Controlling Emotional Conditions for Learning

Orly Benchetrit ** Claude Frasson*

*Département d'informatique et de recherche opérationnelle. Université de Montréal
2920 Chemin de la Tour, Montréal, (Québec) Canada H3C 3J7

** Virtual Age International
75 Queen, Montréal, (Québec) Canada H3C 2N6

Abstract : Emotional Intelligence (EI) is emerging as an important factor in high performance at work, at school, and at home. In this paper we first identify certain emotional conditions of learning which contribute to learning enhancement and learner performance and we present two accelerated learning techniques. The first one is called Suggestopedia which integrates a number of key elements able to place the learner in certain conditions known to accelerate learning. The second one called Visualization, is also known to promote learning through the mental imaging and mental practice of the task at hand, prior to its realization. Using a holistic approach, these two accelerated learning techniques can be successively combined to incite “positive emotion”.

Introduction

Although it was commonly assumed that learning implicated intellectual and cognitive processes, Emotional Intelligence (EI) is emerging as an important factor in high performance at work, at school, and at home. The impetus to engage in and persist with any learning activity is directly linked to the emotional state of the learner (how he feels about himself) and his motivation (how he feels about the subject). According to Damasio (Damasio 1995), without emotion, we cannot make a decision while scientific experiments have demonstrated the importance of the Amygdalia, the center of emotion, in this decision process. We also know that different emotions will incite different outcomes. Positive emotions, for example, allow for efficient acquisition and creation of knowledge, while negative emotions reduce and inhibit knowledge retrieval and memory (Lisetti & Schiano 2000).

E-learning environments need to consider all of these elements and particularly the emotional state of the learner. But how can we identify the emotional state of the learner? How do we generate the best possible learning conditions for each learner? And most importantly, how do we create an eLearning system capable of controlling and managing emotional learning conditions? These questions remain essential to the understanding and enhancement of learning processes and mechanisms.

In response to the first question stated above, our work in (Ochs & Frasson, 2004) indicates a method for retrieving and measuring the emotional state of the learner. This state can be assessed through a self-evaluation questionnaire where the learner can situate himself in a scale of nine emotional couples of emotions (Ortony, Clore & Collins, 1988). Because the current emotional state of a learner can also result from a previous emotional state resulting from a specific situation (joy, disappointment, anger etc…), we can present him with different cases and ask him to identify his feelings in relation to that case.

For the second question, we know that a learner can increase his receptivity when placed in a positive emotional condition or emotional state. Amongst these emotional conditions, we find characteristics such as relaxation, concentration and the ability to visualize tasks. Also, recent studies confirm that certain emotions reduce our capacity to learn while others improve it (Goleman 1997) (Klein, Youngme & Picard 2002) (Lisetti & Schiano 2000) (Keller 1987). Hence we are presently identifying and implementing the most positive emotional conditions for improved learning.
In answer to the third question, we know that Intelligent agents have proven their effectiveness through their intervention inside interactive environments, through their adaptation to learner behaviors, and through the generation of elements designed to enhance learning (Frasson, 1998). Consequently, an intelligent agent able to take into account the emotional aspects of a learner should improve his performance. This leads to a specific learning environment where the emotional behavior of the learner can be supported by Emotional Intelligent Agents (EIA) enhanced with specific intelligent agent components.

Several topics will be discussed in this paper and will include the following: The identification of certain emotional conditions of learning which contribute to learning enhancement and learner performance; an accelerated learning technique called Suggestopedia (Lozanov, 1978) which integrates a number of key elements able to place the learner in certain conditions known to accelerate learning; and Visualization, another accelerated learning technique also known to promote learning through the mental imaging and mental practice of the task at hand, prior to its realization. Using a holistic approach, these two accelerated learning techniques can be successively combined to incite “positive emotion”. We are presently integrating these techniques into intelligent agents rendering them capable of generating elements, responses and strategies in support of optimal learning conditions.

The first section will comment on the role of emotions in the learning process, how these can be used to improve learning, and how they can be controlled. The second section will present Suggestopedia and Visualization techniques while highlighting key components that can generated by intelligent agents to create optimal emotional conditions for learning. Finally, the last sections will illustrate how these embedded systems can be integrated into intelligent agents.

The role of Emotions in Learning

Learners are highly complex beings and as such, learning involves both a cognitive and emotional process. In fact, emotional intelligence is recognized as an essential component to the success of human learning processes (Salovey & Mayer, 1990; Goleman, 1995). Goleman argues that “emotional intelligence” is of much greater importance than “academic intelligence” in developing a well-rounded person, stating that “at best, IQ contributes about 20 percent to the factors that determine life success, which leaves 80 percent to other forces” (Goleman: Emotional Intelligence).

Positive and negative emotions can go as far as affecting the way the brain processes and retrieves information. An “emotional high” will provoke the release of endorphins in the brain, which in turn, trigger the flow of acetylcholine, the vital neuro-transmitter that orders new memories to be imprinted in various parts of the brain. Pulitzer Prize-winning science writer Ronald Kotulak describes acetylcholine as "the oil that makes the memory machine function. When it dries up, the machine freezes.", often resulting in Alzheimer (Kotulak, 1997).

The involvement of the emotional-right brain with the cognitive left-brain can dramatically improve learning. It is suggested that a synergistic principle operates between the hemispheres, hence, a functioning whole becomes significantly greater than the sum of its parts. Researcher Colin Rose provides us with a clear example of this phenomenon: "If you're listening to a song, the left brain would be processing the words and the right brain would be processing the music. So it's no accident that we learn the words of popular songs very easily.” Colin Rose: interview in Aston Clinton, Bucks, England (1990).

Different emotions affect learning differently. Anxiety, for example, provides a negative impact on learning, especially in testing situations (Hembree, 1988; Laux et al. 1981; Spielberger, 1980). Success has a positive impact and fear of failure, a negative influence on achievement (McClelland, 1985). Csikszentmihalyi’s “zone-of-flow” can lead to the highest levels of achievement (Csikszentmihalyi, 1975; Csikszentmihalyi & Le Fevre, 1989), while positive emotions can improve creative, flexible and integrated thinking and learning processes (Isen, Daubman & Nowicki, 1987).

Having understood the impact of emotion on learning, our challenge now becomes the finding of a means to control the emotional state of the learner, infusing him only with positive emotions and removing all of the deterrents that might impede on his natural abilities.
The role of Suggestopedia

'Suggestopedia', derived from suggestion and pedagogy, utilizes various techniques in order to improve learning. Developed in the 1970’s by the Bulgarian doctor and psychotherapist Georgi Lozanov (Lozanov, 1978), this learning method includes several components, i.e. suggestion, authority (prestige), communication (verbal and non-verbal), intonation and rhythm of presentation, breathing synchronised with presentation, relaxation, "mind-calming", mental imagery, subliminal stimuli and active role playing (Racle 1976; Schuster & Gritton, 1986). Each key component is elaborated below and constitutes a functionality which can be generated by an intelligent agent:

Communication: It is founded on the premise that much of what we learn is not by direct verbal instruction but by direct and indirect non-verbal cues such as body language, expressiveness, eye-contact and facial expressions. These remain key elements in human interaction while the ability to effectively utilize non-verbal cues is known to influence the level of communication (Baron & Byrne, 1984).

The Communication Agent (CA) is capable of generating appropriate verbal and non-verbal communication techniques for optimized interaction with the learner.

Learning Environment: There is also great emphasis placed on the learner’s physical environment and in particular, to the possible influence of subliminal messages present in every setting (Scovel, 1979). Rich sensory learning environments (pictures, colour, music, etc.), a positive expectation of success and the use of a varied range of methods: dramatized texts, active participation in songs and games are key to Suggestopedia.

The Environment Agent (EA) generates all of the aforementioned functionalities in order promote an optimal learning space.

Music: Lozanov introduces specific classical music and relaxation in order to induce a hypnotic-type state known to increase concentration and strengthen memorization (Lozanov, 1978). "Certain types of musical rhythm help relax the body, calm the breath, quiet the beta chatter and evoke a gentle state of relaxed awareness which is highly receptive to learning new information" states Webb (Webb, 1990).

The Music Agent is able to deploy musical pieces specifically designed to enhance learning and retention.

Suggestion: Lozanov claims that tension, stress, and preconceptions hinder the learning process and hence, introduces positive suggestion to counteract our self-limiting beliefs. Hence, at the on-set of each Suggestopedia lesson, the teacher begins by creating an expectation that learning will be easy and entertaining, as teacher expectancy is known to significantly impact learner performance (Rosenthal & Jacobson, 1968). The teacher will continue to bolster learner confidence through positive affirmations and reminders of successful past performances, a "placebo" effect frequently used by Lozanov (1978).

The Suggestion Agent (SA) can provide appropriate reinforcement to the learner through positive affirmations and suggestions.

Relaxation: Lozanov touts the benefits of yogic exercises and breathing, essential in the attainment of the appropriate combination of relaxation, concentration, slow pulse rate and alpha state in which accelerated learning is made possible (Bancroft, 1976). “It is in the alpha and theta states that the great feats of super-memory, along with heightened powers of concentration and creativity, are achieved” says Terry Wyler Webb with Douglas Webb (1990). British accelerated learning innovator Colin Rose adds: "This is the brain wave that characterizes relaxation and meditation, the state of mind during which you daydream, let your imagination run. It is a state of relaxed alertness that facilitates inspiration, fast assimilation of facts and heightened memory. Alpha lets you reach your subconscious, and since your self-image is primarily in your subconscious it is the only effective way to reach it" (Colin Rose, 1985).

The Alpha Agent alpha agent (AA) induces the learner into a relaxed state through breathing and relaxation techniques.
Left and Right Brain. The human brain consists of two hemispheres responsible for different learning activities. Although no two people are alike, dreaming, imagination, creativity, music, colour, rhythm, visualization, and the like are generally referred to as right-brain activities, while the left-brain is sequential, analytical, rational, objective, and mathematical (Klauser 1986: 26). Traditionally, education has placed emphasis on (dominant) left brain thinking; but increasingly it is being recognised that the involvement of both brains can make dramatic improvements in learning. It is also suggested that a synergistic principle operates between the hemispheres, with the functioning whole brain being significantly greater than the sum of its parts.

The Brain Agent (BA) stimulates both brain hemispheres by introducing right and left-brain functions simultaneously throughout the learning process.

All of these agents can be combined or used independently to enhance learning.

The following graphics represent a Suggestion Agent and a Communication Agent.

**Suggestion Agent**

**Communication Agent**

Visualization

Visualization is an important component of the human brain and can be used to enhance knowledge acquisition not only for concepts and rules, but also for gestures, behaviour, … For instance, a professional dancer will visualize the different steps, gestures and sequences to perform prior to actualizing them. The visualization process can be further optimized through the generation of specific emotional conditions such as positive suggestion, derived from Suggestopedia techniques as previously mentioned.

Using the “power of suggestion”, an agent will reassure the learner by creating an expectation that learning will be easy and entertaining, as teacher expectancy is known to significantly impact learner performance. The agent will continue to bolster learner confidence through positive affirmations and reminders of past successes, hence heightening learner receptivity, excitement and motivation (Rosenthal & Jacobson, 1968). The sequence of emotional states ensuing from positive suggestion is as follows:

![Figure 2 Positive Suggestion](image-url)
These emotional conditions prepare the learner to acquire new knowledge. Once this is achieved, the visualization process intervenes. Visualisation is largely a right brain function, and we can be trained or learn to use it more effectively. It is frequently used to help people to move beyond their current boundaries and to achieve targets they thought were impossible. It is a method employed in NLP, Inner Game and Autogenic Training, and it has many applications, including confidence building, sports training and the treatment of cancer. The following a key features involved in the visualization process:

**Achieving a Relaxed State:** We begin by getting into a relaxed or meditative state. This can be achieved by using a range of relaxation techniques, including music, diaphragmatic breathing and the tensing of muscles. We can also choose to visualise ourselves in our own 'special place'. This illustrates the importance of the first emotional steps mentioned above.

**Creating a Mental Picture:** We then create a mental picture of ourselves in the desired circumstances, for example we imagine ourselves completing a challenging project or excelling in a particular sport. We try to make the image as multi-sensory and real as possible, by incorporating pictures, sounds, smells, tastes and feelings.

**Revisiting Your Picture:** We regularly revisit our visualisation, with all of its positive associations, until we can successfully accomplish our objective. The visualisation is a mental rehearsal for the real thing, and over time it can raise our expectations of what is possible. This image eventually becomes part of our normal perceptual framework and can ultimately result into a self-fulfilling prophecy. Steps for the visualization process are as follows:

![Figure 3 The Visualization Process](image)

When we imagine the different steps of a dance for instance, using visualization techniques, it creates a kind of pattern in the conscious part of the brain. By repeating the visualization several times, as in real practice activities (repeating), the pattern enters into conscious memory which coordinates the sequence and coherence of physical gestures. This type of repeated behaviour promotes confidence while if we want to further optimize the process, then we can combine it with goal-setting through visualization.

Based on the Visualization model, we have designed an agent able (1) to provoke a positive suggestion and (2) to teach or give advices on how to create mental images.

**A Hollistic Agent Based Model**

According to John Heron's (1996) holistic learning model, learning is an interaction between four distinct modes of psychological being: *feeling, imaginal, thinking* and *practical*. With feeling at the base of the pyramid and practical at the top, this model not only challenges the once predominant role of intellect, but designates feeling as the fundamental mode, supporting and feeding the other three. Claiming that motivation is closely linked to both our feeling and imaginal modes, Heron believes that we become highly motivated about an
endeavor once we invest in it emotionally ('feeling') and begin to use our imagination in order to envision all of
the possible outcomes ('imaginal').

In fact, the two accelerated learning techniques presented in this paper can be integrated into a cognitive
approach (Frasson, 1998) using BDI agents (Belief, Desire, Intention, initially designed by Rao and Georgeff,
1991). These allow us to design and implement mental categories.

The different specialized agents intervene on demand or can be activated according to the emotional state of the
learner; this one can be obtained by asking the learner directly to select his estimated emotional state on a
variety of scales (Ochs, Frasson, 2004). To give an example on how these agents can interact between the learner
and the system, let us consider the Imagine Agent (IA). To prepare a given action (for instance playing a golf
shot) the agent can successively
- show a video of the shot,
- decompose the gesture element by element,
- ask the learner to reproduce the movement with eyes closed,
- analyse the result of the shot and invite the learner to train again on the sequence of gestures.

This architecture is currently being implemented although a number of agents are already functional and include a music agent (MA), a suggestion Agent (SA) which reinforce learner affirmation, and a Communication Agent CA which uses verbal and non-verbal communication techniques. This last one was developed for France Telecom in an elearning course based on Effective Communication.

**Conclusion**

That emotions are essential to the success of the human learning process is a well established idea substantiated by cognitive science. Our aim is to create an emotion-based ITS capable of integrating all of the key elements emanating from accelerated learning techniques in order to provide learners with the best possible eLearning environments. We have created and continue to create agents endowed with the skills and techniques required to induce learners into optimal emotional states and capable of emulating human teachers. Combined with personalized and adaptive virtual learning environments, we hope to create and control emotional conditions vital to the enhancement of eLearning as a whole, a sector which has, until recently, placed very little emphasis on the emotional and psychological factors essential to the human learning process.

**References**


