Towards Emotionally Adapted Games

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Abstract

In this paper, we present a framework for a gaming personalization system to systematically facilitate desired emotional states of individual players of games. Psychological Customization entails personalization of the way of presenting information (user interface, visual layouts, modalities, narrative structures and other factors) per user or user group to create desired transient psychological effects and states, such as emotion, attention, involvement, presence, persuasion and learning. By varying the form of information presented in a game in an emotionally intelligent way it may be possible to achieve such effects. Theory, key concepts, available empiric evidence and an example of an application area in emotional gaming as well as a basic system design are presented.

1. Introduction

Gaming research is often conducted on the basis of game content and genre analysis, typologies of gaming styles or consumption and sales of games. Little research is done on the actual user experience of games, such as presence and emotion. Most of this research does not conceptualize user experience, such as emotion, sufficiently from the point of view of emotion psychology. It is often also concentrating on some overly technical aspects of gaming such as ways to detect emotions of players with sensor technology. Further, very little research is available to understand how various individual differences may influence emotions during gaming. Also, the emotional influence of the way of presenting the basic elements of a game has not sufficiently been studied. The field also lacks a more general framework of seeing how one may match individual differences to the way of presenting and adapting games to create emotional effects.

This article explores these issues and attempts to provide a preliminary approach to understand emotionally adapted games.

User experience is seen within this article as the transient attentional and emotional states, presence, moods, information processing, learning, flow, persuasion and various other subjective experiences occurring i) just before a user engages with technology, ii) as a result of the user perceiving and processing information mediated by technology during a session of use and iii) immediately after the use of technology within a given task and context of use. User experience is related to action, i.e. the user has an experience and may perform a certain action or decide not to act, i.e. the user has creative and autonomous degrees of freedom for action.

When perceiving external stimuli like information or a game via a communication technology users have a feeling of presence. In presence, the mediated information becomes the focused object of perception, while the immediate, external context, including the technological device, fades into the background [3, 28, 29]. Empirical studies show that information experienced in presence has real psychological effects on perceivers, such as emotional responses based on the events described or cognitive processing and learning from the events [see 40]. It is likely that when playing games people experience presence with the content of the game.

2. Psychological Customization

Media- and communication technologies, such as systems for gaming, as special cases of information technology may be considered as consisting of three layers [1]. At the bottom lies a *physical* layer that includes the physical technological device and the connection channel that is used to transmit communication signals. In the middle is a *code* layer that consists of the protocols and software that make the physical layer run. At the top is a *content* layer that consists of multimodal information. The content layer includes both the substance and the form of multimedia content [2, 44]. Substance refers to the core message of the information. Form implies aesthetic and expressive ways of organizing the substance, such as using different modalities and structures of information [44]. Naturally, these are difficult to separate.

Technologies are most often designed from the point of view of available communication capacity, software and hardware around a certain task. In addition to this there is another approach to design of technology taking into account the user experience of the users of technology and the goals users may have regarding a certain technology. For instance, a user may wish to perform a certain task as efficiently as possible, or a user may wish to be in a good mood when performing the task. Hence, there is another

layer for design of technology in addition to the task-based approach.

This type of design may be called as being Mind-Based, i.e. paying attention to the needs and goals of users to achieve desired user experiences, such as positive mood and efficiency of cognition. It also involves personalization and customization that entail the automatic or semi-automatic adaptation of information per user in an intelligent way with information technology [42, 54].

Media- and communication technologies may be called Mind-Based if they simultaneously take into account the interaction of three different key components: i) the individual differences of perceptual processing and sense making of different segments of users, ii) the elements and factors inherent in information and technology that may produce psychological effects (physical, code and content layers), and iii) the consequent transient psychological effects emerging based on perception and processing of information at the level of each individual. [51]. Hence, Mind-Based design takes into account individual differences in processing information in order to be able to offer a particular user a particular type of experience. Naturally task and for instance the content or substance of information, such as email, Mobile Multimedia Messaging (MMS) or a news article, influence the user experience.

However, it may be feasible to facilitate desired user experiences just by varying the form of information. For instance, with Mind-Based Technologies one may vary the form of information per user profile, which may systematically produce, amplify, or shade different psychological effects. This type of system design approach may be of practical use, as it is known that individual differences in processing information may produce sometimes quite large variance in the intensity or type of psychological effects, such as depth of learning, positive emotion, persuasion, presence, social presence and other types of psychological states and effects [44, 45, 46, 47].

Hence, the Mind-Based Technologies- approach may be valuable also when creating systems for facilitating clear and cognitively optimised or emotionally focused interactive and adaptive systems. One operationalization of Mind-Based Technologies in system design is Psychological Customization [51, 55].

Psychological Customization includes modeling of individuals, groups, and communities to create psychological profiles and other profiles based on which customization may be conducted. In addition, a database of design rules is needed to define the desired cognitive and emotional effects for different types of profiles. Once these components are in place, content management technologies can be extended to cover variations of form and substance of information based on psychological profiles and design rules to create the desired psychological effects.

The key idea is that matching a particular individual difference, such as user´s fluency in processing textual information, with a desired user experience, such as the need for efficient cognitive processing. This results the system presenting the user with as much text-based modality within a certain task as possible. This would then enhance information processing related to task of that particular user. Another user may be more fluent in processing audio information or video material with the same task to achieve more efficient processing of information, for example.

Psychological Customization can be applied to various areas of HCI, such as Augmentation Systems, Notification Systems, Affective Computing, Collaborative Filtering, Persuasive Technology and Messaging Systems. It can be hypothesized that the selection and manipulation of substance of information takes place through the technologies of the various application areas of Psychological Customization. Underlying the application areas is a basic technology layer for customizing design. This implies that within some limits one may automatically vary the form of information per a certain category of substance of information. The design space for Psychological Customization is formed in the interaction of a particular application area and the possibilities of the technical implementation of automated design variation [51].

The particular focus of this paper is gaming. Even though no actual system has been implemented yet for Psychological Customization related to gaming, empirical evidence supports the feasibility and validity of this idea. First, it is well established that there are individual differences in cognitive processes such as attention, memory and language abilities. These individual differences have a considerable effect on computer-based performance [e.g. 8]. For example, individual differences in memory capacity have an effect on people's behavior in many types of activities [57]. This suggests the need for Psychological Customization Systems that optimize the presentation of information to different target groups having different psychological profiles. There is considerable evidence in literature that varying the form of information creates for instance emotional and cognitive effects [e.g. 15, 16, 18].

In media studies it has been found that different modalities, such as visual and auditory, may lead to different kinds of psychological influences and the valence of a preceding subliminal stimulus influences the subsequent evaluation of a person evaluated [5, 14]. In educational studies it has been shown that different ways of processing information influence learning and emotion of stimuli with certain modality [41]. Research concerning emotional influences on the cognitive processing of information has often concentrated on how different emotions related to information change the way users pay attention to, evaluate and remember the mediated message. This research has results on the influence of emotional information as increasing the user's self-reported emotion [22]; attention (physiological and self-reported) [21] and memory for mediated messages, particularly arousing messages [20, 21, 22]. Studies in experimental psychology have shown that recognition and memory can be influenced or even enhanced by previous exposure to subliminal visual or auditory images of which the subjects are not consciously aware [13]. Some of these effects are produced in interaction with individual differences, such as cognitive style, personality, age and gender.

In our own research on the influence of form factors of colour screen PDA´s and mobile phones of information (such as news, games, messaging content and entertainment content) on psychological effects has yielded many results. Regarding emotional responses has also shown that subliminal exposure to happy affective primes in connection with video messages presented on a small screen has several putatively positive influences (i.e., increased pleasure, perceived message trustworthiness, and memory) [38]. Further, recent studies in our laboratory have empirically confirmed that media messages can be modified in terms of audio characteristics [12, 37] and the presence of image motion [35] to meet the personality (as defined in terms of dispositional behavioral activation system sensitivity) of the user, thereby enhancing his or her attentional engagement, information processing, and enjoyment. The role of hardware should not be neglected. A device with a large screen or a portable device with smaller screen with user-changeable covers may also influence the emerging effects [e.g. 17].

Saari (2001) has grouped the clusters of form related variables relevant to psychological effects as: i) hardware layer (size, proximity, fixed place/carried by user), ii) code layer (way of interaction and degree of user control, ways of presenting visual-functional controls in the user interface) and iii) content layer (substance: essence of the event described in the message, form: modalities, visual layouts and temporal structures).

The empiric evidence presented here partly validates the possibility for Psychological Customization Systems at least with mobile devices and user interface prototypes used in our own research. Typical experiments we have conducted on the influence of form of information on psychological effects have included such manipulations as animation and movement (for orientation response), fonts of text, layout of text, background colors of text, user interface navigation element shapes (round vs. sharp), user interface layout directions, adding background music to reading text, use of subliminal affective priming in the user interface (emotionally loaded faces) and use of different modalities of information, for instance.

As the task of capturing and predicting user´s psychological state in real time is highly complex, one possible realization for capturing user´s psychological state is to have the user linked to a sufficient number of measurement channels of various i) psychophysiological signals (electroencephalography [EEG], facial electromyography [EMG], electrodermal activity [EDA], cardiovascular activity, other), ii) eye-based measures (eye blinks, pupil dilation, eye movements) and iii) behavioural measures (response speed, response quality, voice pitch analysis etc.). An index based on these signals then would verify to the system whether a desired psychological effect has been realized.

Another approach would be to conduct a large number of user studies on certain tasks and contexts with certain user groups, psychological profiles and content-form variations and measure various psychological effects as objectively as possible. Here, both subjective methods (questionnaires and interviews) and objective measures (psychophysiological measures or eye-based methods) may be used as well interviews [for a review on the use of psychophysiological methods in media research, see 36]. This would constitute a database of design-rules for automatic adaptations of information per user profile to create similar effects in highly similar situations with real applications. Naturally, a hybrid approach would combine both of these methods for capturing and facilitating the user´s likely psychological state.

3. Applications in Gaming

3.1. Basic Elements of Games

Games have often been researched from the point of view of narrative, consisting of a dramaturgical structure focused on crisis and the resolution [32]. However, it may be that gaming is not easily understood as a linear narrative. For instance, a gamer may be more interested in collecting points and more powers for his character inside the game and mere survival between different levels of the game than in moving along a story line coherently towards a climax. [25]

Similarly, it has been argued that the participatory aspect of gaming is the key to the experience of gaming [7]. It may be stated that the algorithm of the game is another key source of experiencing a game [31]. This implies that as the player learns the hidden rules and logic behind the game and is therefore successful in playing it, a state of satisfaction may arise. Further, it is evident that the skills of the gamer vs. the challenges presented in the game should be in balance [11]. If a game is too difficult or too easy to play, it may not be involving, but rather frustrating or boring. Another difference between narrative and games is that the tensions in narrative are dependent on the irreversibility of the consequences of the events of the narrative [33]. For instance, if the hero dies in the end of a book, it creates emotions because it cannot be reversed. However, in gaming it is often possible to gain a "new life" and return to a situation where one has "died". Player´s knowledge of this may lessen the involvement with a narrative or a dramatic event.

Despite the differences between traditional narratives and games, many similarities exist. The basic structure and elements of the narrative may be present also in games although the reactions of a player of a game may be different than those of the reader of the book to a particular linear sequence of a storyline due to the possibility of reversibility of effects of events or their consequenses. It is proposed that narrative is a basic way of organizing people´s experiences of various events of the world into sequences with a beginning, middle and end [4]. Further, memory research has demonstrated that schemas related to even complex events are often organized according to such a narrative structure [see 30].

A narrative schema may have the following structure: i) introduction of a setting and key characters, ii) explanation of the current state of affairs or the situation at hand, iii) initiating event leading to a motivation to act or change the state of affairs, iv) emotional response of the

protagonist and a goal for acting or changing the state of affairs, v) the difficulty experienced by the protagonist while performing actions to change the state of affairs and vi) the outcome of the action of the protagonist, i.e. success or failure in changing the state of affairs [4]. This implies that i) the role of the characters in the game is of key importance, including the role and point of view of the player and his character or role and ii) it is possible to create emotional reactions and motivation in the player to act in a desired manner by introducing events in a certain manner, or by offering a chance to succeed in attaining a goal. Hence, from the point of view of emotions, manipulating the events within a particular sequence of the game as well as introducing the situation and creating basic tensions and motivations as a basis for the task of the user in the game are important.

Outside narrative elements of a game, also the factors related to the presentation of the substance of the game or the form of the game, such as visual representations of the gaming events, amount and pace of image motion, audio effects and background music, and the level of interactivity offered to the player, are important from the point of view of emotion.

However, despite the amount of research on gaming the systematic adaptation of elements of the game to produce psychological effects has not been presented. A basic approach to an element to be adapted inside a game is a psychologically validated template that is embedded inside the game to create a particular psychological effect. A broad view of templates may be that the whole game consists of a database of psychologically validated templates that are presented in sequences. A limited view entails that a smaller collection of templates is used. The element of psychological evaluation means that the selected psychological influence (such an emotional response) of the template on a particular type of user is sufficiently well predictable.

These psychologically evaluated templates may consist of i) manipulating the substance of a game, such as story line (initiating events, new characters etc.) and manipulating the situations specifically related to the character of the player (such as putting the character into sudden and dangerous situations inside the game) and ii) manipulating the form or way of presentation of the game (such as visual elements, shapes, colours, types of objects, sound effects, background music, level of interactivity and feedback etc.). The difficulty level of the game may also be continuously automatically be adjusted, thereby keeping the skills and challenges in balance, which results in a maintenance of an optimal emotional experience and possibly also a flow-state.

3.2. Gaming, Presence, Emotion and Personality

How then to conceptualize emotion and related psychological constructs in gaming to understand how to psychologically validate the influence of various gaming templates? Emotions are biologically based action dispositions that have an important role in the determination of behavior [23]. This would be expected to

be the case also in connection with gaming behavior, which makes emotional responses elicited by games an important target of investigation. That is, people seek, and are eager to pay for, games that elicit optimal emotional responses (or response profiles).

Emotions can be seen as constituted by three aspects or components: subjective feeling, expressive behavior, and physiological arousal; others add motivational state or action tendency and/or cognitive processing [23, 53]. A dimensional theory of emotion holds that all emotions (e.g., joy, fear, depressed feeling, pleasant relaxation) can be located in a two-dimensional space, as coordinates of valence and arousal (or bodily activation); [e.g., 23, 26]. The valence dimension reflects the degree to which an affective experience is negative (unpleasant) or positive (pleasant). The arousal dimension indicates the level of activation associated with the emotional experience, and ranges from very excited or energized at one extreme to very calm or sleepy at the other.

Presence [i.e., the perceptual illusion that a mediated environment is not mediated; 27] may also be related to emotions. Factors such as a first-person view and naturalness may contribute to the experience of presence. Video games that engender a greater sense of presence are likely to elicit greater physiological arousal (at least when the game content is arousing), involvement, and attention (real-world stimuli, or stimuli that are perceived more or less as such, are likely to elicit greater attentional engagement compared to stimuli that are readily perceived as mediated presentations of real-world stimuli; [see e.g., 34, 35]. Importantly, games contributing to a high sense of presence have been suggested to be highly entertaining and, simply put, fun [greater enjoyment; 27]. The sense of presence may also facilitate game performance [see, 27].

People's responses to different kinds of media have often been shown to vary as a function of their personality [e.g. 35]. Video games vary wildly in terms of thrill and violence, for example. It is likely that whether players find a thrilling, violent game as more entertaining and engaging compared to a nonviolent game with a happy atmosphere depends on the player's enduring personality traits. In this connection, the Sensation Seeking trait might be particularly relevant, given that high sensation seekers have a high general need for thrills and excitement [39, 59].

How then to verify emotional reactions to validate the emotional influences of chosen gaming templates on different types of users when playing games? One solution is to have the user linked to a psychophysiological measurement system. An important advantage of psychophysiological measurements is that they can be performed continuously during game playing and have a high level of temporal precision.

It is well established that tasks requiring cognitive effort or active coping (e.g., many games) elicit emotional arousal accompanied by sympathetic nervous system (SNS) arousal and tonic heart rate (HR) acceleration (Ravaja, in press). Thus, in this connection, a tonic HR acceleration indexes emotional arousal. EDA, commonly known as skin conductance, is another psychophysiological index of arousal. As people experience arousal their SNS is

activated, resulting in increased sweat gland activity and skin conductance. [see 36]

Although tonic HR acceleration is related to emotional arousal, phasic changes in HR are sensitive indicators of attention. There is a considerable body of research showing that HR decelerates when attention is paid to an external stimulus or information is taken in [e.g. 19, 56]. The phasic HR deceleration is an important component of the orienting response (initiates the processing of external stimuli), and is mediated by the parasympathetic nervous system [36].

Facial electromyography (EMG) is frequently used as a psychophysiological index of hedonic valence [e.g. 24]. Increased activity at the zygomaticus major (cheek) and corrugator supercilii (brow) muscle regions has been associated with positive emotions and negative emotions, respectively, during affective imagery and when viewing media [24, 36]. Several studies have also found that tonic activity at the orbicularis oculi (periocular) muscle area is greater during high-arousal than during low-arousal emotion conditions [e.g. 58]; orbicularis oculi activity appears to be particularly high during positively valenced high-arousal emotions [36].

3.3. Example: Emotionally Adapted Gaming

The question then remains, how can a Psychological Customization system modify the emotional responses of various gamers? What elements of each gaming template may be varied per type of player to enhance various effects? Without detailed empiric evidence this is difficult to answer. However, at the conceptual level three typical emotionally focused scenarios of gaming are presented to shed light on this issue.

In the scenario, the user is sitting home alone at night with nothing special to do. He is a bit bored and needs some excitement and uplifting experiences. He opens his computer and selects a 3D first person shooter type of computer game to be played. From the available settings to control the type and intensity of his emotional experience in the game he decides to set the general levels to maximum arousal and selects the valence levels to be set also to maximum whether positive or negative. He thinks this should lift his mood and provide some exciting action. He further selects a medium level of difficulty of playing the game, resulting in a good balance between his skills and possibility to have engaging experiences inside the game, not being bored or not getting killed all the time.

The system has previously tested and modeled his personality and various other psychologically relevant factors. He then hooks himself up with a sensor system linked to the system measuring his level of emotional valence and arousal (such as measuring HR and skin conductance from his finger and EMG from his facial muscles in a non-intrusive and simple way). The game begins. The user is introduced to the starting point of the game: he needs to save the earth from alien invaders by using futuristic weaponry. While playing the user is suddenly disturbed by a high-speed and seemingly hostile alien attack. The user is in quite a hurry to point his weapon and shoot the alien and he just barely manages to do this.

Next, the user navigates the terrain in the game and is presented with an especially grim and scary scenery of ruins of a well known city. The lighting conditions, shadows, appearing nightfall, shapes and colouring of objects seen in the visual field, the audio effects and the quiet background music are together creating quite an eerie and sinister effect. As the user ranks quite high on the sensation seeking scale, the level and intensity of stimuli to create a particular emotional reaction and mood is increased throughout the game. The system may also use subliminal stimuli, such as smiling or angry faces not detectible to the user to increase particular emotional states in the game.

In another scene, a desperate little girl character suddenly appears to very persuasively plead for his help to save a group of humans captured by aliens in a nearby village. This creates an urgent need in the user to go and release the prisoners. The user goes about this and succeeds in the task well over expectations. Consequent praise of the released prisoners, including several quite attractive females, and the simultaneous subtle change in the tone of the present contextual scenery to be more uplifting (lighting, types of objects, music, audio effects) add to the feeling of high satisfaction and positive valence of the player. Hence, all emotional reactions are taken to the extreme inside the game.

From the point of view of ecological validity it may be stated that the key to a "good" fighting or war game is the optimal division of different types of emotional experiences while gaming, rather than just intensifying for instance excitement and arousal all the time. For instance, fear and hatred may be skillfully interlaced with joy and positive emotion. In other words, some parts of the game contain hatred and fear but there also have to be parts in which these are relieved and moments of victory and joy can be experienced (a terrible enemy has finally been devastated by the player).

Another approach not concentrating on maximizing and interlacing for instance negative high-arousal states and positive emotions would be a parental control of the level of emotional reactions elicited by a game. In such a scenario, parents may set the valence and arousal levels desired in a game to a particular level, such as avoiding too much arousal and negative valence, hence making most of the game either neutral or positive and only moderately arousing.

Yet another idea would be to maximize entertainment and fun within a genre of game that is quite positive by basic attitude, such as a level-playing game (Mario or similar). In this type of game scenarios and elements may be varied to create a flow of experience mostly characterized by moderate arousal and high positive valence, when possible. Naturally one may think of several other feasible scenarios.

Evidently, these scenarios may represent some mainstream uses of gaming. How then can emotionally adapted gaming add value in these scenarios? To answer this, first a matrix including the technological possibilities of creating emotionally focused gaming templates is presented in Table 1.

Layer of Technology	Emotionally Adapted Gaming Templates
1. Physical	-Mobile device: user changeable covers in colours and shapes that facilitate desired emotion -PC: colours and shapes that facilitate desired emotions
2. Code -*Windows-type user interface* -*Mouse, pen, speech,*	-The user interface elements (background color, forms, shapes, directions of navigation buttons etc.) may be varied in real-time per page per user in which a certain advertisement is located to create various emotions and ease of perceptual processing -audio channel may be used to create emotional effects (using audio input/output sound, varying pitch, tone, background music, audio effects etc.) -the interaction modalities may be adapted to suit the nature of the task
3. Content A. Substance - *Multimedia content created by authors or generated by game algorhithms*	-The genre of the game or type of game should be taken into account (first person shooter, simulation game, level playing game, other) -Various emotionally engaging story lines may be used to create different types of emotional reactions -The role of the user in the story can be varied to create emotional reactions -Adding subliminal extra content to create desired emotion while playing
B. Form Modality -*Multimedia*	-Modality may be matched to cognitive style or pre-existing mood of the receiver to create ease of processing -Background music, audio effects or ringing tones may be used as a separate modality to facilitate desired emotions and moods
Visual presentation	-Emotionally evaluated and positioned layout designs and templates for ads (colors, shapes and textures) may be utilized per type of user segment
Structure -linear/non-linear	-Using emotionally evaluated and positioned narrative templates for creating emotionally engaging stories

Table 1. Technological possibilities of Psychological Customization in emotionally adapted gaming.

Based on Table 1 it may be then said that Psychological Customization in creating emotionally adapted templates for adapted gaming may be used in several quite feasible ways. Further, while the use scenarios presented are somewhat pushed to the extreme corners of possibilities of Psychological Customization, they illustrate some aspects that may add value to the users of such systems in emotionally adapted gaming. In the example provided the system offered more opportunities to be playful, have fun, to have more arousing experiences and to be able to control childrens´ experiences of games.

Naturally, if the capture of user´s psychological states with psychophysiological and behavioural methods is realized with future gaming technologies, it may be possible to more objectively capture the effects of a given emotionally positioned template on the receiver designed to induce positive emotion, for instance. Such recording technologies would make the system more reliable and allow for fine-tuning of effects and allow the system to learn each individual´s patterns of responses in order to conduct better Psychological Customization over time.

As noted above, there are several psychophysiological measures that may be used to capture player's emotional and attentional responses. First, tonic and phasic HR can be used to index emotional arousal and attention, respectively. Second, EDA is also a very sensitive index of emotional arousal. Third, facial EMG measured from the zygomaticus major and corrugator supercilii muscle areas can be used to index positive and negative emotions, respectively (i.e., the valence of an emotional experience). Finally, EEG can be used to measure both emotional valence and attention.

4. Conclusion

The authors know of no other comprehensive framework to systematically adapt elements of games to create desired psychological effects, such as emotions.

It should be noted that to build a smoothly functioning Psychological Customization system one should do much more research and gain more evidence of the systematic relationships of user profiles, information forms and psychological effects than what is currently reported in scientific experiments with available methods of acquiring such complex information. More empiric evidence is needed per selected focus area before conclusions can be provided. However, in our research for the past four years in varying the form of multimodal information, such as news, entertainment and games presented through color-screen high-capacity mobile phones we have found many emerging commonalities and possible rules for altering designs and user interfaces to reliably facilitate emotions, presence, attention, and learning.

Consequently, clear and conclusive hypothesis, best practices for design or other low-level and explicit recommendation on how exactly to build and best use a Psychological Customization system in gaming is beyond the scope of this conceptual paper.

Despite this, the authors argue that the approach to system design presented in this paper may be beneficial in gaming application areas because: i) it provides a possibility to personalize the form of information that may be more transparent and "acceptable" to the users than adapting the substance of information in gaming, ii) it offers a way of more systematically accessing and controlling transient psychological effects of users of games by the users themselves, and iii) it is potentially compatible with existing and new systems as an add-on or a middleware layer in software with many potential application areas.

The potential drawbacks of the framework include the following: i) it may be costly to build the design-rule

databases and actually working real-life systems for creating systematic psychological effects, ii) the rule-databases may have to be adapted also locally and culturally, iii) the method needed to create a rule-database is not easy to use and may be suspect to ecological validity (eye-tracking, behavioral and psychophysiological measures, self-report, field tests are needed to verify laboratory results etc.) and iv) if the system works efficiently it may raise privacy issues, such as the intimacy of a personal psychological user profile (personality, cognitive style, values, other) or even issues related to mental health and mind-control (such as clinically depressed patients using emotional controls of the game to induce negative emotional states and become even more depressed or children experiencing unwanted emotional states).

These issues should be addressed in order to achieve technically, commercially and ethically feasible systems for emotionally adapted gaming. Regarding future research, we aim to build, evaluate and field-test prototypes of emotionally adapted gaming. Finally, it is evident that the area of Psychological Customization of gaming is still in its infancy. International-level collaboration of multidisciplinary research groups focused on gaming is much needed to fully realize the framework proposed in this article.

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