MULTIMEDIA ELEMENTS AND EMOTIONAL PROCESSES

Multimedia, Stories, and Emotion -
An Integrated Model for Research and Design
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Abstract

There are theoretical models concerning Multimedia and cognitive and motivational processes. However, such models are missing for emotional processes. In order to develop such a model, studies from literary text research were analyzed. Literary text research was chosen as a starting point because Multimedia environments often contain texts (or stories) with an emotional quality. Analyzing and optimizing such texts or stories have a long tradition within this kind of research. The resulting model relates Multimedia elements, story elements (e.g., foregrounding), perceptual-cognitive-emotional processes (e.g., presence), and emotional outcomes (e.g., pleasantness) to each other. Theoretical implications concern the expansion of the model in respect to other Multimedia elements and to the integration with existing cognitive and motivational approaches. Methodological implications focus on suggestions for measurement development. Practical implications deal with Multimedia design and dramaturgical e-learning strategies.

Multimedia, Stories, and Emotion - An Integrated Model for Research and Design

Multimedia elements are fascinating people in computer games or web environments, not only because of their power to influence cognitive and motivational processes, but especially because of their capability to stimulate emotions, like fear or pleasure. How to arouse emotions with Multimedia represents an issue in research which is usually related to computer games. There is tremendous research on how computer games can produce emotions like, for example, aggression (e.g., Singer & Singer, 2002). However, this kind of research focuses mainly on negative emotions (e.g., anger) and on general long-term effects of different games or media settings (including TV). It shows little about which specific Multimedia elements produce positive influences on short-term emotional processes (e.g., Bryant & Zillmann, 2002). To identify short-term effects on emotional processes is important because it can be assumed that long-term effects are built when continuously short-term effects are cumulated. In addition, it can be assumed that short-term effects can more easily

be used for educational purposes (e.g., for establishing emotionally sound learning environments for children).

Identifying short-term effects of Multimedia elements was done in the field of cognitive and motivational processes based on sophisticated theory building and related empirical research (e.g., Astleitner & Wiesner, 2004; Keller, 1999; Malone & Lepper, 1987; Mayer, 2001). However, such activities are lacking in respect to emotional processes. For example, recent comprehensive reviews of Multimedia effects neglected entirely the emotional perspective (e.g., Hede, 2002). Indeed Astleitner and Leutner (2000) presented a research-based approach dealing with the question of how computer-based environments can be made more emotionally sound. But, this approach is focusing on instructional elements on a macro-level (referring to emotional outcomes), and not dealing with Multimedia elements on a micro-level (including emotional processes). Also, the "emotioneering"-techniques from Freeman (2003) do not improve the situation, because they are not related to research, but to the practice of game design. Such techniques induce, for example, a computer player to identify with the role he or she is playing. The over 300 distinct techniques include, for example, ways to give emotional depth to a non-player character, even if the player has just one line of dialogue.

Finding suitable basic research dealing with Multimedia and emotion can be based on a definition of Multimedia. According to Jonassen (2000, p. 207), the commonality among these definitions "involves the integration of more than one medium into some form of communication" and "refers to the integration of media such as text, sound, graphics, animation, video, imaging, and spatial modeling into a computer system". Referring to this definition, a first step of research can be to relate each element of Multimedia to emotional processes, and a second step, to combine some elements and analyze their joint effects on emotional processes achieving finally a comprehensive model of different Multimedia effects on emotion. There is, for example, research on sound (e.g., Bradley & Lang, 2000), on music (e.g., Juslin & Sloboda, 2001), and on video (e.g., Cennamo, 1993) and emotional processes.

However, the way of establishing a first research-based link from Multimedia elements to emotional processes in this paper is to focus on text and especially on literary text research. There are several reasons for this decision: a) one of the most frequently stated reasons for reading literary text is to experience emotions or emotional processes, so there is a strong relationship between literary text and emotion (see, for example, fiction with high emotional appeal from Gass, 1999 or Obermayr, 1998); b) the main elements in many Multimedia environments (e.g., learning environments on CD-ROMS or on the Internet) are texts, because texts represent the major source of information and handling of texts do not require sophisticated technical equipment (Jonassen, 1999); c) there is a long tradition in research on literary text and emotion what increases the chance to identify a highly elaborated network of variables which can build a basis for Multimedia research and design (e.g., Oxenhandler, 1988); and d) there are reviews concerning media in general and emotions, however, they do not focus on literary text and/or Multimedia (e.g., Schwab, 2001).

Based on literary text research, the following research questions should be answered within this study:

a) Which elements of texts do trigger emotional processes? For analyzing literary texts, the following aspects are usually considered: theme, character, plot, structure, setting, point of view, language and style, etc. These aspects must be evaluated in their capacity to produce emotions in Multimedia based on empirical literary text research.

b) Which emotional processes are triggered? According to Kleinginna and Kleinginna (1981, p. 355) emotions are "a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can: (a) give rise to affective experiences such as feelings of arousal, pleasure/displeasure; (b) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labeling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behavior that is often, but not always, expressive, goal directed, and adaptive". Emotional processes are based on the acceptance or rejection of objects and facts and have an evaluational relation to the world (Kuhl, 1986). Emotions, although they interact with cognitive and motivational processes, are considered in research as a unique component of human mental states, experiences, and behavioral expressions (e.g., Frijda, 1986). Emotions may initiate, terminate, or disrupt information processing. They may result in selective information processing or they may organize recall. "Feelings" are the "conscious recognition of emotions" (Greenberg & Snell, 1997, p. 96). Emotional processes are interactive and numerous. It is the task of this paper to select these processes which turned out to be important in research and which are relevant for designing Multimedia environments.

c) How can emotionally relevant elements of texts be used and implemented within Multimedia environments in order to improve their capacity to affect emotions? Such Multimedia environments allow for the electronically integrated display and user control of a variety of media formats and information types, including motion video and film, still photographs, text, graphics, animation, sound, numbers, and data. The resulting experience for the user is a multidimensional, multi-sensory interweave of self-directed reading, viewing, listening, and interacting, through activities such as exploring, searching, manipulating, writing, linking, creating, juxtaposing, or editing (e.g., Wilson 1992). Within this paper, however, only texts and their emotional capacities are analyzed. For example, from text comprehension research it is well known that learning from text and learning from, for example, pictures are qualitatively different ways of constructing mental models. While text comprehension is an indirect transformation between a text as a symbolic representation and the mental model as an analog representation, picture comprehension is a direct mapping of the picture as an analog representation onto the mental model as an analog representation by establishing an analogy between the visual information and the corresponding mental model (e.g., Chun & Plass, 1997). There exists no such comparable research for emotional processes. That is the reason why exclusively texts are analyzed in a first step of research.

All the questions should be answered on the basis of a narrative literature review concerning results of empirical studies. This literature review is based on some general assumptions about emotions and media (e.g., Mangold, Unz, & Winterhoff-Spurk, 2001). These assumptions are: Confrontations with media contents produce different intensities of emotional experiences. These emotions refer to situations situated within the media contents but also to real life situations which are, to some extent, similar to the media contents. Emotional experiences can be related to one, but also to different multiple emotions. Emotions can change rapidly in time. Finally,

different people experience different emotions if confronted with the same media contents.

According to a taxonomy of literature reviews from Cooper and Hedges (1994), the focus of the review concerning literary text research and emotion was on practices or applications in the field of reading, on the identification and integration of central issues, on a representative (but not exhaustive) coverage of literature, on a conceptual organization of research results, and on Multimedia researchers in the field of education and psychology as target group.

Despite this anchoring in existing empirical research, it has to be stressed that the resulting review do not represent definite generalizations of empirically well-founded research results for Multimedia designers, but nothing more than hypothetical prescriptions which should guide researchers and practitioners in their daily work concerning research on and design of emotionally sound Multimedia. Although many of these hypothetical prescriptions refer to results found in empirical research, they also have a speculative element delivering an inspiring force for future Multimedia research and design. For that purpose, it is not useful to distinguish between empirically well-founded and not well-founded results. All results, even the ones related with some empirical evidence, should be seen as hypotheses, because they are part of a systematic and mingled framework which has not been tested yet in the field of Multimedia.

A Model of Multimedia, Story Elements, and Emotions

Figure 1 shows the variables which relates Multimedia elements to emotional output variables based on literary text research results. The identification of these variables was based on research from Alfes (1995), Appel, Koch, Schreier, and Groeben (2002), De Vega, Leon, and Diaz (1996), Lombard and Ditton (1997), Oatley (1994), and Miall and Kuiken (1994, 2002). Relations between these variables are hypothesized related to research from Dijkstra, Zwaan, Graesser, and Magliano (1994), Gygax, Oakhill, and Garnham (2003), Kneepkens and Zwaan (1994), Levorato (2003), Sadoski, Goetz, and Rodriguez (2000), and Van Reekum (2000). These research results were used to build a model of Multimedia, story elements, and emotions. Within a first step, important components from research were selected. Within a next step, their position within the relationship between Multimedia elements and emotional outcomes were fixed. Then, research results were used to connect components as hypotheses. Finally, the model was evaluated (e.g., by proofing for inconsistencies) and calibrated (e.g., by improving definitions of concepts).

Components of the Model
Visual and auditory inputs build Multimedia elements which can be related to certain text or story elements. Such text or story elements which can be part of a Multimedia environment produce different cognitive-emotional processes which finally result in emotional outcomes.

Figure 1. Multimedia, story elements, and emotional processes.

Multimedia elements	Story elements	Perceptual-cognitive-emotional processes	Emotional outcomes

Visual input	Theme				
Text	**Character**	Sensory			
------------------	**Plot**	arousal	Presence	Aesthetic	
-------	**Structure**	Realism		feelings	
Pictures	**Setting**				Activation
Diagrams	**Point of view**	Dynamics	Emotional		Deactivation
Video			tracking	Narrative	
Animation	**Foregrounding**	Coherence		feelings	Pleasantness
	Imagery		Emotional		Unpleasantness
Auditory	Symbolism	Novelty	motivation	Evaluative	
input	Allegory	Relevance		feelings	
Sound	Syntax and	Valence			
Signals/Cues	diction	Difficulty	Sympathy		
Music	Voice/Sound	Legitimacy	Empathy	Self-	
Narration	Rhythm and			modifying	
Instructions	meter			feelings	

Multimedia elements

Visual input can take the form of text, pictures, diagrams, video, or animation. Auditory input can consist of sound, signals/cues, music, narration, or instructions. Multimedia elements are used in combination within Multimedia environments to produce "stories".

Story elements

Literary text elements build "stories", i.e., pieces of information that contain a chain of related fictional and/or non-fictional events. They can entertain, inform, or instruct people. Texts for entertainment are, for example, novels. Texts for information are, for example, reports in newspapers about political issues, or documentations in TV. Texts for instruction are, for example, contained in chapters of text books or teaching software on CD-ROM.

On a macro-level, literary texts show - as a rule - a certain dramaturgy consisting of exposition (i.e., an explanation of something), confrontation (i.e., a situation in which a problem appears and needs to be dealt with), and solution (i.e., the correct answer to a problem). Typical literary text elements on a micro-level are: a) theme (idea or point of a story formulated as a generalization); b) character (imaginary or real people who act within the story); c) plot (arrangement of ideas and/or incidents that make up a story); d) structure (design or form of completed actions); e) setting (place or location of an action as well as the historical and cultural context for characters); f) point of view (pertains to who tells the story and how it is told); and g) foregrounding (stylistic effects at phonetic, grammatical, or semantic level; e.g., irony (a contrast or discrepancy between one thing and another), imagery (a concrete representation of a sense impression, a feeling, or an idea which appeals to one or more of our senses), symbolism (when objects or actions means more than themselves), allegory (a form of narrative in which people, places, syntax, diction (denotations and connotations), and events seem to have hidden meanings), and voice/sound (e.g., rhythm and meter)) (e.g., Jordan-Henley, 1999).

Cognitive-emotional processes

It is assumed that Multimedia and story elements are processed within working memory based on three types of processes: perceptional-cognitive, cognitive-emotional, and emotional.

(1) First, Multimedia and story elements are evaluated within a perceptional-cognitive process. The evaluation process is based on different aspects: Sensory arousal concerns the number of human senses which are stimulated by the Multimedia and story elements. Realism refers to the degree of correspondence with reality. Dynamics concern the level of changes within an environment. Coherence is achieved when sequences of the text have something in common like similarities in, for example, time or place, or if they have a causal relationship. Novelty is the quality of being new. Relevance means the importance of a stimulus or event to one´s goals and concerns. Valence is the pleasantness or unpleasantness of the stimulus or event. Difficulty concerns the estimated own ability to deal with the event and its consequences. Legitimacy represents the evaluation of one´s own actions in relation to moral standards, social norms, or one´s self-ideal.

(2) Then, a cognitive-emotional process takes place in which cognitive and emotional conditions of feelings are controlled and processed. Presence concerns a feeling of being part of an environment. Emotional tracking means the representation of changing emotional states of characters. Emotional motivation is dealing with the control for achievement of emotional goals (i.e., entertainment, relaxation, stimulation, suspense). Sympathy refers to feelings for a character, empathy to feelings with a character.

(3) Finally, emotional processes result in general feelings towards different aspects of the Multimedia and story elements. Aesthetic feelings are based on formal components of Multimedia or story elements (e.g., foregrounding). Narrative feelings concern feelings towards the sequence of events (e.g., resulting in increasing the empathy with a character). Evaluative feelings refer to feelings towards the text as a whole (e.g., overall enjoyment). Self-modifying feelings represent feelings that restructure own´s understanding and sense of the self.

Emotional outcomes

They concern emotions, especially their pleasantness or unpleasantness (positive or negative value) and their activation or deactivation (energetic or lethargic arousal). In this way, emotions are characterized in terms of continuous dimensions, rather than as discrete categories. Emotions or emotional states can be easily placed in an emotional space defined by these dimensions (e.g., Västfjäll & Kleiner, 2002, p. 6), for example, "surprised" (activation), "excited" (pleasant activation), "happy" (pleasantness), "content" (pleasant deactivation), "passive" (deactivation), "bored" (unpleasant deactivation), "sad" (unpleasantness), or "annoyed" (unpleasant activation).

Relationships between Components of the Model

In general, there are multiple relationships between variables which are depicted in Figure 1. At the moment, it is not possible to relate systematically, comprehensively, and exclusively different independent variables (i.e., Multimedia and story elements) to mediating (i.e., perceptional-cognitive-emotional processes) and to dependent variables (i.e., activation and pleasantness).

However, there are some general relationships combining groups of variables. It is assumed that Multimedia elements can be used to design certain story elements.

These elements influence perceptional, cognitive, and emotional processes. It can also be hypothesized that perceptional processes influence cognitive processes and that cognitive processes affect emotional processes. Emotional processes should be accumulated and result in emotional outcomes. Finally, it is also highly probable that emotional outcomes also influence perceptional, cognitive, and emotional processes.

In particular, the following specific relationships between the variables are assumed based on results of empirical research. Levorato (2003) found that there was a relationship between imagery and the perception of novelty, and also between novelty and emotional outcomes (e.g., pleasure). Alfes (1995) suggests on results of a qualitative study that the difficulty of a text in respect to understanding produces evaluative feelings and negative emotional outcomes (e.g., anger). The author also identified self-modifying feelings as control mechanism during reading. Others found that difficulty (concreteness) and relevance (familiarity) were related to a pleasant and active emotional outcome (interestingness) (Sadoski, Goetz, & Rodriguez, 2000). Results from Gygax, Oakhill, and Garnham (2003) suggest that the emotional information readers infer from stories is too broad to determine specific emotions. The results are consistent with the idea that a general emotional response is evoked which is compatible with one or more specific emotions. These results support the assumption (of this paper) that especially emotional outcomes can be described along few dimensions. A review from Lombard and Ditton (1997) shows that presence is associated with sensual arousal, realism, and pleasant activation (i.e., enjoyment). De Vega, Leon, and Diaz (1996) found that the salience and accessibility of emotional representations depend on the amount of contextual cues provided throughout a text. Once an emotional representation was built, guided by the initial plot of a story, the incoming information is checked against it. Results from a study by Dijkstra, Zwaan, Graesser, and Magliano (1994) suggest that sympathy occurs most strongly in text segments to the extent that these conveyed suspense (dynamics), described plausible events (realism), were important (relevance), contained dialogue, and occurred towards the end of the story (foregrounding, structure). In a study by Miall and Kuiken (1994), it is pointed out, that text segments with more foreground features (on a phonetic, grammatical, and thematic level) took longer to read, were found more striking, and evoked more affect. In explaining these results, the authors assumed that foregrounding prompts defamiliarization, (which is related to difficulty and coherence), defamiliarization evokes affect, and affect guides refamiliarizing integrative efforts. Also, Miall and Kuiken (2001) stress, based on their results, that a reader's perspective is repeatedly disrupted and reshaped, especially in response to foregrounding (e.g., using metaphors).

All these exemplary results can be anchored with the presented model as they concern relationships between different variables. They deliver - to some degree - a first validation of the model.

Implementation Strategies: How to Use the Model in Multimedia Research and Design

The model can be used to stimulate research and practice in different ways:

a) Theoretical implications: It builds a first network of hypotheses which can guide the development of existing and future theoretical models on Multimedia environments. The model can be expanded by other Multimedia elements (like pictures, sound, or video) and therefore build a comprehensive basis for testing

emotional effects of Multimedia environments. The model can also be expanded in a way as it can be integrated within existing cognitive and motivational models of Multimedia effects (e.g., Astleitner & Wiesner, 2004; Mayer, 2001).

b) Methodological implications: The model shows a list of independent and dependent variables which represent possible emotional effects of Multimedia environments. Such a list can be used for instrument development resulting, for example, in a questionnaire measuring emotional processes and outcomes when dealing with a Multimedia environment.

c) Practical implications: The model builds a framework for solving emotional problems in Multimedia environments. The model can tell Multimedia designers which emotional processes can be influenced by which (story-/text-related) elements of a Multimedia environment.

The variables which are depicted in Figure 1 can be seen as a basis for designing "emotionally sound" Multimedia (e.g., Lee & Boling, 1999). "Emotionally sound" means that positive emotions are increased and that negative emotions are decreased during handling a Multimedia environment. When using this basis, the Multimedia designer has to analyze emotional goals (i.e., increasing or decreasing activation and/or pleasantness) and emotional problems which are experienced from users before and during performing within a Multimedia environment. Based on the observed problems, different Multimedia elements have to be designed and changed in or implemented into a Multimedia environment. Then the consequences of the implementation have to be evaluated.

For example, the variables which were identified within this paper can be used and integrated within the "Dramaturgical E-learning Strategy (DES)" by Mödinger and Thissen (2004). Within DES, tasks are transformed into conscious and unconscious spheres of experience using a dramaturgical basic structure (i.e., exposition, confrontation, and solution), cryptic knowledge, and community (i.e., a social-communicative context). Problem solving tasks which are embedded within a dramaturgical basic structure are assumed to be solved with knowledge modules which are available in form of hypertexts which include texts, but also other Multimedia elements.

Discussions

The model of literary text elements, Multimedia, and emotion focuses on literary text research in order to identify variables which influence emotions when handling a Multimedia environment. Relevant research from emotion and non-fictional texts, film, video, music, sound, intelligent agents, computer-mediated communication, web-based training, etc. was not considered (e.g., Astleitner, 2000; Astleitner, 2001; Lepper & Chabay, 1987; Schiefele & Krapp, 1996; Tan, 1996). Also, research concerning the "flow"-experience and literary texts was not included within this study, because this kind of research is significantly situated in the field of motivational research (e.g., Appel, Koch, Schreier, & Groeben, 2002).

Important questions are unanswered so far, and represent major starting points for future activities in research and design:

a) Do Multimedia elements used in cognitive and motivational Multimedia design also improve emotional problems? If this is the case, the presented elements and processes are more or less superfluous. In this respect, it has also to be proved whether the proposed story and Multimedia elements really influence the related emotional processes.

b) Are all variables proposed in this article necessary to establish emotionally effective Multimedia? There may be ones which are more effective than others or which cover the effects of others. The proposed story and Multimedia elements have to be compared in their effects.

c) How changes emotional processes if different story and Multimedia elements are used in combination? Emotional processes are complex and dynamically interacting with each other. From this characteristic, it seems to be necessary that Multimedia elements must be combined in order to produce significant emotional effects. But, when combining different elements, unknown effects might occur that have to be given special attention. There also might be an overlapping with elements from cognitive and motivational design of Multimedia which can produce unintended side effects. Such disturbances resulting from implementing at one time different types of story and Multimedia elements have to be clarified.

d) Which story and Multimedia elements are effective and efficient in influencing emotional processes? Of course the proposed elements have to be tested whether they are effective, but they should also be evaluated concerning their efficiency. For example, the realization of some elements in Multimedia design might be time consuming and can intensify information overload what has to be avoided.

e) Which story and Multimedia elements should be applied in which situation and for which type of persons? Story and Multimedia elements do not work for all people in all kinds of situations. There has to be research for defining the situational and personal conditions for the application of particular elements in a way of "emotionally adaptive Multimedia environments" (e.g., Song & Keller, 2001).

Despite these open questions, the presented article should motivate Multimedia designers and researchers to consider emotional processes more systematically and on a larger scale.

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