Affective attribute in a Distributed Learning Environment

Anne Brisebois
LICEF Research Centre,
Télé-université
4750, avenue Henri-Julien,
bureau 100,
abrisebo@licef.teluq.uquebec.ca

Gilbert Paquette
LICEF Research Centre,
Télé-université
4750, avenue Henri-Julien,
bureau 100,
gpaquett@licef.teluq.uquebec.ca

Anis Masmoudi
LICEF Research Centre,
Télé-université
4750, avenue Henri-Julien,
bureau 100,
masmoudi@.teluq.uquebec.ca

Abstract

Modeling affective attributes in a DLE (Distributed Learning Environment) poses many challenges. We aim to extend the learner's model with attributes such as his emotional states (sadness, fear, joy, gratefulness, culpability, anger, pride and hope) related to a context (objects of the pedagogical structure). The emotion becomes private or public depending on the learner's choice. A private emotion is kept confidential but contributes anonymously to build a group affective model. Group affective attributes are of great interest for all learners, the trainer and the course designer. For example, summaries give the designer a portrait of emotions triggered by the learning events and resources he proposes. On an individual bases, combining learner's affective attributes with her cognitive, metacognitive and collaborative attributes provides a set of key data to the learner and the trainer. Inspection of these data leads learners and trainers to significant reflections and formative interventions. On a continuous basis, the system, informed of learners' usual problems and their indicators, watches learners' data. When these indicators are observed and when a significant threshold is reached, the system displays warnings to the learner and trainer. Bringing these problems to their immediate attention helps prevent learning problems before they happen.

1. Affective modeling in a DLE (Distributed Learning Environment)

Designers of a learning event define a cognitive structure of selected target competencies. They propose a more or less flexible progression path through a series of learning activities. These activities are accompanied with relevant resources. Learners are invited to follow this learning path or create their own path under certain conditions. They are expected to engage in cognitive processes, making use of these resources and interacting with human and computerized agents.

In a learning environment, like in any other environment, emotions affect cognitive processes. So, affective modeling is of great interest for all agents engaged in the environment: the learner, the trainer, the designer and other learners.

Emotions are a person's internal states prompted by a clear trigger. They emerge from interactions with one's environment and are associated with an object of the environment whether this object is a human: *I like this trainer*, a physical object *I hate this book* or an event *I am afraid of this exam*.

The agent externalizes his emotions using cues while interacting with the environment. These cues are placed within the verbal content of a communication, like *I hate that assignment,* the verbal characteristics of a communication like facial expressions, gestures, variations in pitch, intensity, speech rate, rhythm, and voice quality and non-verbal acts of communication like going out hastily of the room.

Other agents, in contact with these behaviours, can bypass the recognition of the emotional state. They can also acknowledge the verbal content and characteristics of a message or the nonverbal acts of communication and search for contextual cues to interpret and make hypothesis on the emotional state and its environmental object. Skilled humans can assess emotional signals with varying degrees of precision.

Our DLE (see Figure 1 – A host web environment and an Explor@ resource navigator model) (Paquette, 2002; Paquette, 1997) offers a process-based learning scenario. A host, a web-based learning environment, houses a series of resources. The learner interacts with other actors like the trainer and other learners and carries out the tasks proposed in a network of learning activities using a set of information processing, collaboration, self management and assistance resources. Learner's productions become resources for the trainer feedbacks or for the learners further activities.
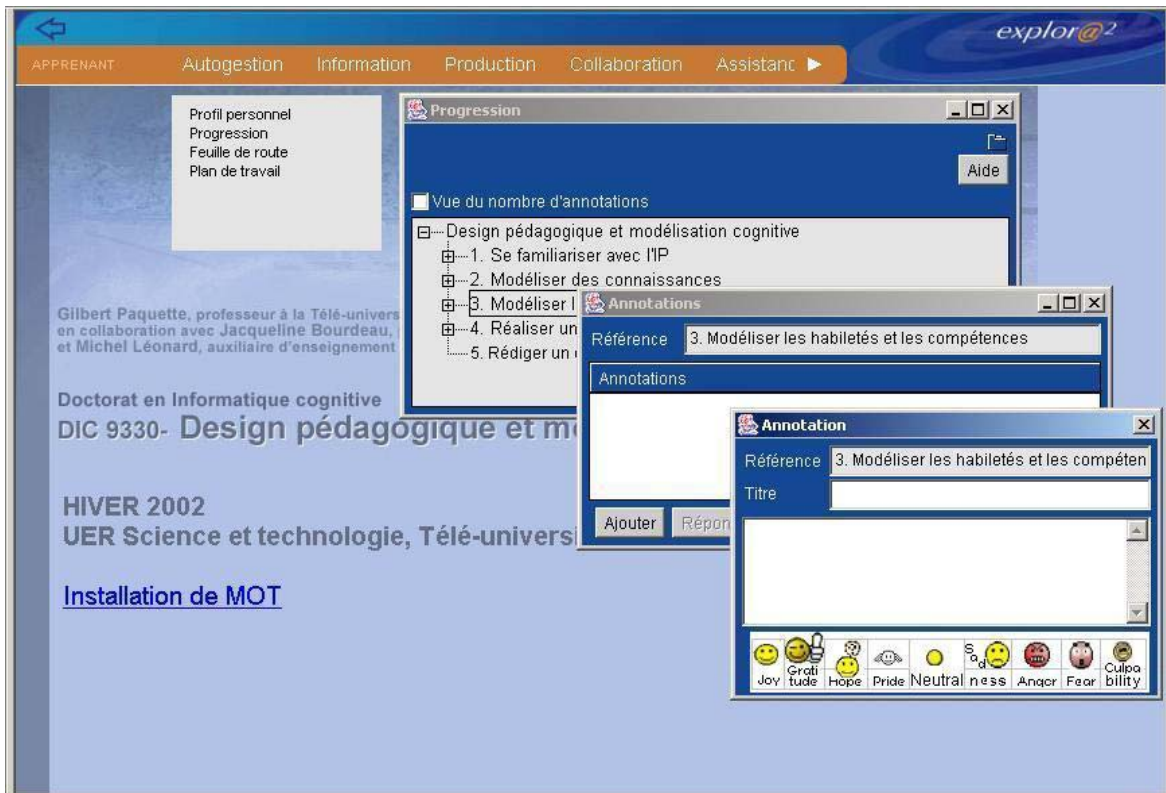
Figure 1 – A host web environment and an Explor@ resource navigator model

	Joy	Gratitude	Hope	Pride	Neutral	Sadness	Anger	Fear	Culpability
Design pédagogique et modlélisation cognitive	(4,5)	(2,8)	(2,5)	(3,2)	(1,2)	(1,1)	(1,2)	(1,2)	(0,1)
-1 Se familiariser avec l'IP	(1,2)	(1,3)	(2,2)	(1,1)	(0,0)	(2,3)	(1,2)	(2,2)	(1,2)
-1.1 Prendre connaissance de l'IP	(7,1)	(5,1)	(3,3)	(0,0)	(0,0)	(1,0)	(1,2)	(1,0)	0,2
Texte 1.4 Ingénierie pédagogique	(1,0)	(8,1)	(5,1)	(2,1)	(2,0)	(0,0)	(0,1)	(1,0)	(1,1)
Webographie du cours	(5,1)	(3,0)	(5,1)	(1,2)	(0,3)	(4,1)	(1,1)	(0,0)	(1,0)
-1.2 Se familiariser avec MISA et ses outils	(6,1)	-5.2	(2,3)	(6,1)	(3,3)	(2,1)	(4,3)	(2,4)	(1,0)
Conférence sur l'IP	(5,1)	(3,2)	(5,2)	(1,1)	(2,1)	(5,2)	(2,5)	(2,1)	(0,0)
Présentation d'ADISA	(4,5)	(2,8)	(2,5)	(3,2)	(1,2)	(1,1)	(1,2)	(1,2)	(0,1)
-1.3 Conduire une analyse préliminaire	(1,2)	(1,3)	(2,2)	(1,1)	(0,0)	(2,3)	(1,2)	(2,2)	(1,2)
Profils de compétence MM	(7,1)	(5,1)	(3,3)	(0,0)	(0,0)	(1,0)	(1,2)	(1,0)	0,2
Exemples de rapport d'analyse	(1,0)	(8,1)	(5,1)	(2,1)	(2,0)	(0,0)	(0,1)	(1,0)	(1,1)
- 2. Modéliser des connaissances	(5,1)	(3,0)	(5,1)	(1,2)	(0,3)	(4,1)	(1,1)	(0,0)	(1,0)
-2.1 Systèmes de représentation	(6,1)	-5.2	(2,3)	(6,1)	(3,3)	(2,1)	(4,3)	(2,4)	(1,0)
Texte 2.1 Représentation des connaissanc	(5,1)	(3,2)	(5,2)	(1,1)	(2,1)	(5,2)	(2,5)	(2,1)	(0,0)
-2.2 Se familiariser avec l'éditeur MOT	(4,5)	(2,8)	(2,5)	(3,2)	(1,2)	(1,1)	(1,2)	(1,2)	(0,1)
Présentation de MOT	(1,2)	(1,3)	(2,2)	(1,1)	(0,0)	(2,3)	(1,2)	(2,2)	(1,2)
Texte 2.3 Taxonomie des modèles	(7,1)	(5,1)	(3,3)	(0,0)	(0,0)	(1,0)	(1,2)	(1,0)	0,2

Figure 2 – Summaries

Among resources offered, an annotation tool gives her the possibility to record personal notes or public messages coupled with items of the learning scenario. Opening the annotation tool in either mode will show all contextualised public messages and her personal notes recorded in the past. The add button will open a window showing an editing area and nine emoticones posted as means of closing the window.

Another affective report tool (see figure 2 Summaries) shows a detailed table of the learner's

emotions in relation to learning events and/or resources. The user may ask to view his own summary, other learners' summaries or the group summary. Only public emotions are presented in other learners' summaries. An affective view of the group, summing up each emotion recorded, private or not, gives a representation of emotions shared among learners in an anonymous way.

2. Affective Attributes

In our setting, emotions have six attributes: emotion type, agent, contextual cues, access given, time and annotation. Table 1: Emotions' attributes, outlines them. Emotion type is the nature of the emotion experienced by the agent. Researchers have tried to develop taxonomies of emotions. Aubé (2000) proposes a small set of eight fundamental emotions, which typically includes fear, culpability, anger, sadness, joy, gratitude, pride and hope. Agent: this attribute identifies the agent experiencing the emotion. It is the learner's name or id.

Table 1: Emotion's attributes.

Attributes	Description
Emotion type	Fear, culpability, anger, sadness, joy, gratitude, pride and hope
Agent	The agent experiencing the Emotion
Event	The pedagogical object associated with the emotion' arousal.
Access	The access given to other Agents.
Time	The moment in time when the emotion was expressed.
Annotation	Verbal reminder or message attached to a learning event.

Event: the contextual cues are objects responsible for the emotion arousal. According to Ortony, Clore and Collins (1988) and Elliott (1992), three objects may be responsible for the arousal of an emotion: the occurrence of an event (for example a learning activity), some particular aspects of an object (for example: the length of a learning resource), or any action of oneself or others (for example: feedback from the tutor). In our project, since learner's productions and trainer's feedbacks are part of the pedagogical structure, all three elements mentioned earlier are distributed in our pedagogical structure. We record elements of the pedagogical structure as contextual cues responsible for the emotion arousal. Access: Two types of access are offered: private and public. It allows the agent owner of the emotion to decide who will be able to visualize it. Since emotion relate to highly intimate feelings, the learner may decide to keep secret some of the emotion he records as *private,* or he may want to share it with the co-learners and the trainer, recording it as public.

Time: Here, we record the moment: date and hour where the emotion is expressed. Annotation: This attribute records the verbal content of the learner's written message associated with the emotion.

3. Affective modeling issues

Since emotions are internal states and any external cues gives way to interpretation, naming the emotion is best accomplished by the agent who experiences the emotion. In this respect, we encourage learners to express their emotions in a natural setting. The annotation tool carries reflective moments, which can be shared with others or kept private. Emotions are then coupled with annotations. The learner expresses the nature of her emotion when she chooses the emoticone best representing her feelings.

There are other occasions or strategic moments where expression of emotions must be foster. Prompting the learners to express their feelings after consulting an evaluation report is one of those. The designer has the possibility to pinpoint those strategic moments in his pedagogical structure and ask the system to seek the learners' expression of emotions, opening the annotation tool when specific conditions are met. For example, the learner is about to quit a resource like the trainer's feedback and the learner access this resource for the first time and her consultation lasted for more than ten seconds.

Another issue in affective modeling is to encourage learners' participation without spoiling their privacy. We want learners to remember that confidentiality is possible each time they express a comment and the accompanying emotion. So we ask them to specify the type of annotation at the beginning of the procedure.

Interpretation of behaviors and emotions is essential for an intelligent interaction between two agents. Affective attributes expressed by learners are combined with other cognitive, collaborative and metacognitive attributes in order to search for meanings and to propose possible interpretations. Among interpretation of interest, are the well-known learner's problems like dropout and failure.

On a continuous basis, the system, informed of these problems indicators, watches learners' data. When these indicators are observed and when a significant threshold is reached, the system pushes warnings to the learner and trainer. Bringing these problems to

their immediate attention help prevent learning problems before they happen.

The learner is confronted with the system's interpretation of her emotions and behaviors leading to a metacognitive reflection. The trainer's attention is directed towards learner's problems before they arrive. Trainers' awareness of possible problems is activated. He is informed of learner's characteristics leading to this interpretation. This leaves the trainer enough space to revise the system proposition in light of information he personally has gathered, according to a human in the loop approach proposed by Kumar (2001). The trainer is informed of unknown learner's attributes regarding a possible problem and is encouraged to follow these trends leading to fruitful interactions with the learner.

Group affective attributes are of great interest for all learners, the trainer and the course designer. Summaries offer different views of the relations created between emotions, events, agents, accesses and time. For example, summaries give the designer a portrait of emotions triggered by the learning events and resources he proposes and help identifies resources that trigger negative emotions or learning activities that conducted learners to experience fear.

Grouping the eight emotions in positive (joy, pride, hope and gratitude) and negative (fear, culpability, anger, sadness) emotions, gives another view of the data. One can ask which event created the most positive emotion among learners. Another might be interested in following the fluctuation of positive and negative emotions during a period of time.

The trainer has the opportunity to *take the pulse* of the group and make informed decisions on priorities among his interventions. The system also supports his performance to pinpoint possible problems and diagnose learner's difficulties.

Learners can take advantage of the group summaries. They can position themselves among other's emotions, see the distribution of emotions for a learning event or resource, share positive or negative emotions or become aware of the distance between their own emotions and those of the group.

Some learners might refuse to express their emotions and their decision must be respected. At all time, the learner initiates the procedure leading to the expression of an emotion. But, sometimes, she is invited to express them. This occurs when the designer has identified a learning event as a strategic moment to foster expression of emotions. Nut here, no obligation forces the learner to do so. She can choose to close the annotation window, using the top right corner box or she can use the neutral emoticone.

4. Conclusion

The affective attributes are very important in a learner model but hard to track down. Here, we intend to capture the learners' emotions towards learning activities, resources and interactions in a distributed learning environment by using tools in the environment. The learner uses a special annotation tool to record her emotions. Affective attributes are returned to the learner coupled with learning activities and resources structure. The learner decides if she gives permission to view her emotions to the group and to the trainer. We are actually working on proposing summaries of learner's emotional states tuned to the role of the actor who requested it.

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