present forms [9]. It is usually linked with ritual. Together, they were used to regulate how ancient people were to behave toward nature and construct their basic view of how this world was made. Myths and rituals divide an individual human life into three phases: childhood, adolescence, and retirement. Each of these phases is characterized by corresponding motive complexes: love, power, and death [19]. Two of the foremost functions of myth are to establish models of behavior and to provide explanations for rituals. Rather than merely an imaginary story, a myth is a narrative resurrection of a primeval reality. Malinkowski argued that, "It is a living reality, believed to have once happened in primeval times and continuing ever since to influence the world and human destinies" [17]. Indeed, it is surprising that, even though mythic content may seem unrealistic and irrational, myths are still manifest in modern society. Moreover, contemporary writers have created a new narrative genre, *mythopoeia*, which integrates traditional mythological themes into modern literary forms [5]. We still can see many traces of myths today, not just in books but also in mass media such as artwork, music, and movies.

The connection between ancient myths and human minds was first revealed by Carl Jung. Based on his extensive studies of myths, religions, and cultures, he proposed the concept of *the collective unconsciousness* [16]. This suggests that, far below the surface, all human beings share an unconscious mind that is hidden beneath the personal psyche (including both conscious and unconscious minds). The collective unconsciousness contains content and modes of behavior that are identical in all human beings and thus constitutes a common psychic substrate of a universal nature that is present in every individual. As a result, all human beings, sharing essentially the same biological equipment (e. g., the brain and central nervous system), would tend to perceive common meanings embodied in a given symbol, if only unconsciously [2].

Jung further developed the concept of archetypes [15]. Archetypes are defined as the components of the collective unconsciousness, which is an inborn tendency (i. e., it cannot be consciously acquired) to experience things in a certain way. They exist universally in the psyche and psychologically prepare individuals to deal with universal life experiences [23]. Archetypes are unconscious

Editing details for the movie clips of archetypes

Archetype	Movie	Scenes
Hero	*V for Vendetta*	1:24:59–1:26:00
	Braveheart	2:15:39–2:16:15
		2:17:35–2:18:01
	The Matrix	2:04:35–2:05:45
Shadow	*The Lord of the Rings: The Two Towers*	1:35:19–1:36:20
	Fight Club	1:48:24–1:49:32
	The Dark Knight	1:24:22–1:25:30
Anima	*American Beauty*	0:16:15–0:17:17
	Malena	0:19:18–0:20:20
	Perfume: The Story of a Murderer	0:18:03–0:18:18
		0:21:20–0:22:15
Mentor	*The Lord of the Rings: The Fellowship of the Ring*	2:03:05–2:04:10
	The King's Speech	1:42:13–1:42:44
		1:42:58–1:43:18
		1:45:33–1:45:52
	The Lion King	0:24:38–0:25:05
		0:25:29–0:26:06

psychic impulses; they are impersonal, inherited traits that present and motivate thoughts, emotions and behaviors long before any consciousness develops. An extreme analogy might describe archetypes as the structure of the psyche in a way comparable to the organs of the physical body. In this way, archetypes are similar to other sensory and cognitive models, e. g., receptive fields of the retina are not consciously perceived but determine the structure of visual perception [18]. People interpret the world through archetypes but without any awareness of their existence [6]. These theories created a basic framework that explains the connection between myths and human minds and, moreover, became the theoretical basis for analytical psychology and Jungian psychotherapy.

Universal Patterns in Modern Storytelling: Movies

Based on Jung's study, archetypes can be seen as manifested by ancient people as observable patterns in *primordial imagery*, an earlier term that Jung used to describe the repeated thoughts, ideas, or imaginings throughout history that have come to be represented in symbols found worldwide in artwork, religion, and myth [2]. Movies constitute one of the most prominent sources of archetypes in the modern world. Movies contain a very complex form of symbolic content that communicates delicate and rich audiovisual information to the audience by means of storytelling. Cinema offers not only the content of a film but also both a means and a space, highly similar to a psychotherapeutic session, to enable the viewer to witness his or her own psyche projected on a screen [13]. This means that viewers are engaged in a process of projecting themselves and not just purely viewers. Moreover, cinema delivers a contemporary experience that allows viewers to separate from their daily lives and engage their unconsciousness in a manner similar to hypnosis or dreaming.

Jung discovered several essential archetypes: the hero, shadow, anima, animus, mentor, and mother. Furthermore, mythologist Joseph Campbell [4] gave Jung's concept of the hero archetype a more complete scope, the *monomyth* or hero's journey, a common structure in all mythical hero stories in different cultures and religions. These theories that explain the symbolic meanings from a Jungian standpoint are called archetypal symbolism [11]. Archetypal

symbolism still appears to apply to modern society and these universal patterns are strongly manifested in modern mass media, particularly in movies.

Considering movies as a form of storytelling, the task becomes a matter of extracting featured scenes from different movies that correspond to specific archetypes. As a starting point, we collected three clips for each of four archetypes: hero (a projection of the self), shadow (the hidden part of the self), anima (the feminine image in men's minds), and mentor (the image of a wise old man who provides guidance). We utilized a Jungian approach to analyze these movies and select featured scenes. (The analysis method and symbolic meaning of each archetype were described in detail in [7] and [8].) Each movie clip was edited to create a unified format (1 minute long; 720 × 480 pixels; MOV format), and this format had to meet the requirements of our experimental design.

The editing details for all clips are given in Table 1. Using the first clip as an example, the character Evey in the movie *V for Vendetta* endures mental and physical trials and is finally released from her prison and attains enlightenment in the heavy rain amid thunder and fire. According to Campbell [4], this is typical of "the hero's rebirth" in the mono-myth. To further confirm that the selected scenes authentically represent archetypes, we asked several Jungian scholars from the Archive for Research in Archetypal Symbolism (ARAS) to review our collections of movie clips. They each reviewed all the clips individually and we only used the clips that they all considered representative of archetypes. After several discussions and strict filtering sessions, we constructed a set of film clips that had had their archetypal content verified.

Mapping Emotional Responses to Archetypal Movie Clips

Because emotion is a psychological phenomenon that cannot be directly recorded, laboratory research on emotion is usually done by means of emotion elicitation and emotion recognition. A number of effective emotion elicitation techniques have been developed, e. g., hypnosis, affective guided imagery, and presentation of affective stimuli [12]. Since we have collected specific movie clips, presenting these clips as affective stimuli would be the most straightforward technique in this case. The essence of this technique consists of presenting se-lected audiovisual material to participants, which is a passive method of elicitation. Unlike approaches that involve confederate interaction procedures, this method may not provide psychological responses of high intensity, but it does ensure a high degree of standardization [20].

In order to use this approach, different cate-gories of affective stimuli should be collected in advance. Stimuli in each category should be homoge-nous with regard to the researchers' own criteria. For this paper, we developed four categories of af-fective stimuli representing four distinct archetypes. Each category includes three clips that contain the same archetypal content according to archetypal symbolism. In our previous work, we confirmed that some archetypal images may elicit emotions that are different from basic emotions [14]. In the present study, we propose a similar hypothesis: Each category of archetypal movie clips should induce a particular kind of emotion that is exclusive of the other categories. If this hypothesis proves correct, then it should be possible for a storytelling system to generate new storylines that correspond to the audience's emotional responses.

Psychophysiological Approach

Our experiment follows a within-subject design. Each session accommodated one participant and every participant viewed all 12 film clips that we collected. To enact a double-blind design, the movie clips were played in random order; neither the host nor the participant knew the sequence of the playlist in advance.

Participants. For this study we recruited 23 volun-teers; 10 females and 13 males. The average age of the females was 27.80 years (SD = 8.80) and of the males 27.77 (SD = 6.13) years. Most of the participants were international undergraduate or graduate students who were taking classes at the authors' university. The participants had diverse national backgrounds (they came from five different Asian countries, seven European countries, and three South American coun-tries). Prior to the experiment, each subject signed an informed consent form and was later rewarded with a small present for participating in a laboratory session that lasted approximately 1.5 hours.

Apparatus. The experiment was conducted in our laboratory, which was arranged to replicate a typical

Table 2

Confusion matrix of the model obtained through LDA of the self-reporting data for the stimuli of archetypes [count (percentage)]

Category	Predicted Group Membership			
	Hero	**Shadow**	**Anima**	**Mentor**
Hero	14 (20.3 %)	18 (26.1 %)	16 (23.2 %)	21 (30.4 %)
Shadow	7 (10.1 %)	43 (62.3 %)	8 (11.6 %)	11 (15.9 %)
Anima	11 (15.9 %)	25 (36.2 %)	13 (18.8 %)	20 (29.0 %)
Mentor	7 (10.1 %)	16 (23.2 %)	11 (15.9 %)	35 (50.7 %)

Canonical Correlation = 0.418, Effect Size = Medium, 38.0 % of cross-validated grouped cases are correctly classified.

living room in order to make the participants feel comfortable and relaxed. Movie clips were projected onto a white wall. In order to measure emotional responses, we adopted the Self-Assessment Manikin (SAM) [1] as the self-reporting technique. SAM is widely used in psychological experiments and has become a very common self-reporting technique for emotions. It applies a dimensional model to represent human emotion using three dimensions to represent affective space: valence, arousal, and dominance. It is claimed that these three scales are capable of representing most of the commonly known human emotions. To obtain physiological measurements, we also measured electrocardiography (ECG) and skin conductance with Shimmer^{TM} wearable wireless sensors [3], which streamed physiological data to a laptop via a Bluetooth^{TM} protocol.

Procedure. Each participant was invited to sit on a couch. He or she was then required to read and sign an informed consent form. After signing the agreement, the participant followed our instruction to attach electrodes and physiological sensors. Next, we checked to ensure that the sensors were successfully connected. Meanwhile, the participant was asked to fill out a short questionnaire about demographic data. Once the questionnaire was filled out, the participant was given a tutorial about the experiment and a sample test for practice. After the sample test, the light in the laboratory was dimmed to make the viewing experience similar to a real cinema, and the movie clips were presented. Before each clip, the participant followed a guided-breathing video for 20 seconds to help the subject calm down to a common baseline. The physiological data recorded during the breathing-pattern

video presentation was later used as a physiological baseline in the analysis. After viewing each film clip, the participant provided a retrospective self-report by rating his or her emotions along the dimensions of the SAM with paper and a pen. After the participant had recorded his or her ratings, the breathing clip was run again to start the next presentation. The experiment ended when the participant had finished viewing the entire collection of 12 movie clips.

Analysis. In analyzing the data, we compared classification accuracies achieved by the predictive models that we obtained with linear discriminant analysis (LDA). Upon being fed a set of recorded data, LDA would generate a predictive model that would allow us to justify the extent to which these categories of stimuli can be differentiated based on the emotional responses (see Tables 2 and 3). We used leave-one-out cross-validation for this analysis.

We started with the self-reporting data. The predictive model derived from LDA of self-reporting data about archetypal symbols was only 38 % accurate, and the effect size was medium (canonical correlation = 0.418). We extracted useful features from the raw electrocardiography and skin conductance data: heart rate, heart rate variability, skin conductance level, and skin conductance response. These data were then fed through LDA for further evaluation. The predictive model generated by LDA of the physiological features was 52.9 % accurate, and the effect size of the predictive model for archetypal symbols was medium (canonical correlation = 0.523). Analysis of the physiological data showed prominent results for recognizing emotional responses to archetypal content. The results show

Confusion matrix of the model obtained through LDA of the physiological data for the stimuli of archetypal symbols [count (percentage)]

Category	Predicted Group Membership			
	Hero	**Shadow**	**Anima**	**Mentor**
Hero	33 (47.8 %)	16 (23.2 %)	14 (20.3 %)	6 (8.7 %)
Shadow	10 (14.5 %)	44 (63.8 %)	6 (8.7 %)	9 (13.0 %)
Anima	17 (24.6 %)	7 (10.1 %)	28 (40.6 %)	17 (24.6 %)
Mentor	8 (11.6 %)	10 (14.5 %)	10 (14.5 %)	41 (59.4 %)

Canonical Correlation = 0.523, Effect Size = Medium, 52.9 % of cross-validated grouped cases are correctly classified

Table 3

that the emotions elicited by archetypal content can be observed by measuring the signals of ECG and skin conductance, meaning that individuals have a common emotional tendency in response to archetypal movie clips edited from different movies. These emotions appear to be more complex and delicate, which was difficult for the subjects to express through the SAM scale. Nevertheless, these emotions can be observed by measuring the ECG and skin conductance signals. These findings are revealing with respect to mapping stories and emotional responses for designing new types of storytelling systems.

Limitations

As a new direction, we included only four essential archetypes in the present study. To apply archetypal symbolism in practice, we would suggest including additional archetypes. Moreover, we collected relatively few stimuli for each archetype. To ensure the validity of the predictive model, more stimuli must be included in each category. Finally, although the present study confirmed the validity of physiological measurement for recognizing emotional responses to archetypal content, the classification rate only reached approximately 52.9 % accuracy. For practical use in storytelling systems, more data are needed for model training to achieve a higher classification rate.

Implications for Storytelling System Design

The main benefit of applying archetypal symbolism to storytelling is that symbolic content is not bound to specific forms or materials, e. g., movies and paintings can be the media for manifesting archetypal images [10]. Very few studies consider the theory of archetypes a relevant topic in enter-

tainment, but this theory has been discussed in other related fields, such as advertising, branding and marketing. We expect that utilizing archetypal symbolism to decompose existing stories and reconstruct new stories may be a promising approach. The results of the experiment have preliminarily confirmed that archetypal content induces individuals' unspoken emotions. Matching archetypal content with emotional responses would greatly benefit the development of emotion-driven storytelling systems.

Generative Storytelling

Most interactive storytelling mechanisms fulfill the requirement of involving the audience in the decision-making moment in the story. Although the audience is not entirely passive, interactive storytelling overall is still prescripted, meaning that the whole story still follows a linear structure, albeit in a more flexible manner than exists in conventional storytelling. Built upon the original idea of emotion-driven storytelling, the present study establishes several advantages. As was previously mentioned, emotion-driven storytelling presents generative stories in a non-linear way. Scenes appear in response to the spectator's real-time emotional reaction, which takes into account the spectator's subjective experience of the stories presented. Since an upcoming scene is chosen based the current emotional response, the new storyline is actually co-created by the spectator and the original filmmaker. In other words, the original movies are the materials with which the spectator becomes the storyteller who tells the story to himself or herself. Moreover, since each category contains clips from multiple movies, it is possible to create a new form of storytelling constructed with mash-up media

content obtained from various movies. This study demonstrated a standard procedure for identifying universal elements in various movies and a psychophysiological approach to evaluating these movie clips. This will allow developers to build and expand their own collections of movie clips to develop emotion-driven storytelling systems. These collections of movie clips can also be used as references for screenwriting.

Experience Evaluation for Multimedia

The other relevant direction is to develop an evaluation method for detecting emotions in stories. The most challenging part of storytelling is, specifically, communicating the story to the audience. Emotional response appears to be the clearest reflection of the quality of the storytelling. When a storytelling system is under development, it will often be quickly evaluated at some point for further improvement before it is finalized. Particularly where games are concerned, it is essential to test whether the entire emotional experience can be elicited as expected. This also helps storytellers enhance their knowledge about the connection between storylines and emotional qualities. Most evaluation relies on expert reviews, and sometimes this approach is limited or biased by the expert's subjective opinion. Utilizing physiological measurement to evaluate emotional responses to a story appears to be an alternative approach to reviewing that story. The predictive model generated by psychological experiments would help researchers recognize archetype-relevant emotions along with the storyline.

Conclusion

In the present paper, we have traced the origin of storytelling and explained how storytelling can be connected to the human mind based on the archetype theory. As a basis for developing emotion-driven storytelling systems, we identified archetypal content in modern movies and mapped these film clips to emotional responses by conducting a psychologically-based experiment. The results of our experiment lead to the conclusion that the emotions elicited by archetypal content in movies are difficult to express through self-reporting but can be differentiated using physiological ECG and skin conductance data. Our work has revealed the potential for archetypal symbolism in story analysis

and confirmed the validity of utilizing affective computing methodologies to build predictive models as the key component for emotion-driven storytelling systems. In this study, we have established a standard procedure for investigating the relationship between story content and the corresponding emotional responses, which could provide a basis for future emotion-driven storytelling system development.

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