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Effects of Emotions in Cognitive Based Game

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Abstract:

Recognition of emotion has been done through different perspectives and is useful in many domains of Human Computer Interaction (HCI), especially in intelligent systems, interactive robots, web applications interaction, and to elaborate social media. Our aim is to design a system which encapsulates the behavior's set into roles which helps other developers in wrap behaviors into segments that can diverse dynamically, based on player moves. Games utilize contextual data about players and their environment to explore new means of interactions and enhance game experience. Cognitive science plays an important role in the performance of cognitive ASs. Recent research claims that the cognitive based games must incorporate in adaptive mechanisms especially in real- time adaption. Our research focuses on the domain of computer games based on emotions of player. In this research paper, we will layout a framework for adaptive agent game at which player's emotions are shown at each move in emotion avatar. With the help of cognition adaptive nature, system can change its level of difficulty as any change occur in performance of player. After achieving a real cognitive improvement, system will be able to provide appropriate challenges. Emotions in games enhance the motivation of player's by dynamically adapt the procedure of agent systems.

Keyword: Dimensional Model (DM), Classification Model (CM), facial expression emotions (FEE), Affective Virtual Reality (AVR), Game State (GS), AS (AS), Heart Rate Variability (HRV)

1. Introduction:

Psychology has many topics in his area but most important concept is "Emotion". In computer science paradigm, we can handle the emotions in the "Human-Computer Interactions (HCI)". In computer science, we can model emotions in two categories.

i. Dimensional Model (DM)
ii. Classification Model (CM)

In DM, emotions are understandable by designed in a coordinate system and mentioned in space. In CM, emotions are described after categorization. In general, emotions are categorized in four categories, i) behavioral reaction ii) expressive reaction iii) physiological reactions iv) subjective feelings [1]. Our research is basically based on behavioral reaction category

Behavioral Reaction: Behaviors shows complete picture of feelings and in our mechanism, behaviors are based on engine of game. There are five types in which behaviors are categorized [2]. Our agent-based system supports all these five categories.

i. Responsive: behavior should be "Responsive" such as quick reaction.
ii. Interruptible: behavior may be affected by other events, actions and behavior.
iii. Collaboration: it should respond corresponding to the other behavioral action.
iv. Generative: they can be easily created by other programmers which are at initial stage.
v. Resumable: we can continue the process if it break at any stage.

Emotions are conveying meaning through facial expressions and these emotions are handling of skin, movements, and facial muscles. These facial expression emotions (FEE) are analyzed through computer science techniques such as computer vision and image processing.

Agents are characterizing by their location of placement. In general they are categorizing in three types. First type is known as "Purely Reactive Agent". In these type insects, virtual insects and insect-like robots are used. This type is considered as most general one. Second category is "Continuum of Agents" which deals with animals and robots, in other words they deal in artificial life. Third class name is "Cognitive Agents or Thinking Agents". They are based on humans (may be humans are consider as virtual humans) and intelligent agents. The classification of agents is shown in figure 1.

Fig. 1: Categories of Agents

Reactive agents performance is very limited when we compare it with cognitive. Cognitive agents have more plan ability; they have more co-ordination power with other sets or themselves. In other words cognition reacts when an event happens [3]. Whereas, reactive agents are worked collectively with the bounding of all together in terms to solve complex problems. Some comparison is given below in figure 2.

Reactive Agents	Cognitive Agents
Use simple behaviors	Use Complex behaviors
Have low complexity	Have high complexity
Are not capable of foreseeing the future	Anticipate what is going to happen
Do not have goals	Have specific goals
Do not plan or co-ordinate amongst themselves	Make plans and can co-ordinate with each other
Have no representation of the environment	Map their environment
Do not adapt or learn	Exhibit learned behavior
Can work together to resolve complex problems	Can resolve complex problems both by working together and by working individually

Fig. 2: Comparison between reactive agents and cognitive agents

Facial expressions can be helpful in game scenario by showing the response of game player (emotional response), such as what are the feeling of a player at different levels specially game levels became harder and harder; with the help of these features we can get a feedback of player in terms of emotions through the process of game design [4, 5, 6, 7].

The latest "resurrection" of activity in VR, spurred with the incipient gaming technologies. Designers of Human-Computer Interaction (HCI) system are utilized in the immersion experience, distribute compelling, announce different multidimensional input/output contrivance, interactive style with approach of 3D world. Furthermore, one research area of HCI is controvertible, that achieves best place in upcoming time which creates strives towards straightforward communication in person Encephalon and computer systems. In 2006, Cairns present an idea that accurate "Immersion" which may only be access through proper utilization of latest Encephalon-computer Interfaces [8]. But, as that day concerns, it is paramount to accept, in leading, how it may be conceivable to quantify and, emotional connectivity and person engagement influence with basic worlds utilizing "Psychophysiological" methods. Encephalon-Computer Interaction (BCI) systems endeavor to ameliorate HCI and increment the engagement impression by precisely interfacing with the nerve system of human and abstracting the unreal fence to emotional interaction controlled by ordinary input-exhibit strategies. These incipient channels of interface can have the possibilities for the purpose of introduction an immensely colossal number of incipient communication methods in latest HCI systems, and may be they are able to amend the process of interaction considerably. As the interaction process has been highly predicated when we use "Conventional" techniques, in that system operators mostly deal with "Physical Interaction" contrivances to optically discern, sense haptic, auricular discern, act, and in a few perspective even verbalize with the scheme. As a development to these conventional schemes; the near-term purpose of BCI structures, may be able to convert user Noetic conceptions and concerns by blunt contact to the user Encephalon and utilize this advice as an incipient method channel for HCI structures [9]. Researchers have move their attentions towards prelude of straight Encephalon system interaction from HCI structure, Aljandro at el. and Avinash at el. Cited some examples in their literature [10], these

examples discuss quantification of melancholy, control mechanism and stress-level at adaptation of game [12, 13]. Affective computation is described under the umbrella of research sub-categories into BCI systems. Affective computation, in basis, file psycho physiological signals which receive from the computer-users, which after facilitating the whole system to retrieve data of pertinence to their cognitive states and emotions. This input data could give many distinguish features for latest HCI systems, endeavoring to fortify the development of tenable immersive interpretations. When we discuss briefly VR field and the pertinence of affect issues, analysts have calculated the implementation of constructive realities in many distinctive areas. As well as regalement, Vrs and soi-disant "serious games" counterparts have been utilized for purposes of training [7, 8, and 9], pain diversion, rehabilitation régimes, and emotional disorder therapy, to mention but a handful of applications. The all above mention discussion focus the attentions of users interaction with virtual situation, and to increment their impression of immersion and presence within them, so efficaciously distributing incipient proficiency, erudition or may be in rare cases, alternate as a form of clinical diversion. In 2006, Joel's advise that transmutations in the exhilaration level, affect the cognitive and recollection action. He suggested that recollection performance adjustment (either impairments or ameliorations) are fully time dependent and the emotional experience background. Ergo, describe the users' emotions perception, when bare to virtual realities and handling their affective experiences in the virtual situations. We conceptualized, evaluated and designed an AVR, capable to arouse sundry emotional maturities on the component of the user's utilizer. In the latest study, by using the architecture of Affective VR, a computing scheme which is based on affect was conceptualized, evaluated and designed. By doing this, the affair in the middle of human emotions and psycho physiological signals have been the investigation focus, and evoked through the designed AVR. To back this work:
The AS control consideration; and fully check has been perform in WM [2] [3] [4]. Consideration and WM are the two cognitive skills assessment tools that are essentially cognate; input information as signal regulates which create attention and WM absorb it [5].

When we are taking about other processes of cognition they are perpetual. Recent work in understanding of game environment suggests that WM does not consistent effected with the negative valence [2] [4]. However, utilizing felicitous can be incremented by the attention through which a player can activate [4].

The latest strategy in this current research cognition based game has adaptive nature through which a player transmute the difficulty level of game in authentic time which is based on the players' performance [6] [7].

However, when we talk about adaptive mechanisms they ignore the paramount AS role on performance of cognition. The analysis and detection of AS Include in this flexible structure can amend the adaptation which has a positive impact on the cognitive performance of player [9]. The main goals of this research are twofold: 1) investigating WM achievement with comparing desktop with VR when a player playing a video game, and 2) examine the role of arousal and valence on performance of WM.

Games are fun and fun is playing games. When we are talking about computer games, they are measured in affective computing. Games have properties such as they are interactive, result-oriented, competitive, dynamic, has excited nature. Because of these characteristics, we can influence player's state of emotions.

1.1. Affect and Cognition:

AS, represented arousal and valence in a two dimensional form, which can have effects of both negative and positive on WM and attention [10]. Benin et al. [2] in his paper summarize the hypotheses related to the following question. "How emotion affects recollection?" While negative and positive valence conventionally enhances recollection, arousal avails recollection. Furthermore, when emotion avails to process information (encoding), it additionally facilitates the storage of that particular information (consolidation) [2]. This affair between cognition and affect has withal been studied in terms of physiological to utilizing mainly HRV as a quantification of cognitive load and stress.

1.2. Affect detection in gaming:

User experience related to earnestness and vividness of emotions are highly suggested [12]. In last few years, researcher induced the utilization of VR in video games especially has brought an instrument in engagement and immersion of game player's. In the virtual world the feelings of player our reported to incipient the immersion degree level [12]. AS presence in game have been suggested the direct influence in the presence of earnestness and vividness of emotions [12]. Many researchers referred VR as "Affective medium" because it has the capacity to evoke and the AS concentration [12].

AS is utilized to improve adaptive assessment i.e. closed-loop input in video games that are based on habituating the game confer to the current AS of player [13]. AS can withal for purpose as well as to amend the player experience.

1.3. Cognitive Training Affects:

A new trend of cognitive skill effect is studied in video games. However, most of the games do not induce the beneficial skills of cognition. Studies were highlighted reiterated contributions of cognitive skills without adaptation of difficulty [13]. Recently, Anguera et al. engendered a new video game "Neuro racer". In this game, he demonstrated authentic amendments to improve the cognitive skills for example multitasking and attention. His game habituates the player's performance through the difficulty level in order to opportunely check their cognitive art. With the utilization of such approaches we can handle the emotional disorder's like despondence and cognitive capabilities like in different other games such as in game "EVO" [7]. Some certain elements related to game are integrated to gain rewards, increasing more fun levels in game and in releasing mental stress [13]. This incipient game generation for the use of train cognitive system demonstrates the paramount of keenly intellective flexible mechanisms in terms to test the player and introduce personalized training. Mishra et al. [13] demonstrate that the closed-loop as input channel should utilize the performance of player's additionally authentic data related to time computed as player perform some comportment and interaction.

2. Related Work:

Machine-learning techniques and genetic algorithms are the latest trends which are used in gaming to learn player's game and make a game more challenging. Curz and Demasi designed an "Intelligent Agent Employing Genetic Algorithm techniques" to make a user game level into a best fit curve [18]. In these types of games player's activity is monitor and then made decisions about game goals. Our aim too is to monitor a player's activity in game and after collecting the information of player's progress and system defines player's emotions about game activities.

Now a day, a "Dynamic Game Difficulty Balancing" (DGDB) technique is used to adjust parameters of games. In other words, this mechanism is incorporate adaptation in games. By using, that technique we can monitors the performance of player in terms of game's level difficulty. Chapman's and Hunicke make an approach in which they can handle the environment setting of games. By doing this they measure the game harder and easier level of challenges [19]. Resident Evil uses a "Difficulty Scale" parameter in their systems to measure the performance of player according to player's grade [20]. Mario Kart introduces a bounce feature to help in upgrading player's position. Imbert and de Antonio use emotion-driven reasoning technique in the model of Cognitive Architecture to handle social behavior and emotions [21].

Yeh et al. [4] described the strategy of negative emotions that how they influence WM in an ingeniousness of game by simply inquire participants to play game in three incrementing levels of difficulty. Homogeneous to Bennion et al. [2], he fined a point that arousal can avail the WM but negative effects could be generated. They defined a game with evading negative emotions in the game which increases the challenges to arouse the player's consideration.

3. Framework:

This part represents the necessary data for guiding the designers of games for enhancing their game through the concepts and techniques for artificial intelligence to incorporate player's emotions and feeling. So we present software framework architecture in figure 3 and define

their components in detail form. This system framework architecture is visible in figure 1 to provide a flexible model of artificial intelligent based games. Further components with different roles are clearly separated to provide flexibility in implementation of each component to the designer. As we know each decision in agent based systems, is based on "Local Situation" and this decision is affected only "Local Situation" [22].

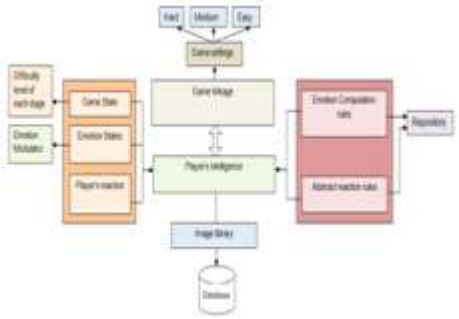

Fig.3: Framework Architecture

3.1. Game Linkage (GL):

GL provides the fundamental functionality to the player to interact with the agent system. In order to co-operate such communication, a protocol is used for communication to characterize the specific picture message to convey player's emotions [23]. As a player execute a particular action in this game, the GS become changed for that particular reason, through the process of cognition player avatar is selected and successfully send to the Player's Intelligence phase.

3.2. Player's Intelligence (PI):

This component part works with all the parts of system. Firstly, it connects with a communication protocol to game GL to communicate with game system. When the state of game or emotion is changed by taking further step in game; the state sends next latest avatar command to PI. PI then receive a corresponding avatar from IL after the conformation of rules.

3.3. System Rules:

The system makes its decision, based on logics of AI in the rule form. This rule system works as backbone of AI system. In our system this part is split into two parts, i) Emotion Computation rule (ECR) and ii) Abstract Reaction Rule (ARR). In order to design a system for AI rules, programmers can choose many programming languages. In our system we use C#. The main beneficial point of our system is that programmers can switch player's emotions by just switching the system rule.

3.4. System states:

This part is split into three further components. Game state: each game has many level of competition. Game player have to complete a level to reach at next level. After completion of one level, the state will updated and state of game will be changed. Emotion state: after each step or decision command at each level, emotion of avatar will be changed according to the situation. Player's reaction will vary after each move or after each change in avatar.

4. System Input:

We capture emotions as input parameter through facial expressions. The main purpose of this research idea is to design a novel scheme based on player's emotions interaction in a game. We build a system, which directly handles the player's facial expressions. Our proposed system handles five categories of emotions (happy, sad, surprise, angry, fear) out of eight emotions (Happy, Sad, Fear, Normal/ Neural, Surprise, Anger, Disgust, Contempt).

Fig.4: Types of Emotions

4.1. Methodology:

Our Agent based system focuses on characters (characters which player used to play). System thoroughly monitors the game activities by continually collecting data at each move of player and at each level.

At each move made by player, our agent system predicts player's emotions about game difficulty. The following are the decisions of our proposed agent based system. These rules are graphically defined in figure 5.

i. If player move is valid and accurate, our agent system makes "Happy Face"
ii. If player move is invalid and not up to the mark, our agent system makes "Sad Face"
iii. If player move take much time in decision, system makes "Disappointed Face"
iv. If player continuously made wrong moves then system generates "Angry Face"
v. If player hit a move and generated results are excellent, then system generates "Surprise Face"
vi. At the start of game Player's emotions described by "Normal Face"

Fig.5: Rules for Player's Emotions

4.2. System Outcomes:

In our idea, we employ the player's emotional states, in plan to increase the social assessment. At that stage we neither use any conquer substantive player's emotion structure. Our main focus is to introduce a new idea based on intelligent system, to build a new avatar of player that is dynamically build emotions. That avatars are selected on the player's selection of objects and player's score gained. Our system behaves like a commentator of sports and any TV-show game and tries to simulate human behavior.

4.3. Algorithm:

We use C# language to build our agent based system for defining the player's emotions in game at each move in each level. The system pseudocode is visible in figure 6, 7 to provide a main methodology of artificial intelligent based games.

Fig. 8: Best player move, "Happy" avatar.

Fig. 9: little mistake in player's move, "Surprise" avatar.

Fig. 10: not an accurate move, "Contempt" avatar.

Fig. 11: Player's wrong move, "Fear" avatar.

Fig. 12: Not best player move, "Disgust" avatar.

Fig. 13: Player going to be loses the game, "Sad" avatar.

Fig.14: Player loses the game, "Sad" avatar.

5. Future work:

Future work may be based on emotion distinguished between the player's different smiles such as some smiles are only close-lip and some smiles convey real meaning of laugh means obviously big smile. Both are handling in our system as "happy". Really need is to distinguish such difference in emotion types.

Emotion agent system is based on image processing and artificial intelligent approaches by characterize and analyze the FEE. System collected this FEE which is stored in a database on a windows computer. This system handles five categories of emotions (happy, sad, surprise, angry, fear) out of eight emotions (Happy, Sad, Fear, Normal/ Neutal, Surprise, Anger, Disgust, Contempt). As our system generate output in image form, in future researcher can enhance these outputs at audio messages corresponding to behavior, can generate any text message on screen corresponding to player's behavior, and any animation based on type of emotions as define in figure 4.

6. Conclusion:

In our research paper, we design a framework for constructing a game based on artificial intelligence techniques, to present player's emotions at each level of game or at each move. Our work exhibit the usefulness of generic framework architecture for game player's emotions. By using this novel approach, designers can design their games by search processing, way of inducing and utilization of player's emotions. We can motivate player's by dynamically adapt the procedure of agent systems. Another important element is improving the game experience with the emotion images explaining the emotions of player, it will introduce the social interaction. Our research idea will help the game's developer in player's characters creation for the development of new games, insert new emotions and adaptation of social assessment.

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