ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΥΠΡΟΥ
ΤΜΗΜΑ ΠΛΗΡΟΦΟΡΙΚΗΣ

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Ατομική Διπλωματική Εργασία

Χρήση αισθητήρων για την αξιολόγησης της επίδρασης της συναισθηματικής κατάστασης σε δικτυακά περιβάλλοντα εξατομίκευσης

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Επιβλέπων Καθηγητής
Γιώργος Σαμάρας

Η Ατομική Διπλωματική Εργασία υποβλήθηκε προς μερική εκπλήρωση των απαιτήσεων απόκτησης του πτυχίου Πληροφορικής του Τμήματος Πληροφορικής του Πανεπιστημίου Κύπρου

Abstract:

This paper describes the design and development of Intelisense System that includes accommodations for cognitive styles and the measurement of sentimental situation of a user in order to improve student interactions and learning outcomes. Also this research is attempt to examine some of the critical variables, which may be important in the design of an adaptive hypermedia system based on student's cognitive style, about the use of sensors in such system and includes information's about affective systems in general.

General the purpose of the system is to get and process the data from the sensor system before the user start the interaction with the learning environment. Then we get the sensor data we define how mush stress the user has .After that and according to the learning style of the user we adapt the environment of the user appropriate. In general, Human-Computer Interaction (HCI) systems that utilize multimodal information about the emotional state of users are presently at the forefront of interest of the computer vision and artificial intelligence community. Such interfaces give the opportunity to less technology-aware individuals, as well as handicapped people, to use computers more efficiently.

Chapter 1

Introduction

1.1 Motivation

Emotions are at least partly responsible for our motivation. They serve to energize people, providing intensity and direction. Also, studies show that a person's affect influences the cognitive processes associated with motivation. For example, people who feel positive emotions, such as fulfillment and satisfaction, are willing to exert more mental effort to a task than those experiencing negative emotions. In addition, emotion often underlies curiosity and creativity, all of which can be motivational factors in the learning process. Also emotions direct and focus our attention on those objects that have been perceived as important to our needs and goals, so we can deal with them appropriately.

Emotions are a significant part of our life and for that reason we must study the emotions in the domain of interactive design. Traditionally we know that computer interaction as traditional cognitive approach but also the emotions must concern in usability. Lab experiments have shown that information processing is slower than emotional response.

Emotions are necessary for human knowledge and explaining the human behaviour and their interaction exclusively on terms of rational.

People that interact with computers may engage to negative emotional states such as frustration, confusion, anger, anxiety and similar emotional states. Emotions guide and regulate human choice behavior, due their ability to modulate cognitive and physiological activities. In general, Human-Computer Interaction (HCI) systems that utilize multimodal information about the emotional state of users are presently at the forefront of interest of the computer vision and artificial intelligence community. Such interfaces give the opportunity to less technology-aware individuals, as well as handicapped people, to use computers more efficiently. We can make the user regulate his stress with the design of systems that recognize user's stress and adapts his Hypermedia content according to his needs. The goal of adaptive hypermedia research is to improve the usability of hypermedia applications by making them personalized. Adaptive Hypermedia Systems can be useful in any application area where users of a hypermedia system have essentially different goals and knowledge and where the hyperspace is reasonably large. Adaptive Hypermedia Systems provide a certain level of intelligence to hypermedia systems in the sense that they have the ability to understand the user and to adapt their behavior to the user's needs.

1.2 Purpose

The purpose of the system is to define the cognitive and learning style of the user and capture measures of the sentimental situation of a user with the automatic export of certain biometric signals (heart rate, blood pressure, skin conductance) based on these data we adapt user's website. The result that we want to achieve is to decrease the stress of user. The purpose of my thesis is to adapt the environment that the user navigates in, according from the data that we take from the sensor system and from the cognitive characteristics of the user (wholist/analyst, visualizer/verbalizer) which are set from three questionnaires answered by the user. First user construct his profiles ,he sets his traditional characteristics such as name, age, gender, profession and after that he answers to three questionnaires to determine his cognitive style. Then user wears in his hands the sensors that correspond to the biometric signals: heart rate, blood pressure and skin conductance and the metrics of these signals are

saved in a file. According to these measurements and the characteristics of user (wholist/analyst,visualizer/verbalizer) we personalize and adapt the navigation environment to the needs of each user . The purpose is to decrease the possible stress that the user could have. Before user starts the interaction with the system the admin must import user profile in the database of the system and upload user sensor file to the server .Throughout upload of the sensor file, file's metrics are read and stored in the database of the system.

1.3 Emotions

The most important factors in human behaviour are the emotions. For example emotions are significantly met in attention, perception, learning, memory, problem-solving, decision-making, creative thinking, and human-human interaction. Emotion is a reaction to events considered relevant to the needs, goals or concerns of an individual. It also includes physiological, affective, behavioral, and cognitive components. Cognitive scientists define emotions as powerful, usually short-lived experiences that are a reaction to a specific stimulus. Emotions arise from a rapid evaluation of an object or event's significance in order to prepare us for action. Emotions not only increase our general awareness and help us adapt to changes in an unpredictable environment, but they also facilitate social communication and interaction. That's because we read the emotions of others through their facial expressions, bodily postures, gestures and tone of voice. Related to this is the concept of feelings, which are the subjective experience of emotions. Whereas emotions are thought to be linked to survival, feelings are not. Emotions can be measured in terms of brain imaging, skin temperature, heart rate and blood pressure. Feelings are currently difficult to measure.
Emotion, mood and sentiment, each of those term have different definition. Someone has emotions when he implies relationships with a particular object. Moods may be indirectly caused by a particular object, they are not connected to any object in particular. Sentiments are assigned properties of an object for example frustrating interface. Emotions and moods are temporally. Sentiments can persist indefinitely. Sentiments are significant for HCI because they motivate users to return to a particular web site or system.

1.4 Emotions and human computer interaction

The need that led the scientists of Computer Science to built affective systems is that all humans are not only information processors but also are affective beings with emotions and needs. Many studies show that when the needs of a human are met then they are more efficient and productive. Also each person has different style to learn, achieve his goals and satisfied his needs. People that interact with computers may engage to negative emotional states such as frustration, confusion, anger, anxiety and similar emotional states. The solution is to design human-computer interaction systems to actively support users in their ability to manage and recover from negative emotional states.In general, Human-Computer Interaction (HCI) systems that utilize multimodal information about the emotional state of users are presently at the forefront of interest of the computer vision and artificial intelligence community. Such interfaces give the opportunity to less technology-aware individuals, as well as handicapped people, to use computers more efficiently. We can make the user regulate his stress with the design of systems that recognize user's stress and adapts his Hypermedia content according to his needs.

Intelligence and emotions differentiate humans from animals. Emotion is part of a person's behavior and certain feelings can affect his/her performance, emotions can even prevent a person from producing an intelligent outcome. Therefore, when a computer aims to emulate human behavior, not only should this computer think and reason, but it should also be able to show emotions.

1.5 Stress

In an ideal world, maybe we could get away from stressful situations, or change them. Too often we can't do that - but we can learn to control our response to those situations. And we can develop techniques that will reduce the effects of stress on our mental and physical health. People react to stress in different ways such as change in body functions and physical health, changes in emotions and feelings, changes in behavior, changes in thoughts.

We can see the term of the stress in psychology and biology. Stress is a consequence that produced when an organism fail to respond to emotional or physical threats. However, anything that puts high demands on you or forces you to adjust can be stressful. What causes stress depends, at least in part, on your perception of it. Something that's stressful to you may not faze someone else; they may even enjoy it. The excessive stress is an enemy of productivity and efficiency. Also the excessive stress may influence human computer interaction or the interaction with hypermedia content in general. These may cause the incomplete understanding of the content and ineffective interaction. We can make the user regulate his stress with the design of systems that recognize user's stress and adapts his Hypermedia content according to his needs.

1.6 Adaptive Hypermedia Systems

Adaptive hypermedia systems are presently being designed and developed in recognition of the need to provide some system support and control to users. An adaptive hypermedia system aims to provide a solution to the problem of disorientation and the need to accommodate varied users by being capable of searching for and filtering out the information most relevant to the users needs goals and interests. Adaptive systems can incorporate domain knowledge (for example about a particular subject area such as mathematics) and knowledge about its users. An adaptive system might provide a different body of information, or a different level of abstraction or treatment based on characteristics such as user's age, language, and geographical location or on whether the user is a novice or expert. Thus, such a system attempts to tailor its response to the user's needs. By adaptive hypermedia systems we mean all hypertext and hypermedia systems which reflect some features of the user in the user model and apply this model to adapt various visible aspects of the system to the user.

1.7 Review of Work

The first chapter is an introduction to the purpose and motivation research, as well as to emotions, stress and adaptive hypermedia systems.

The second section presents the theoretical background and there are some important issues relating to the subject as emotions, emotional intelligence and affective computing.

The third section presents some existing systems that created to observe the biological behavior of individuals when experienced emotion. These systems are used sensors for export biometric signals. Also in this section presents the measurements taken for the purposes of research.

The fourth section explains what adaptive hypermedia systems are and their characteristics also this section presents some existing adaptive systems.

The fifth section presents the system InteliSense created for the purpose of this research. This section presents the requirements and specifications, the design and construction of the system.

The sixth section is the experimental evaluation of the system. Describing how measurements are taken and analyzed the results.

The work completed by the seventh section, detailing the findings and future work.

Chapter 2

Theoretical Background

Emotions have a significant role in human lives. This chapter describes how emotions function in humans and how it affects them. Another important issue related to the emotions is emotional intelligence, which expresses the ability of people to understand their own and others emotions and to manage them. The last issue studied on emotional feelings is affective computing, which has to do with the ability of computers to understand the emotions of users and to behave in a similar emotional way.

2.1 Emotions

Emotions are important in human lives, they guide as during life but also are a valuable source of information. Emotion is also the most important factor in human behaviour. For example emotions are significantly met in attention, perception, learning, memory, problem-solving, decision-making, creative thinking, and human-human interaction. Emotions are related to perception, this means that to understand others emotion we must see them, listen to them, to touch them. Emotions are influence our logic in situations of fear, panic or love. Emotions also affect human performance and influence his intelligent decision .Emotions have a significant role in human decision making process and when we model human reactions we must embedded them, more specific emotions help us make decisions. Studies show that when a person's emotional connections are severed in the brain, he can not make even simple decisions because he doesn't know how he will feel about his choices. Emotions are important also in human learning. Learning can be done in two steps, first creating an emotion for learning, before the stimulus-response. The actions of a human are

motivated by his emotional state. Also the memory retrieval is affected by emotions. Emotional states attach to experiences and ideas, and all this are stored in our memory. Memory is involved in decision-making and almost every aspect of cognition. So emotion is affected by influence on memory.

Emotion is a state of being. However, in order to manage this state of being requires emotional intelligence. Goleman defines emotional intelligence in terms of "knowing what you are feeling and being able to handle those feelings without having them swamp you; being able to motivate yourself to get jobs done, be creative and perform at your peak; and sensing what others are feeling, and handling relationships effectively.

2.1.1 Emotions definition

Emotions are the feelings that color our lives and allow us to experience all of the joys and sorrows of life. The definition of emotions is ambiguous, some experts define them as the physiological changes induced in the body and others as a mental process. In general the majority agrees that an emotion is a psychological situation consisting of cognitive or stimuli and situations evaluations. Also are responses to external stimuli and/or internal mental representations that (i) involve changes across multiple response systems (e.g. experiential, behavioral, peripheral physiological), (ii) are distinct from moods, in that they often have identifiable objects or triggers,(iii) can be either unlearned responses to stimuli with intrinsic affective properties (e.g. an unconditioned response to an aversive shock) or learned responses to stimuli with acquired emotional value (e.g. a conditioned response or stimulus–reward association), (iv) and can involve multiple types of appraisal processes that assess the significance of stimuli to current goals , that (v) depend upon different neural systems

We have basic and cognitive emotions. Basic emotions are those that in some situations can be associated with facial expressions. The cognitive emotions are vary for each human (e.g. shame).The combination of emotions and cognition can control thoughts and behaviours. Emotions and cognition are interrelated .Emotions can regulate thoughts and behaviours and cognition regulates emotions.

Primary emotions:

• Anger: fury, outrage, resentment, wrath, exasperation, indignation, vexation, acrimony, animosity, annoyance, irritability, hostility, and at the extreme, pathological hatred and violence.

• Sadness: grief, sorrow, tirelessness, gloom, melancholy, self-pity, loneliness, dejection, despair, and when pathological, severe depression.

• Fear: anxiety, apprehension, nervousness, concern, consternation, misgiving, wariness, qualm, edginess, dread, fright, terror; as a psychopathology, phobia and panic.
• Enjoyment: happiness, joy, relief, contentment, bliss, delight, amusement, pride, sensual pleasure, thrill, rapture, gratification, satisfaction, euphoria, whimsy, ecstasy, and at the far edge, mania.
• Love: acceptance, friendliness, trust, kindness, affinity, devotion, adoration and infatuation.
• Surprise: shock, astonishment and amazement.
• Disgust: contempt, disdain, scorn, abhorrence, aversion, distaste and revulsion.
• Shame: guilt, embarrassment, chagrin, remorse, humiliation, regret, mortification and contribution.

Happiness, sadness, anger, relief and joy are all different types of emotions we have. Not only are emotions associated with thoughts in our heads, they can be physically felt or expressed as well. In some cases, more than one emotion can be felt and expressed at the same time. This complexity makes it difficult to directly define where emotions come from. Several scientists and experts have come up with ways to classify emotions and theories as to their origins.

2.1.2 The nature of emotions

The thalamus region of human brain is in charge of basic vital physiological functions (e.g., breathing), automatic movements (walking) and reactions (to move away from fire). This primitive brain does not think or learn, it can be considered as a set of regulators which are programmed to keep the body working and alive. For example smell sense that is the main sense of the emotional life is placed in a region around the thalamus, a cluster of neural nets which registers and analyses smells. The region of the brain that is related with emotions is called ‘amygdala’. This is an almond shaped brain structure packed with neurons located .Each half of the brain has one of these 1-inch long structures—not too far from the ear—thought to be part of the limbic system, which regulates emotion. The amygdala is considered to be the primary component involved in emotional memory. Of interest to learning design, is that activation of the amygdala correlates with greater retention of information. In other words, increased emotional arousal following a learning event influences the strength of the memory for the event. This makes sense in terms of survival. It’s important to remember the fearful and rewarding events in order to protect and enhance your life. Emotions originate in

the brain, specifically in the limbic system. The limbic system is a component that added the emotions to the brain response actions. When a person is afraid of something, shows anger, or is in love his/her limbic system is working. The limbic system is a small structure located in the middle of the brain between the lower center or brainstem and the higher center or cortex. The brainstem controls alertness and arousal and sends sensory messages to the cortex via the limbic system. Much of our thinking and learning takes place in the cortex. Memory, an important component of learning, involves the limbic system. The limbic system includes two new features to the brain: memory and learning mechanisms. This system is the root of the neocortex, the thinking brain (the region of the brain that understands, feels and co-ordinates movements).Animals without neocortex (e.g., reptiles) lack the maternal instinct and their children must survive by themselves; their own mothers can even eat them. The emotional region directly influences in the global operation of the brain human brain response to any external stimulus. Any external stimulus is projected from the perception layer towards the thalamus where the stimulus follows two separated paths. In the first path, the stimulus moves to the hypothalamus where corporal responses are generated (e.g.,changes in the blood pressure, hormone releases, etc.). This path that goes from the stimulus perception to the physical reaction is called the stream of feeling, the response is very fast but unique. The second path goes from the thalamus to the cerebral cortex and is called the stream of thought. This path is slower than the first one and corresponds to cognitive capabilities of the human brain, such as reasoning and memory.

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2.1.3 Emotions and cognition

Emotions are important for the survival of the individual. Emotions effectively guide and centralize memory storage and retrieval. They effectively guide social attitude, an extremely important survival factor in many species. Also emotions efficiently guide and modulate reproductive behavior. A simplified computer analogy is depicted in figure below. It assumes that the basic emotional value-system is genetically determined. In terms of technology it can therefore be compared to the read-only memory (ROM) of a computer. Higher cognitive functions could then be compared to random access memory (RAM). The interaction of the two can ultimately result in long-term memory (learning) comparable to programmable read-only memory (PROM).

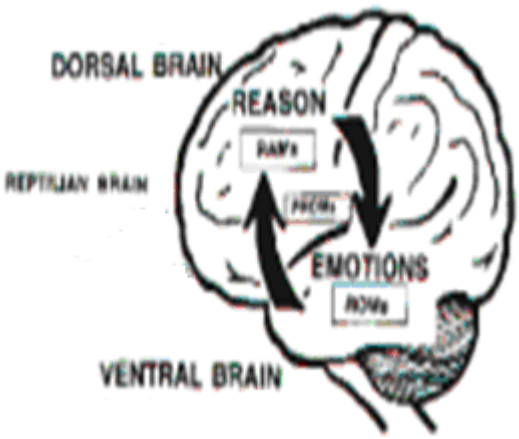

Figure 1: brain structure

Decades before prevailed the idea that emotion and cognition are opposing phenomena .It was thought that if emotions were connected to feelings and bodily sensations then they must be quite separate from cognition, which was associated with logic and the mind. Now sophisticated imaging tools have demonstrated the error in this thinking. We now know that emotion and cognition are dynamically interdependent in terms of both neurology and psychology. Emotion and cognition not only interact, but their integration is necessary for adaptive learning.

Emotions guide and regulate our choice behavior, due their ability to modulate cognitive and physiological activities. Emotions are one of the tools that allow agents to make adaptive inferences and choices by correlating specific instances of cognitive processing and physiological. Emotions make individuals to make quick inferences and decisions because have the ability to cause changes in cognitive and physiological functioning.
Emotions affect various cognitive processes. The main cognitive processes are:

I. Perception

There is little doubt that emotions color perception. They influence and bias the way we see the world. Not surprisingly, research shows that people who are in a positive emotional state will be open to a learning experience, make more positive judgments and give more favorable feedback than someone in a negative state. The challenge for designers is to create learning experiences that are sufficiently meaningful and engaging that they elicit positive reactions from learners. In terms of attitudinal training and soft skills, it's important to know that a person with an emotional bias may be unwilling to accept facts that cause unpleasant feelings or to believe facts that cause positive feelings, even when there is clear evidence to the contrary.

II. Motivation,

Emotions are at least partly responsible for our motivation to pursue goal-directed behaviors and activities. They serve to energize people, providing intensity and direction. For example, motivation increases when a goal is neither too difficult nor too easy to succeed. A moderate challenge is optimally motivating. Also, studies show that a person's affect influences the cognitive processes associated with motivation. For example, people who feel positive emotions, such as fulfillment and satisfaction, are willing to exert more mental effort to a task than those experiencing negative emotions. In addition, emotion often underlies curiosity and creativity, all of which can be motivational factors in the learning process

III. Attention,

Emotions play a central role in directing our attention .They distract us from our current thoughts and actions and call our attention to tasks that require our immediate attention Cognitive neuroscientists have also found that the amygdala – a key brain structure of emotional processing – is involved is assessing the significance of an incoming stimulus that subsequently influences attention and reaction. Through attention, we select the object of our concentration and focus on it, ignoring the noise in the environment. Research indicates that attention and motivation are highly correlated. People tend to pay attention to those things with a higher motivational significance. Paying attention to a task implies the person expects to find or is currently finding an intrinsic or extrinsic reward. During a learning experience, participants continually appraise the experience. This may elicit an emotional response that affects the learning process. For example, a learner who is bored might experience dissatisfaction and irritation, which can interfere with paying attention. A positive reaction to the experience should help the learner sustain attention.

IV. Learning

The conscious affective component of an emotion process and the bodily expression associated with it enable individuals to learn from their own experiences and from others' interactions within the environment. (Soldiers respond quickly and automatically to the sound of bullets because previous experiences taught them to appraise this as a cue for danger.)

V. Memory

Memory processes are intimately related to learning and they are also influenced by emotion.

This is partially due to their role in activating and regulating activities involved in encoding, storing, and retrieving information about important events. Research on emotion and memory shows that the activation of emotions affect the ways in which individuals reconstruct previously experienced situations This is partially due to their role in activating and regulating activities involved in encoding, storing, and retrieving information about important events. Many studies show that positive emotions can facilitate the processes of working memory as well as help long-term memory and retrieval. When emotions are central to a learning experience, they can enhance a person's ability to remember the experience. For example, when a group collaborates and successfully solves a difficult challenge, the achievement and social nature of the experience can arouse positive emotions. The emotions enhance the encoding process and make the learning experience meaningful and memorable. When powerful visuals or emotional scenarios are part of a learning experience, these can also enhance memory. The explicit conscious memory of an emotional situation will be more powerful than a non-emotional situation.

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2.1.4 Emotion and learning

The limbic system interprets and directs emotion and behavior .When the limbic system interprets sensory information and dispatches it to the cortex for processing, it sets the emotional tone of the information before its reaches the cortex. If the limbic system interprets the information as positive, it dispatches a message of purpose and excitement and directs our behavior toward a goal. When this happens, we become motivated to act; thinking and learning . When the interpretation is negative then the thinking and learning are stifled. The system's interpretation of sensory information is based on the person's memories and immediate reaction to a current event. The more positive the learner's memories and reaction to the event (emotional state), the better the learning will be. Research has shown that happiness has a positive effect on learning, memory and social behavior. Conversely, negative emotional states, such as anger and sadness, have been shown to have a negative impact on learning and motivation.

Because the limbic system is the mediator between thought and feeling, it is easy to see why emotion is so crucial to making good decisions and thinking clearly. Emotions can disrupt

thinking and learning. When we are happy we have a "clear mind" but when we are upset we can't "think straight". Positive emotions such as joy, contentment, acceptance, trust and satisfaction can enhance learning. Conversely, prolonged emotional distress can cripple our ability to learn. We all know how hard it is to learn or remember something when we are anxious, angry or depressed.

2.1.5 Emotions in everyday life

Human being is emotional and emotions thus influence our everyday behavior and as a consequence emotions affect our work. The intelligent part of a person can be used to determine a person's cognitive capabilities for a given job but the emotional part is also required to predict whether this person will succeed or fail in that job.
Sociability is part of a person's personality, which is closely linked to the emotional intelligence. Social skills are nowadays considered as most jobs require working in a team. If different people need to work together, it is important to create a ''good working environment'' among the team members to achieve good results. The team needs not only intelligent people but also people with social intelligence.

2.2 Emotional intelligence

Emotional intelligence is the emotional ability to perceive, integrate, understand, express and manage emotions also is the ability to embedded emotions in cognitive process. Emotional intelligence may influence evaluations of tasks that cause stress and the task performance . The ability to understand and manage our emotions is different from general intelligence. Five qualities that comprise emotional intelligence are : knowing our emotions (self-awareness), managing our emotions (impulse control), motivating ourselves to achieve goals (persistence, zeal and self-motivation), recognizing emotions in others (empathy) and managing relationships with others (social skills). These are the necessary steps to achieve high emotional intelligence. Because emotional intelligence is learned rather than inherited like general intelligence, it can be nurtured and strengthened. Therefore, parents and teacher's

play an important role in sculpting a child's emotional intelligence, contentment and success in life. Deficits in emotional intelligence can create serious problems in our relationships and impact our physical health.

Emotions influence how we perceive and react to life, which in turn, determines how content and successful we are. We achieve emotional intelligence by attaining our goals and managing negative emotions. Unmanaged, negative emotions take control of life. It is impossible to manage our lives until we can manage our negative emotions. Emotional intelligence covers ways in which people differ in their ability to understand and make use both of their own emotions and the emotions of the people they interact with.

2.2.1 Dimensions of Emotional intelligence

Emotional intelligence has four dimensions

1) Emotional perception (EP)(Perceiving emotion in oneself and others:) is the ability to perceive emotions that occur to your self but also to others and you can express them. They help us to distinguish the threats from benefits. The informational part of emotions is important source of information in many situations and for this reason Perceiving emotion in oneself and others give you the ability to handle different person–environment relationships.(For example, perceiving fear in another gives the perceiver important information relevant to a situation involving confrontation)

2) Facilitating cognition (FC) embed emotions in cognitive process, this help cognitive processes. Specialists at emotions and cognition use positive emotions to increase performance ,performance includes more creativity and process information more efficiency also use negative emotions to keep focus when needed. The two above dimension do not require understanding or managing emotions but only to perceive and using them. Using emotion to facilitate thought this ability involves using emotion to focus attention and think logic.

3) Emotional understanding (EU) involves identifying emotions, to identifying the reasons that these emotions occur and what inferences have and how are indicated. The ability to understand emotions is useful to identify the emotions also .Namely is the ability to name emotions, to understand their meanings and to understand relations between them knowing the source of one_s emotions

and what emotion to expect next should be associated with feelings of prediction and control.

4) Emotional management (EM) is the ability to maintain or change your emotions or others emotions depend on your needs. (Enhancing positive or reducing negative emotions needed; Mayer & Salovey, 1997).This ability confers stress benefits. Namely is the ability to adjust emotions in self and others. This ability gives satisfaction to people because that someone supports them and that is a part of society. Although when a person has an ability may be unaware of the ability

Many variables related to personality may relate to emotional intelligence. These are life satisfaction, stress, performance and academic achievements.

The stress is related with the environment of human. Stress: one's perceived ability to manage the person–environment relationship. The life becomes easiest when we have the ability to control and predict emotions. The first thing that should do to deal events that cause stress is to control our feelings. When someone has the ability of a sense control then you have well mental and physical health. Three meta-emotion traits moderate the relationship between EI and stress: clarity, intensity and attention. Also these traits are related to be directly related to well-being, attribution style, and beliefs about coping style. Clarity is the ability that a person can identify and describe his emotion. The Emotional understanding and Emotional management areas may be most beneficial in stress responses. The Emotional understanding area can identify the source of stress responses. Individuals who can manage their emotions may be able to change or maintain their emotions to make easiest the adaptive stress responses.

Trait-based EI enhances performance and cognitive tasks. Day and Carroll found Emotional perception alone was related to better performance. Emotions can influence thought processes according with different information processing strategies. For example, positive emotions use heuristic processing strategy and may be useful for creative tasks and short-term memory tasks and negative emotions use deeper processing strategy.The area Facilitating cognition is related with emotion and cognition which influence performance on a variety of tasks so if someone high in Facilitating cognition has high performance on various tasks. The Emotional perception and facilitating cognition dimensions influence more the performance than the others.

2.3 Anxiety

Anxiety is one of the most commonly felt emotions. It has been referred to as the "common cold" of mental health. The core of anxiety is the emotion of fear. People who are anxious may be fearful of specific things such as heights, snakes, lightening, flying or dentists. Students may be fearful of tests or in social situations. Some people are extremely uncomfortable in situations where they feel they are being scrutinized or evaluated. They fear they will be humiliated or embarrassed. Some anxious people may even obsess about certain things, such as cleanliness, safety, their health or being the best at everything they do. They cannot get these thoughts out of their minds even if they want to or try to. They may attempt to manage their anxiety and prevent feared events from happening by engaging in compulsive behaviors such as hand washing, checking, hoarding or superstitious behaviors. Behaviors such as repeatedly checking to see if a door is locked, being unable to throw anything away or having to repeat a ritual, such as touching a mirror seven times, over and over, can be signs of problems managing anxiety. Although these compulsions are used to reduce obsessive thoughts, they don't work because they too are out of the person's control. Anxious people may also have panic attacks or episodes of intense fear or discomfort that are accompanied by physical symptoms such as palpitations, shortness of breath or trembling and a fear of going crazy or losing control. These attacks may be triggered by an external event (test, elevator, airplane, crowd) or may be unexpected and come out of the blue. It's pretty normal to feel a little nervous and stressed before a test. Just about everyone does. And a touch of nervous anticipation can actually help you get revved and keep you at peak performance while you're taking the test. But for some people, this normal anxiety is more intense. The nervousness they feel before a test can be so strong that it interferes with their concentration or performance.

2.3.1 Test Anxiety

Test anxiety is actually a type of performance anxiety, a feeling someone might have in a situation where performance really counts or when the pressure's on to do well. For example, a person might experience performance anxiety when he or she is about to try out for the school play, sing a solo on stage, get into position at the pitcher's mound, step onto the platform in a diving meet, or go into an important interview. Like other situations in which a person might feel performance anxiety, test anxiety can bring on "butterflies," a stomachache, or a tension headache. Some people might feel shaky, sweaty, or feel their heart beating quickly as they wait for the test to be given out. A student with really strong test

anxiety may even feel like he or she might pass out or throw up. Test anxiety is not the same as doing poorly on a certain test because your mind is on something else. Most people know that having other things on their minds , such as a breakup or the death of someone close , can also interfere with their concentration and prevent them from doing their best on a test.

All anxiety is a reaction to anticipating something stressful. Like other anxiety reactions, test anxiety affects the body and the mind. When you're under stress, your body releases the hormone adrenaline, which prepares it for danger (you may hear this referred to as the "fight or flight" reaction). That's what causes the physical symptoms, such as sweating, a pounding heart, and rapid breathing. These sensations might be mild or intense. Focusing on the bad things that could happen also fuels test anxiety. For example, someone worrying about doing poorly might think thoughts like, "What if I forget everything I know?" or "What if the test is too hard?" Too many thoughts like these leave no mental space for thinking about the test questions. People with test anxiety can also feel stressed out by their physical reaction and think things like "What if I throw up?" or "Oh no, my hands are shaking."Just like other types of anxiety, test anxiety can create a vicious circle: The more a person focuses on the bad things that could happen, the stronger the feeling of anxiety becomes. This makes the person feel worse and, because his or her head is full of distracting thoughts and fears, it can increase the possibility that the person will do worse on the test. People who worry a lot or who are perfectionists are more likely to have trouble with test anxiety. People with these traits sometimes find it hard to accept mistakes they might make or to get anything less than a perfect score. In this way, even without meaning to, they might really pressure themselves. Test anxiety is bound to thrive in a situation like this. Students who aren't prepared for tests but who care about doing well is also likely to experience test anxiety. If you know you're not prepared, it's a no-brainer to realize that you'll be worried about doing poorly. People can feel unprepared for tests for several reasons: They may not have studied enough, they may find the material difficult, or perhaps they feel tired because didn't get enough sleep the night before.

2.3.2 Computer anxiety

Computer anxiety is anxiety generated around the use of computers. The computer anxiety is similar to test anxiety. Even that computers are introduced early in education (from primary school), many students expose computer anxiety such as fear, anxiety, and frustration in computer interactions. Computer anxiety is related with factors such as human-computer interaction experience, how much someone like the computers and the confidence about the use of them. As the computer anxiety increases, the performance decreases and vice versa. Feelings of anxiety toward computers and computer use, is common, affecting 30 to

40% of the population. Anxiety by definition is intense dread, apprehension, or nagging worry. Computer anxiety as defined by Howard, Murphy & Thomas (1986) is the "fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer". Computer anxiety is a concept specific anxiety type; that regularly occurs in a specific type of situation. Those who are computer anxious may experience fear of the unknown, feeling of frustration, possible embarrassment, failure and disappointment.

2.4 Affective computing

The need that led the scientists of Computer Science to built affective systems is that all humans are not only information processors but also are affective beings with emotions and needs. Studies show that human computer interaction is natural and social since this interaction is based on the humans' interaction protocol which is natural. So to have a natural interaction with computers, computers must recognize and express emotions.
Emotions are related with affective computing. Affective computers help people to provide better performance but in addition the computer must have the ability to help people make decisions. Recently computers start to recognize and express emotions.

2.4.1 Definition of affective computing

The field of research that investigates emotions in human-computer interaction is affective computing. Affective computing is the field of research that computing relates to, arises from, or influences emotions. Picard said that the only way to make human computer interaction natural is that the computers should recognize and express emotions. Affective computing correlated with computers and emotions. The necessary background for affective computing is the knowledge on emotions and their role in human behavior and cognitive processes. Affective computers help people to provide better performance but in addition computer must have the ability to make decisions. Affective computing expands human computer interaction by including emotional communication together with appropriate means of handling affective information.

Affective computing improves human-computer interaction. Emotions and rational intelligence go together for that reason intelligent computer must have emotions. For example application of affective wearable computers is a portable music player that plays music depending on your mood and listening preferences.

2.4.1.1 Emotions and affective computing

People using computer system should not be adapting to the system but the system should be designed to match their requirements. The main objectivity of affective computing is the recognition of emotions and their interpretation to emotional state. Some computers can recognize emotions without having them. The helpful tool that used to recognize emotions are human senses, like hearing and vision, capturing face expressions and the voice volume .When the emotional expressions are recognized then the system using its knowledge about emotion generation infers the emotional state. There two ways to express emotions. The first way is face expressions and the other is voice. Although is difficult for a computer to understand the human senses because they exist multiple factors that affect human emotion recognition such as the express of emotion vary among humans, so human senses can be replaced by physiological data such us body temperature ,skin conductivity, heart rate and respiration. Being able to recognize user's emotions and adapt its behavior accordingly makes well-behaving computer. However, is not enough for human emotional system to only recognize emotions. There also other emotional abilities should be given to a computer in order to make it emotionally fully capable. A computer does not have emotions although with multiple manners, it can express emotions (like showing a face picture). A computer can express emotions through multiple channels of communication such as voice, image, and an ability to communicate affection over those channels.

2.5 Emotion management

Humans are not only information processors but also are affective beings with emotions and needs. Many researchers show that when their needs are met then they are more efficient and productive.

People that interact with computers may engage to negative emotional states such as frustration, confusion, anger, anxiety and similar emotional states. Frustration often leads to anger. Frustration is the occurrence of an obstacle that prevents the satisfaction of a need or goal. We do not get what we want. The solution is to design human-computer interaction systems to actively support users in their ability to manage and recover from negative

emotional states because the most important factors in human behaviour are the emotions. For example emotions are significantly met in attention, perception, learning, memory, problem-solving, decision-making, creative thinking, and human-human interaction. Humans are able to manage their own emotional state depending on the situation and their degree of emotion management skill. The failure of emotion manage can cause difficulties in our interaction with other humans and to social relationships, decrease productivity, inability to focus attention and learning, increased anxiety and other mental and physical problems. Humans use different methods that help them to manage their emotions such as interacting with media or other humans, engaging in sports or in work, pray, positive thinking, eating.They exist two types of support for emotion regulation : passive supports and active ones. The passive support is used by humans to manipulate their moods without discussing them. For example their participation in team sports .On the other hand active support humans discuss their emotions as a means of managing them. Active listening is one example of active support this means that someone talks to a friend or a relative for what is bothering him and about his feelings.

2.6 Emotional computers

The main objectivity of affective computing is the recognition of emotions and their interpretation to emotional state. Emotions are related to perception, this means that to understand others emotion we must see him, listen to him, to touch him. The helpful tool that used to recognize an emotion is human senses .When the emotional expressions are recognized then the system using its knowledge about emotion generation it infers the emotional state. Although is difficult for a computer to understand the human senses, so human senses can be replaced by physiological data such us body temperature and skin conductivity, heart rate and respiration. Being able to only recognize user's emotions and adapt its behavior accordingly makes well-behaving computer. However, is not enough for human emotional system to only recognize emotions. Therefore also other emotional abilities should be given to a computer in order to make it emotionally fully capable. A computer does not have emotions although with multiple manners, it can express emotions (like showing a face). A computer can express emotions through multiple channels of communication such as voice, image, and an ability to communicate affection over those channels. Having emotions affects the ability to express them. Picard (1998) suggests a model of five components that all should be present in a system if it is to have emotions.

First component: “emergent emotions”: emotions that are assigned to the system based on their observable emotional behavior

Second component: fast primary emotions. Are innate responses, we can feel them before an event comes.

Third component: cognitive emotions they are generate through cognitive reasoning, in humans cause an emotional experience with subjective feelings, bodily feelings

Forth component: emotional experience, the system knows and recognize its own emotional behaviors, also is about feelings that let’s you know subjectively something is good or bad.

Fifth component: Body-mind interactions: Emotions influence cognition and as a result the intelligence, cognitive thoughts can generate emotions and also emotions are affected by cognitive and bodily functions thus is important to computers the influence of emotion on cognitive processes

All humans are managing cognitively their emotions .All humans are affected by their emotions, namely their actions motivated by their emotions for this reason a computer must has Emotional intelligence. One computer has Emotional intelligence when has the ability to understand and express its own emotions, to recognize emotion in others, to affect and using emotions to motivate adaptive behaviors. Recognition of emotion in others it means to understand his preferences, goals and to give reasons for the emotion that produced in a specific situation. The above components of emotional intelligence are based on the abilities of affective computing: recognizing and expressing emotions, and “having” emotions. Also an important factor that the designers of affective systems should consider is situations that a computer will take harmful decisions for the human and to prevent them. Emotional decision of a computer should combine the positive effects of emotionality and rational behavior because when we use only the emotion without the logic in our decisions we do things bad and catastrophic for the human. So computers that affect human actions should affect them logically. For example this kind of computer should not mislead and deceive users. (Example authoritarian government).One example that the affective information is missing is emails, the email text without affectual meanings has different interpretation from the existence of affectual meaning in the text. If we know a person then we can assume his emotions.

Chapter 3

Physiological responses and related systems

3.1 Physiological measurements

One way to measure the user's emotion-related responses is to use physiological measurements. Positive or negative emotions affect human physiology; this is helpful for the personalization of a system. Human physiology responds such as Skin Conductance (SC), cardiovascular activity, respiration, electrical activity in the brain, muscles and the peripheral nervous system, pupillary size, are vary with factors such as task difficulty, levels of attention, decision-making and problem solving, experiences of frustration, surprise and insult, and the affective meanings of stimuli and mental imagery.

The designers of software interfaces can consult these responses to identify the factors that cause changes in levels of arousal. Changes in levels of arousal caused by the system, for example when a user complete a software task with success then the user is satisfied and has positive emotions in contact if the system cause frustration to the user then the user acquires negative emotions. Emotions influence our physiology, behavior, and experience. A comprehensive assessment of affective states in health and disease would include responses. Physiological measurements are helping us to measure the user's emotion-related responses. The most important subject of research in human-computer interaction is the recording and recognizing physiologic signals of emotion .When we monitor continually the user affective state then we can have a view for his stress and for his emotions in daily life and their relationship to performance, health and disease.

One example of physiological measurement is respiration .Respiration is an important physiologic function that is multi-dimensional in nature. Respiration varies from different emotional states, for example respiration will change when you are relaxed or tense.
The best psychophysiological measurement that we can observe and define the emotional state of a user is heart rate and other cardiac measures. Heart rate is a commonly used psychophysiological measure related to autonomic nervous system activity.

3.2 Basic physiological measurements

3.2.1 Heart rate

Heart rate is a commonly used psychophysiological measure related to autonomic nervous system activity. Heart rate is the number of heartbeats per unit of time (beats per minute (bpm).Heart rate vary as the body's need for oxygen changes, such as during exercise or sleep. The measurement of heart rate is used by medical professionals to assist in the diagnosis and tracking of medical conditions. It is also used by individuals, such as athletes, who are interested in monitoring their heart rate to gain maximum efficiency from their training. Heart rate is measured by finding the pulse of the body. Many factors can influence heart rate, including: Activity level, Fitness level, Air temperature, Body position (standing up or lying down, for example),Emotions, Body size, Medication use.

Example of heart rate monitor

Omron HR-100C Heart Rate Monitor

The Omron HR-100C Heart Rate Monitor allows you to track your heart rate while you walk, jog or use a piece of exercise equipment. The Heart Rate Limits help you determine if you are exercising within your training zone. When you go above or below your limits, an indicator will flash to warn you. This monitor is very convenient since this monitor is placed on the hand like a watch. Also is a cheap choice.

Figure 2:Omron HR-100C Heart Rate Monitor

3.2.2 Blood Volume Pulse

Blood Volume Pulse sensor or photoplethysmo graph, bounces infra-red light against a skin surface and measures the amount of reflected light. This amount will vary with the amount of blood present in the skin. At each heart beat (pulse), there is more blood in the skin - blood reflects red light and absorbs other colors - and more light is reflected. Between pulses, the amount of blood decreases and more red light is absorbed. From the BVP signal, the software can usually calculate heart rate and inter-beat interval. The amplitude of the BVP deviation can also be a useful measure. The BVP increases or decrease according to the emotional state of the user.

This blood pressure monitor detects blood's movement through brachial artery and converts the movements into digital reading. To use it we apply the cuff to our left upper arm .When we set to start the monitor the cuff starts to inflate automatically. Inflation stops automatically and the measurements is started. When the measurement is complete the arm cuff completely deflates and the blood pressure and pulse rate are displayed on the monitor screen.

Figure 3: Blood Volume Pulse device

3.2.3 Skin conductance

The skin conductance is one of the fastest responding measures of stress response and has been previously used to measure the difficulty of driving tasks. It has been found to be one of the most robust and non-invasive physiological measures of autonomic nervous system activity. A characteristic orientation or ``startle'' response occurs in the signal whenever a person is forced to attend to a change in their environment, either external or internal. Signal processing algorithms were developed to detect these responses. Clinically, changes in SC reflect changes in the activity of the sympathetic nervous system. As a person becomes more or less stressed, the skin's conductance increases or decreases proportionally.

Wearable Skin Conductance Monitor / Recorder

A small, light-weight, wearable ambulatory skin conductance measurement and recording tool. The wearable recorder saves data to miniature internal solid state memory. Collected data is downloadable to a PC host computer via a simple USB interface cable. A companion software application controls the wearable recorder and saves the recorded data. The recorder may be placed in a location preferred by the wearer with two short electrode cables to connect to conductance measuring electrode patches.

Figure 4: Wearable Skin Conductance Monitor / Recorder

The deceleration is stronger when exposed to unpleasant stimuli than when exposed to pleasant stimuli. Recently, heart rate and other cardiac measures have also been used in affective computing.

In many studies for heart rate changes the results showed that, in general, heart rate decelerated in response to emotional stimulation and it decelerated the most in response to negative stimuli as compared with responses to positive and neutral stimuli.

3.3 Physiological responses at sites with different design

This is an experiment that collects data of skin conductance (SC), blood volume and heart rate (HR) from participants to identify psychophysiological changes that occur in response to HCI events. They used skin conductance (SC) and Blood Volume Pulse (BVP) sensors to the participants. To see the psychophysiological changes that occur in response to HCI events they illustrate two versions of web design, the ‘‘well-designed’’ version and the ‘‘ill-designed’’ version. The ‘‘well-designed’’ version was designed as far as possible to follow principles of good web and information design and the ‘‘ill-designed’’ version was designed to break these principles where possible. The skin conductance (SC), the blood volume and heart rate (HR) users were monitoring during the user interactions with websites. Data was collected using DataLab 2000 and later was done more detailed analysis. The skin conductance (SC) and blood volume pulse (BVP) were measured by sensors which are placed on the fingers of the non-primary hand users. A Windows PC used for data collection. The data was collected in a quiet room to avoid any confusion or interruption of the proceedings. The first observation is that in state of idle, the HR decreased; there is a steady decrease in SC which indicates reduced activity of the gland that secretes sweat and an increase in blood volume of the finger indicated by dilation of peripheral blood vessels blood. All these signs indicate reduced levels of arousal. It is observed also that when displaying an unexpected event, the participants show increases in HR and SC, with a lower regional blood volume, which shows a sudden increase in arousal. Generally, the measurements taken have proved capable of separating the changes levels of arousal in different situations and seemed to give enough information on using the software. The graph of SC show that participants using the “well-designed” version was relax with the task in comparison, the SC graph of participants that use the “ill-designed” version continued to rise for several minutes. The graph of HR shows exactly the same behavior as SC graph.

3.4 Related systems

3.4.1 A chat system which uses emotional information to show the affective state of the user

In one conversation the non-verbal information is more important from the information that transferred by words. The non-verbal information is important for human cognition. The system uses physiological sensor to obtain the affective state of a chat user. The users of the chat system use online interfaces. The system transfer feelings during an online chat .The system also use animated text .Animated text is text messages that dynamically change their appearance. 'Ford' showed that animated text really transferring a speaker's emotion.
The system show the animated chat associated with the users' affective information. Also users can influence their chat partners' affective states.

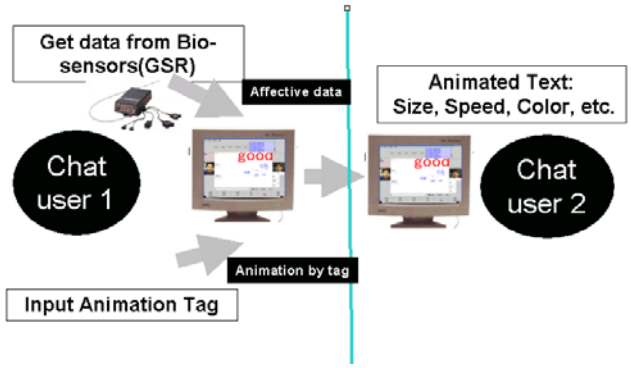


Figure 5: system which uses emotional information to show the affective state of the user

The user emotional state is determined by the physiological sensors and is presented to other chat user as animated text. The evaluation of the chat system is based on Lang emotion map. Lang emotion map is based on two axis the affective arousal and the affective valence. The arousal show the stress, when the arousal increases then the user has stress and anxiety. On the other hand the emotion valence shows if the emotion is positive (positive emotions: happiness, excitement) or negative (negative emotions: fear, sadness).The physiological sensors (GSR sensor) are identify the emotional arousal because is difficult to obtain emotion valence by them. The emotion valence is determined manually. GSR sensors measure skin conductivity (SC). Skin conductivity varies linearly with the overall level of arousal and increases with anxiety and stress. The affective valence decides the animation type to use, such as happy or sad and the arousal decides the speed, size, color, and interaction of animated text. The animated text increases in size and becomes lighter in color when Skin conductivity increase and if Skin conductivity decrease then the animation becomes slower,

the size is reduced, and the color darkens. The affective valence decides the animation type to use, such as happy or sad. At the screen of the user show the sensor result with phrases like "Very tense if GSR is high and "Relaxed if GSR is low.

Six students test the system. They use in turn the affected chat system and one typical Chat system (Microsoft Messenger).They talk in pairs. After the conversation they answered a questionnaire and commented on the system. The specialist compare the GSR data that the sensor capture corresponding to user emotion data with the GSR results from the questionnaires to see if the GSR data that the sensor capture corresponding to user emotion. There was a good correlation between the GSR data and the user-reported tension. The GSR increased as the users concentrated on the conversations and the users reported that they concentrated on the conversations gradually. So the GSR data is useful for the online conversations. The statistics of this chat system show that the users with emotional feedback influenced their impressions of the other users' emotional states.

Also this system is tested for online education. The non-verbal information at user and teacher interaction is more effective. For the online educational conversation test are used one student and one teacher. The physiological sensor was attached to the student, so that the teacher could observe the student's affective state during the session .The teacher ask questions and give information for a particular theme to the student .They found that if the teacher suddenly became very strict, the student's GSR data changed rapidly.

3.4.2 BioStream: System Architecture for Real-Time Processing of Physiological Signals

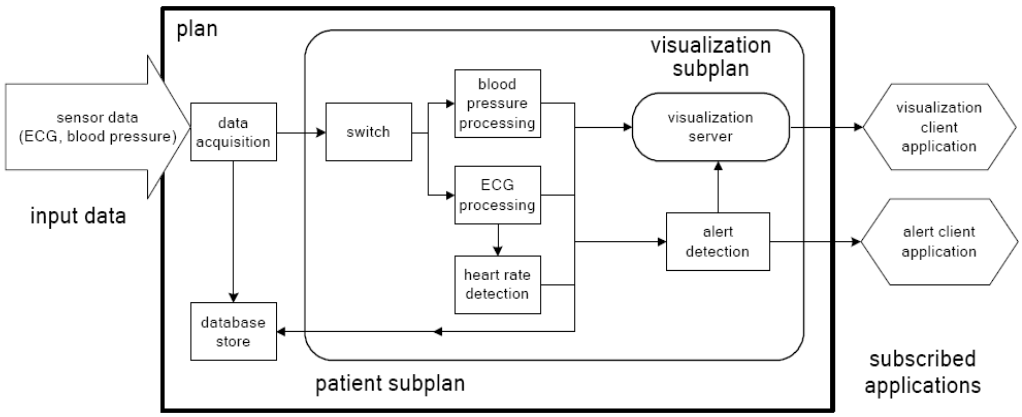


Figure 6:Biostream diagram

Continuous observation of physiological signals has the ability to improve the quality of life of patients with chronic diseases. Recent progress in sensor technology makes the capture of such signals possible. BioStream is a real-time, operator-based software solution for managing physiological sensor streams. The system processes data using plug-in analysis components that can be easily composed into plans using a graphical programming environment. The architecture allows implementation on systems ranging from desktops to server farms. It guarantees real-time response and data persistence in a distributed environment. This architecture is applied to the problem of multi-patient, real-time, physiological signal monitoring, analysis, indexing and visualization. BioStream is a system for real-time processing of physiological signals, built on a general purpose, novel streaming data processing software architecture. The system integrates signal analysis and visualization with a database .Using real-time analysis on incoming streams, the system can be used to detect life-threatening events. In addition, web-based visualization of the streaming sensor data allows caregivers to perform remote assessments if patients call in to report feeling symptomatic. The BioStream system also allows long-term home patient monitoring using pre-programmed data Plans. Continuous monitoring allows problems to be detected early so that preventive actions can be taken. In addition, clinicians can use BioStream as a research tool to test hypotheses through the mining of past data by creating a test plan for their hypothesis and "re-playing"(can also be used to check a current patient's historical record) archived data through the plan. BioStream is an operator-based system that collects, analyzes, correlates, and stores streaming information. It is highly customizable and can be tailored to the special needs of each patient a large number of patient plans

The system is designed to be distributed and scalable. The BioStream system has been designed to have the following properties 1)Flexibility 2)Persistence 3)Real-time and latency guarantees 4)Scalability 5)Fault tolerance(Ανοχή σφαλμάτων)

The BioStream system supports a programming paradigm based on computational elements termed Operators. Operators can range from general-purpose data manipulation and control tasks that resemble database operators such as filter or join, to domain specific algorithms for analyzing medical data, such as heart beat classification. Data from the sensors is streamed into the system through a directed graph of operators, which performs the appropriate analysis sequence on the data(patient plan).Operators communicate via streams. Stream communication mechanisms range from shared memory, to formatted messages over TCP/IP, to XML messaging over HTTP.

New patient plans can be easily designed with a graphical programming environment, or generated by a program. Plans are saved as XML files, which can be subsequently loaded, compiled and executed by the BioStream engine. Plan execution is guaranteed to be real-time

at the cost of bounded latency. This implies that while the system can keep up with the flow of data from sensors without falling behind, the time between the occurrence of an event and its detection by the system can sometimes be significant due to buffering and operator processing constraints.
The goal of the BioStream project is to support multiple sensors and patients, and to automate analysis by incorporating known and novel algorithms as operators in a generic stream processing framework. This system is intended to be used with an ambulatory monitoring system which will transmit data back to a central aggregator using a low-power wireless protocol.

3.4.3 A User Model of Psycho-Physiological Measure of Emotion

Affective computing systems based on psychophysiology aim at interpreting user's physiological activity (e.g. heart rate -HR- and skin conductance -SC-) as discrete emotions or affective dimensions toward near to real time recognition of emotion.
This model aims to mapping physiological emotional measures with associated psychological emotional measures in an emotional given situation, for a specific user. A set of 61 stimuli (31 images, 5 videos, 25 sounds) was selected to be varied regarding the type of media (audio, visual, and video), the contents and the indented emotional characteristic to try to cover the most extended range of emotion.
Figures below show the three steps exposure and emotional measure of the same stimuli, performed by each subject. Phase (1) was a slideshow of stimuli and recording of physiological measure (heart rate and skin conductance) Phase (2) was a static classification of the same stimuli in the emotional space of expression made of valence arousal dimensions Phase (3) was a dynamic measure of the valence, during a slideshow of the dynamic stimuli. For each subjects, they estimated the position in the valence arousal space as discrete emotion (using the Circumplex model and by dividing the valence and arousal space into five regions).They extracted from the physiological signals 28 features related to emotion. Skin conductance (SC), Skin Conductance level (SCL, the tonic signal in SC), and Skin Conductance Responses (SCRs, the phasic signal in SC, considered as discrete events) were extracted for each stimulus. Heart Rate (HR) and Heart Rate Variablity (the variability in different frequency bands), were extracted. The results confirm the general population trend that heart rate could be used as an indicator of valence, while skin conductance could be used as an indicator of arousal.

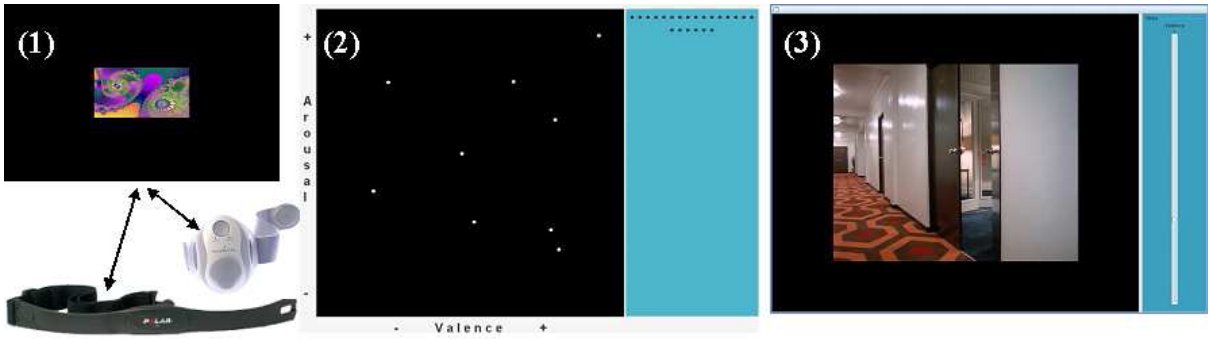


Figure7:Phase (1) Phase (2) Phase (3)

3.4.4 The EMFi chair

The EMFi chair could be used in human-computer interaction for measurement of the user's emotional reactions. Emotions are recognized as important factors in logic human behavior. Emotions are significantly involved in, for example, attention, perception, learning, memory, problem-solving, decision-making, creative thinking, and human-human interaction. Through the interaction with cognitive processes emotions can enable or prevent the optimal use of human potential. This system observes the heart rate changes in response to emotional stimulation. The sensors that are used to capture the physiological measurements were embedded in the chair. In other studies that a user wears sensors on his self observe that the user was uncomfortable and has anxiety towards to the system, this is a reason that the sensors at EMFi chair was on it. The sensors that embedded in the chair are: electromechanical film sensors (EMFi) that detect changes in pressure. Heart rate measurement with the EMFi chair is based on ballistocardiography (BCG), which measures the recoil that spreads through the body as a result of a heartbeat .In general, heart rate decelerated in response to emotional stimulation and it decelerated the most in response to negative stimuli as compared with responses to positive and neutral stimuli.

Figure 8:EMFi chair

3.4.5 An Affective E-Learning System

The aim of this system is to do some action so the user can manipulate his negative emotions and as a result he will have a better learning result.
A good model for e-learning is the model that except from the learning goal it also focus on the emotional component of learning. This is important because negative emotions reduce cognitive effort and as a result the user doesn't achieve his learning goals.
The first step to implement affective applications is the emotion recognition.
One way of detecting emotions is to analyze physiological data to detect emotional states.
In this system is used the emotion recognition sensor system (EREC).The sensors are count skin resistance and skin conductivity.
A catalogue of affective measurements describes actions to support user so he can handle his negative emotions, the measurements are application-independent or application-dependent.
The application-independent measurements are statements that express displeasure to the user. Application-dependent measurements, another way of presenting the subject (e.g. an animation instead of pure text).The user while he interacts with the system has negative emotions an affective measurement depending on the domain is selected and suggested. If the user accepts, the chosen action is executed. At the end his emotional state will be improved.

The results suggest that systems of high usability cause more positive emotions than systems with low usability .System can drive emotional reactions and influence the acceptance and usage of a system.

Figure 9: Emotion Recognition Sensor System (EREC)

3.4.6 Recognition of emotion by facial and body features

Emotions play a central role in guiding and regulating choice behavior, by virtue of their capacity to modulate numerous cognitive and physiological activities. Emotions are one of the tools that allow agents to make (often) adaptive inferences and choices.
The universal way to recognize, descript and perceived emotions meanings are emotion-related facial and body gestures. Along the word body language is the same. To recognize an emotion except from human expression we need taking into account features like hand gestures or body pose. These features are more trusted for recognize human emotions than the oral information. Since humans have multiple ways to describe emotion, we need a representation that is more close to our conception of how emotions are expressed and perceived.

Facial Expression Analysis
Analysis of the emotional expression of a human face requires a number of pre-processing steps which attempt to detect or track the face, to locate characteristic facial regions such as eyes, mouth and nose on it, to extract and follow the movement of facial features, such as characteristic points in these regions, or model facial gestures using anatomic information about the face.
Detection of the position and shape of the mouth, eyes, particularly eyelids, wrinkles and extraction of features related to them are the targets of techniques applied to still images of humans. An example is show at figures below

Figure 10:Facial expressions

Body Gesture Analysis

The detection and interpretation of hand gestures has become an important part of human computer interaction in recent years. We can classify hand movements with respect to their function as (Cadoz,):

· Semiotic: these gestures are used to communicate meaningful information or indications

· Ergotic: manipulative gestures that are usually associated with a particular instrument or job and

· Epistemic: again related to specific objects, but also to the reception of tactile feedback.

Semiotic hand gestures are considered to be connected, or even complementary, to speech in order to convey a concept or emotion. Especially two major subcategories, namely deictic gestures and beats, i.e. gestures that consist of two discrete phases, are usually semantically related to the spoken content and used to emphasize or clarify it. This relation provides a positioning of gestures along a continuous space.

(a) (b) (c)

Figure 11a. Original image gesture

Figure 11b. Detection of the moving hands

Figure 11c. Recognition of applause

The analyses of gestures include representation of the motion, motion analysis,and recognition standard. The first phase of recognition is selecting a model of the gesture. Then

calculate the parameters model, which gives a description of the position of the hand or its orbit and depending on the model used. Then, there is recognition of gesture. In Figure 9, 10 and 11, we see an example of gesture recognition.

3.4.7 Measuring Emotional Valence during Interactive Experiences: Boys at Video Game Play

The survey was done using the facial electromyography (EMG) as a measure of positive and negative emotional valence during interactive experience. Thirteen boys played a car racing video game while facial EMG data were collected. Through video review positive and negative events during play were identified. The zygomaticus muscle EMG, which controls smiling, was found to be significantly greater during positive events as compared to negative. The corrugator muscle EMG, which controls frowning, was found to be significantly greater during negative events. The results of this study demonstrate that positive valence can be measured during interactive experiences with physiologic measures. This study also found that the corrugator EMG can still measure negative valence during high intensity interactive play in spite of the confounding factor of mental effort. These methods appear useful for associating the player's emotion with game events, and could be applied to HCI in general. The most studied and validated of the physiologic emotion measures that can best indicate valence is facial electromyography (EMG). Tiny sensors are placed over certain facial muscles and the minute changes in the electrical activity reflect changes in muscle tension that underlie changes in facial expressions. Facial EMG has been shown to be capable of measuring facial muscle activity to weakly evocative emotional stimuli even when no changes in facial displays have been observed. Even when subjects are instructed to inhibit their emotional expression facial EMG can still register the response Facial EMG is not able to say though which of the discrete emotions (e.g., joy, sadness) is being experienced; its information is limited to how positive or negative a viewer's emotional state is. During interactive tasks the corrugator muscle EMG also has been found to provide a sensitive index of the degree of exerted mental effort, and to increase with the perception of goal obstacles. Though Mandryk and Inkpen found that the games that were post-play rated as more fun also had higher mean skin conductance values during game play, they did not measure valence directly during play. The higher skin conductance values could have been related to more intense challenge moments that led to more enjoyable winning.

3.4.8 Biosignal Based Emotion Analysis of Human-Agent Interactions

Two-phase procedure, based on biosignal recordings, is applied in an attempt to classify the emotion valence content in human-agent interactions.
In the first phase, participants are exposed to a sample of pictures with known valence values (taken from IAPS) and classifiers are trained on the physiological data recorded. During the second phase, biosignals are recorded for each participant while interacting with an embodied conversational agent (ECA) and the classifiers trained in the first phase are applied.
Emotional reactions and users' satisfaction are an important factor in usability evaluation of human-agent interactions. A commonly used method for gathering such information is by means of self-administered questionnaires. An additional method that is used to assess the emotional reactions is by means of biosignals. First of all, we propose and assess a methodology for emotion valence assessment based on classifier training (calibration) in one task (phase 1) and application in the actual task (phase 2). The second goal is to apply this methodology in a real usability study aimed at analyzing the emotional content of the interaction with an ECA and being able to choose the interface with the more positive valence. In order to achieve these goals biosignals have been recorded and subjective ratings collected. Taking into account the problems mentioned above, our ambition was to try to classify emotional response only with respect to the valence of emotions and not with respect to arousal or distinction of various emotions.
The ECA interfaces used have been developed for the RASCALLI multi-agent architecture . The agents can, via a multimodal system, interact with the user in various ways – text, speech, and gesture.The testing comprises two major phases. During the first phase, called the calibration Phase . While users were watching the pictures with a task to get immersed in the emotion related to each picture their biosignals were recorded. Using these data we tried to assess the emotional reactions of the user in the second phase. In the second phase, called the main phase, we studied the emotional reaction of the users while interacting with the embodied conversational agent. The interaction was simulated by showing video clips of the agent engaging in conversation and answering questions. The users' task was to watch the videos and try to imagine that they were actually interacting with the agent. During this second phase the same biosignals as the ones in the previous phase were recorded.
During this session users saw several pictures with emotional content. These pictures have been chosen from the International Affective Pictures System (IAPS) [14] in order to have standardized measures of the valence of the elicited emotions.

Chapter 4

Adaptive Hypermedia and related systems

4.1 Adaptive Hypermedia (AH) and Web Personalization

The goal of adaptive hypermedia research is to improve the usability of hypermedia applications by making them personalized. Adaptive Hypermedia System can be useful in any application area where users of a hypermedia system have essentially different goals and knowledge and where the hyperspace is reasonably large. Adaptive Hypermedia System provide a certain level of intelligence to hypermedia systems in the sense that they have the ability to understand the user and to adapt their behavior to the user's needs. Having knowledge about the users, Adaptive Hypermedia System can support them in navigation by limiting the browsing space, suggesting the most relevant links to follow, resulting in decreasing search and navigation time, they also support the improvement of comprehension of the content by presenting the most relevant information on a page and hiding information that is not relevant. Their aim is to solve the “lost in hyperspace” and “information overload” problems. These objectives are achieved by collecting information about the users while they interact with the system, and by adapting the application based on the gathered information. This information is stored in the so-called user mode, also referred to as a user profile.

By adaptive hypermedia systems we mean all hypertext and hypermedia systems which reflect some features of the user in the user model and apply this model to adapt various visible aspects of the system to the user

Brusilovsky classified Adaptive Hypermedia Systems into six groups according to their application areas:

- Educational hypermedia systems (examples InterBook)
- On-line information systems and on-line documentation and encyclopedias
- On-line help systems
- Information retrieval (IR) hypermedia systems
- Institutional information systems
- Personalized views

The system that we build is an Adaptive Hypermedia system. An adaptive hypermedia system should provide learners the ability to use different instructional modes in order to achieve their individual needs and to improve their performance.
To accomplish the purpose of such system we need to know the meaning of Adaptive Hypermedia but also the meaning of Web Personalization.

4.1.1 Adaptive Hypermedia (AH)

Adaptive Hypermedia (AH) adapts the interface of the user depends on his needs, goals, cognitive style etc. It helps user not disoriented from his goal in hyperspace. A user with low knowledge on the web he will be disoriented if he has many choices of links and no help for the correct choice. Adaptive Hypermedia offers to the current user appropriate links and content depend on his characteristics thus the user is not lost in hyperspace and achieve his goals. Adaptive Hypermedia (AH) is the ideal way to accommodate a variety of individual differences, including learning style and cognitive style.
Also they offer an alternative to the traditional “one-size-fits-all” hypermedia and Web systems by adapting to the goals, interests, and knowledge of individual users represented in the individual user models. In addition they build a user model of user goals, preferences and knowledge and use this model to adapt the content of pages and the links between them to the needs of that user. There are different variables that have been used in adaptive educational systems. The adaptivity variables that user models include are categorized in those variables that directly related to the user and define him/her as an individual(‘user dependent’) and to those that affect the user indirectly and are related mainly to the context of a user’s work with a hypermedia application(‘user independent’).

User dependent variables:

a) Knowledge on the domain presented: the most important user characteristic. We can adapt the learner environment based on his knowledge on the domain presented.

b) Background – experience: The background – experience variable is related to user's previous general knowledge state. It concerns with the user's profession, experience of work in related areas, and the user's point of view and perspective.

c) Preferences: Preferences are user attributes that relate to the user's likes and dislikes. For instance interface elements such as preferred colors, fonts, navigation ways, etc. The system not assumed the user preferences but the user must specify his preferences. When the preferences are determined the system generalizes the user's preferences and applies them for adaptation in new contexts (Brusilovsky, 1996).

d) Interests: It is about the user's long-term interests and uses these in order to improve the information filtering and recommendations. Interests can be modeled through navigation.

e) Individual attributes: A group name for user features that together define a user as an individual. Are extracted by specially designed psychological tests and are stable features of a user. Examples of individual attributes are:

1) User Personality: human-computer interaction would improve if computers behave as a personality. The best way for a human to interact with a computer should closely copy the interaction between two humans

2) Cognitive Style- Learning Style: Cognitive or learning styles refer to a user's information processing behavior .They can be used to personalize the presentation and to organize the content, the navigation support.

f) Personal data: when we designing adaptive educational interfaces we must pay attention to Personal data, such as gender, age, language, and culture. This variable is important, based on this data we can adapt differently an environment for each learner, this is significant for the learner because will be benefit more from the environment which is more comfortable for him.

e) Abilities/disabilities People with disabilities have varying needs regarding content and presentation of the information and often find difficulty to use computer-based systems (for example blind people)

h) social-group: For example a new user of the system doesn't know how he will interact with it very well in contrast with a more experienced. So each profile can be formed according to the group files that exist.

User independent variables:

a) Current goal/task
b) Environment-work
c) Situation variables.

The Adaptation effects are grouped in three major adaptation technologies - adaptive content selection (Brusilovsky & Nejdl, 2004), adaptive presentation (or content-level adaptation) and adaptive navigation support (or link-level adaptation) (Eklund & Sinclair, 2000, Brusilovsky, 2001). The first of these three technologies comes from the field of adaptive information retrieval (IR), when the user searches for relevant information, the system can adaptively select and prioritize the most relevant items. The second technology is associated with a browsing-based access to information, the user navigates from one item to another, the system can manipulate the links (e.g., hide, sort, annotate) to guide the user adaptively to most relevant information items. The third technology deals with a presentation of information, when the user gets to a particular page, the system can present its content adaptively.

4.1.2 Generations of adaptive hypermedia systems:

They exist 3 generations of adaptive hypermedia systems:

1) "Pre-Web" generation explored adaptive presentation and adaptive navigation support and concentrated on modeling user knowledge and goals (Brusilovsky, Kobsa, & Vassileva, 1998). Studies has shown that adaptive navigation support can increase the speed of navigation (Kaplan,Fenwick, & Chen, 1993) and learning (Brusilovsky & Pesin, 1998)
2) "Web" generation explored adaptive content selection and adaptive recommendation based on modeling user interests (Brusilovsky, Stock, & Strapparava, 2000).
3) "Mobile" generation is now extending the basis of the adaptation by adding models of context (location, time, computing platform, and bandwidth) to the classic user model and exploring the use of known adaptation technologies to adapt to both an individual user and a context or his or her work. Mobile Web and the Adaptive Web can benefit a lot from each other an ability to adapt can significantly improve the usability of mobile applications. Adaptive Hypermedia is interrelated with web personalization.

4.1.3 Web personalization

Users become more and more demanding in terms of the quality of information provided to them when searching the web or browsing a web site. Personalization, which allows a web user to choose the content and layout of their own portal web page, is one of the most popular ways of increasing traffic at web sites, and helps to ensure return customers Personalization, properly implemented, brings focus to your message and delivers an experience that is visitor-oriented, quick to inform, and relevant. Personalization, poorly implemented, complicates the user experience and orphans content.

4.1.3.1 Web personalization definition

Most Web structures are large and complicated and users often miss the goal of their inquiry, or receive ambiguous results when they try to navigate through them. On the other hand, the e-business sector is rapidly evolving and the need for Web marketplaces that anticipate the needs of the customers is more evident than ever. Therefore, the requirement for predicting user needs in order to improve the usability and user retention of a Web site can be addressed by personalizing it.

Web personalization is defined as any action that adapts the information or services provided by a Web site to the needs of a particular user or a set of users, taking advantage of the knowledge gained from the users' navigational behavior and individual interests, in combination with the content and the structure of the Web site. The objective of a Web personalization system is to provide users with the information they want or need, without expecting from them to ask for it explicitly. Due to the explosive growth of the Web, the domain of Web personalization has gained great momentum both in the research and commercial areas. Web personalization refers to the whole process of collecting, classifying and analyzing Web data, and determining based on these the actions that should be performed so that the user is presented with personalized information. Personalization levels have been classified into: Link Personalization, Content Personalization, Context Personalization, and Authorized Personalization.

At this point, it is necessary to stress the difference between layout customization and personalization. Personalization implies that the changes are based on implicit data, such as items purchased or pages viewed. The term customization in this context refers to the ability of users to modify the page layout or specify what content should be displayed. In customization the site can be adjusted to each user's preferences regarding its structure and presentation. Every time a registered user logs in, their customized home page is loaded. This

process is performed either manually or semi automatically. In personalization systems modifications concerning the content or even the structure of a Web site are performed dynamically.

4.1.3.2 Principal elements of Web personalization

Principal elements of Web personalization include (a) the categorization and preprocessing of Web data, (b) the extraction of correlations between and across different kinds of such data, and (c) the determination of the actions that should be recommended by such a personalization system. The ways that are employed in order to analyze the collected data include content-based filtering, collaborative filtering, rule-based filtering, and Web usage mining. Web personalization models include rules-based filtering, based on "if this, then that" rules processing, and collaborative filtering, which serves relevant material to customers by combining their own personal preferences with the preferences of like-minded others. Collaborative filtering works well for books, music, video, etc. However, it does not work well for a number of categories such as apparel, jewelry, cosmetics, etc. Recently, another method, "Prediction Based on Benefit", has been proposed for products with complex attributes such as apparel. Many companies offer services for web recommendation and email recommendation that are based on personalization or anonymously collected user behaviors. Following the example of Amazon.com, the online retailing industry has been early adopters of 3rd party personalization tools offered by companies like iGoDigital and Certona. Other 3rd party vendors like Choice Stream or Vignette bring personalization to content and display advertising.

The site is personalized through the highlighting of existing hyperlinks, the dynamic insertion of new hyperlinks that seem to be of interest for the current user, or even the creation of new index pages. A typical hyperdocument consists of a set of nodes or "pages" connected by links. Each page contains some local information and a number of links to related pages. Hypermedia systems can also include special navigation tools such as table of contents, index, and map that could be used to navigate to all accessible pages. What can be adapted here are the page (content-level adaptation) and the appearance and behavior of the links (link-level adaptation). In adaptive hypermedia literature they are referred respectively as adaptive presentation and adaptive navigation support.

4.2 Cognitive/Learning Styles

Less attention has been paid in AH to the fact that people have different approaches to learning, namely individuals perceive and process information in very different ways. We

refer to these differences as Cognitive/Learning Styles. If we look at the educational area we see that students in schools and at university vary enormously in the speed and manner of picking up new information and ideas, and in applying knowledge under new circumstances. Students learn in many different ways. For instance, look at the way in which particular learners prefer to study a foreign language. Some have a preference for hearing the language (the so-called auditory learners), some for seeing it written down (visual learners), some for learning it in discrete bits (analytic learners), some for experiencing it in large chunks (global or holistic or experiential learners), and many prefer to do something physical whilst experiencing the language (kinesthetic learners). The confusion starts from the fact that there is no single definition for the term cognitive/learning style.

4.2.1 Cognitive styles

Cognitive styles are one of the several important factors to be considered from designers and instructors of hypermedia-based courseware. Cognitive style is the way individuals organize and structure information from their surroundings. It is associated with student success in any learning situation. Cognitive style deals with the cognitive activity such as thinking, perceiving, remembering and not with content. Cognitive style is usually described as a personality dimension, which influences attitudes, values, and social interaction. Is the way that individual refers to processes information. Field dependence/independence (FD/FI) is probably the most well known division of cognitive styles. Field independent (FI) learners generally are analytical in their approach while Field Dependent (FD) learners are more global in their perceptions. FD individuals are more likely to require externally defined goals while the FI ones tend to develop self-defined goals. Studies have shown that FD are holistic and require external help while FI have internal cues to help them solve problems.
Cognitive style deals with the “form" of cognitive activity (i. e., thinking, perceiving, remembering), not its content.
In the cognitive psychology literature we found the following definitions for what the cognitive styles are:

- consistent and enduring differences in individual cognitive organization and functioning
- an expression of psychological differentiation within characteristic modes of information processing
- an individual's characteristic and consistent approach to organizing and processing information
- The way the individual person thinks and an individual's preferred and habitual approach to organizing and representing information [Riding and Rayner, 1998].

On the basis of these existing definitions in our point of view a cognitive style is an individual's consistent approach in perceiving, remembering, processing, organizing information and problem solving.

4.2.2 Learning styles

Learning style is an important issue that affects the learning process and therefore the outcome learning styles, is the individual preferences for how to learn. Learning style is seen as a broader construct, which includes cognitive along with affective and psychological styles. Learning Style can indicate a user's preferences for different types of information or different ways of navigating through or interacting with the information space.
Learning styles are described by different researchers as:

- distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment
- preferences for one mode of adaptation over the others; but these preferences do not operate to the exclusion of other adaptive modes and will vary from time to time and situation to situation
- Composite of characteristic cognitive, affective and psychological factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment
- a description of the attitudes and behavior which determine an individual's preferred way of learning
- A coherent whole of learning activities that students usually employ, their learning orientation and their mental model of learning

According to Riding and Cheema learning styles are probably best regarded as an extension to cognitive styles to distinguish the act of learning from simple processing of information.

They reviewed over 30 learning style models and concluded that most of the identified styles can be grouped within two independent dimensions:

- Wholist-Analytic | this dimension describes how an individual tends to cognitively organize information | either into (w)holes or parts. Wholists tend to form an overall perspective of a situation before delving down into the details, while analytics tend to see the situation as a collection of parts and focus on some of these at a time. (Most psychologists use the term holist instead of wholist.)

- Verbalizer-Imager | this dimension describes how an individual represents information while thinking, either as words or mental pictures. For example, verbalizers tend to present information in words, while imagers tend to present information in pictorial form.

4.3 Methods and Techniques Used in AHS

4.3.1 Adaptive presentation

The goal of the adaptive presentation is to adapt the content of a hypermedia page to the user's goals, knowledge and other information stored in the user model. There could be multiple reasons to use adaptive presentation

4.3.1.1 Adaptive presentation methods

1. Additional Explanations
In an adapted document the basic content of the page is extended with particular information. Additional information is shown with respect to user’s knowledge.
2. Prerequisite Explanations
With the appliance of the user model, the system checks, if the user’s knowledge complies with all prerequisites. The explanation of all missing prerequisites is added to the document to facilitate the comprehension of the concept.
3. Comparative Explanations
New concepts are explained in the way of linking them with some concepts already known to the user. Typically, the similarities and differences between these two concepts are pointed out.
4. Sorting Explanations
Parts of the document are sorted according to the relevance of information to the objectives of the user. The level of his knowledge, possibly some other characteristics, are taken into account.
5. Explanation Variants
In the source document there is defined a number of different explanations of a given concept. In the final document the most suitable variant for the user is shown.

4.3.2 Adaptive navigation

The goal of adaptive navigation support is to help users to find their paths in hyperspace by adapting link presentation and functionality to the goals, knowledge, and other characteristics of an individual user. It is typically done by one of the following ways

4.3.2.1 Adaptive navigation methods:

- Direct guidance: The system outlines visually one of the links on the page showing that this is the best link to follow or generates an additional dynamic link (usually called "next") which is connected to the "next best" page. In this method the user is sequentially guided through the hyperspace. The “next button” is offered to the user. The system selects the best page suitable for the user in compliance with the information stored in the user model. Another possible technique is to choose a sequence of pages. This sequence should help the users to find their paths in the hyperspace.
- Link sorting or Adaptive Sorting: The system sorts all the links of a particular page according to the user model and to some user-valuable criteria: the closer to the top, the more relevant the link is. The links in the hypermedia document are sorted according to the importance for the user. The sorting of the links can be made by the similarity of the links in a current document. Another way of sorting is made by the prerequisites. This method is similar to the one used for the adaptive presentation. The only difference is that instead of showing corresponding text, links with needed information are labeled with a higher relevance.
- Link annotation: The system augments the links with some form of comments, which can tell the user more about the nodes behind the annotated links. These annotations are usually provided in the form of visual cues. Typical visual cues include icons , font colors , sizes , and types . In this method the links are annotated to show some information about the content of the pages to the user. The annotation can be provided in a textual form. Another way is to use some visual augmentation, e.g. relevance is represented by a colored sign next to the link.
- Link hiding or Adaptive Hiding, disabling, and removal: The system tries to prevent the user from following links that are not relevant for him or her at the moment. There are several ways to achieve it. A link can be hidden by turning a usually underlined hotword into a normal word. It can be disabled so that clicking on the hotword will produce no effect . For a non-contextual link the very anchor (hotword or hotspot) can be removed .This method excludes the possibility of visiting pages with no relevant

information. Links leading to such pages are hidden or disabled. This restriction avoids the user to be lost in a large hyperspace.

Adaptive hypermedia systems build a model of the goals, preferences and knowledge of each individual user, and use this model throughout the interaction with the user, in order to adapt the hypertext to the needs of that user. For example, a student in an adaptive educational hypermedia system will be given a presentation which is adapted specifically to his or her knowledge of the subject , and a suggested set of most relevant links to proceed further

4.4 Models for Adaptive Hypermedia

4.4.1 AHAM

Adaptive Hypermedia Application Model (AHAM) is one of the first and well-known formal models for adaptive hypermedia. The adaptation is based on a domain model, a user model and a teaching model, which consist of pedagogical rules. AHAM also focuses on the storage layer, the anchoring and the presentation specifications. The domain model uses concept components for an abstract representation of information. A component's information consists of a set of attribute value pairs, a sequence of anchors and a presentation specification.

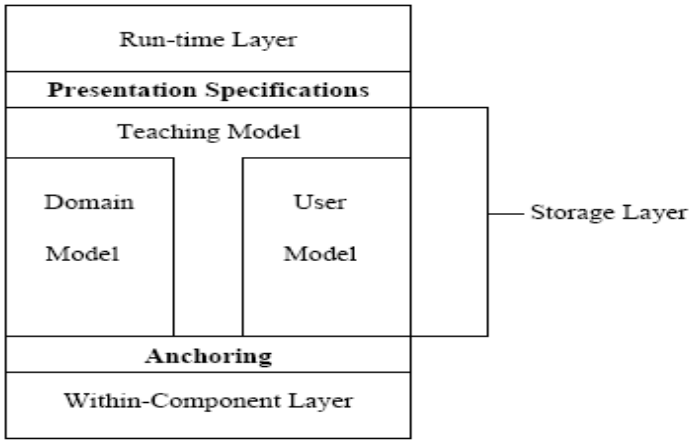


Figure 12: **AHAM**

- Domain model (DM) - describes the structure of the information content of the application.
- User model (UM) - describes user features used in adaptation.
- An adaptation model (AM) - provides the basis for adaptive functionality. The adaptation model contains a set of adaptation rules that are stated in the form of event-condition-action clauses. They use the structure and content of the domain model and

the user model to decide how to update the user model and how to generate the adaptation. Therefore the AM is located between the DM and the UM in the Storage Layer.

4.4.2 AHA! – Adaptive Hypermedia for All, sometimes translated also as The Adaptive Hypermedia

Architecture is a complete system for an adaptive course delivery. Employed adaptive techniques are: fragment hiding and link hiding. Knowledge domain is modeled using concepts and actual content is kept directly in pages. Individual pages are stored as XML files with information about concepts, html fragments and pedagogical rules (adaptation rules). AHA! is used in some universities in the Netherlands and Belgium. A few courses are freely available to the general public, including Hypermedia Structures and Systems.

4.5 Examples of an adaptive hypermedia system:

4.5.1 ELM-ART- first practical Web-based system that used adaptive navigation support

Education was always the most popular application area for adaptive hypermedia systems. ELM-AR (Brusilovsky, Schwarz & Weber, 1996) is the first practical Web-based system that used adaptive navigation support. ELM-ART has pioneered the idea of an adaptive electronic textbook and introduced the traffic light metaphor for adaptive navigation support in educational hypermedia. With this metaphor, green bullet in front of a link indicates recommended readings, while a red bullet indicates that the student might not have enough knowledge to understand the information behind the link. Other colors like yellow or white indicate other educational states such as the lack of new knowledge behind the link.Figure below. Study of ELM-ART has demonstrated that casual users stay longer within a system when adaptive navigation support is provided. It also provided evidence that direct guidance works best for users with little previous knowledge while adaptive annotation is most helpful for users with some reasonable subject knowledge.

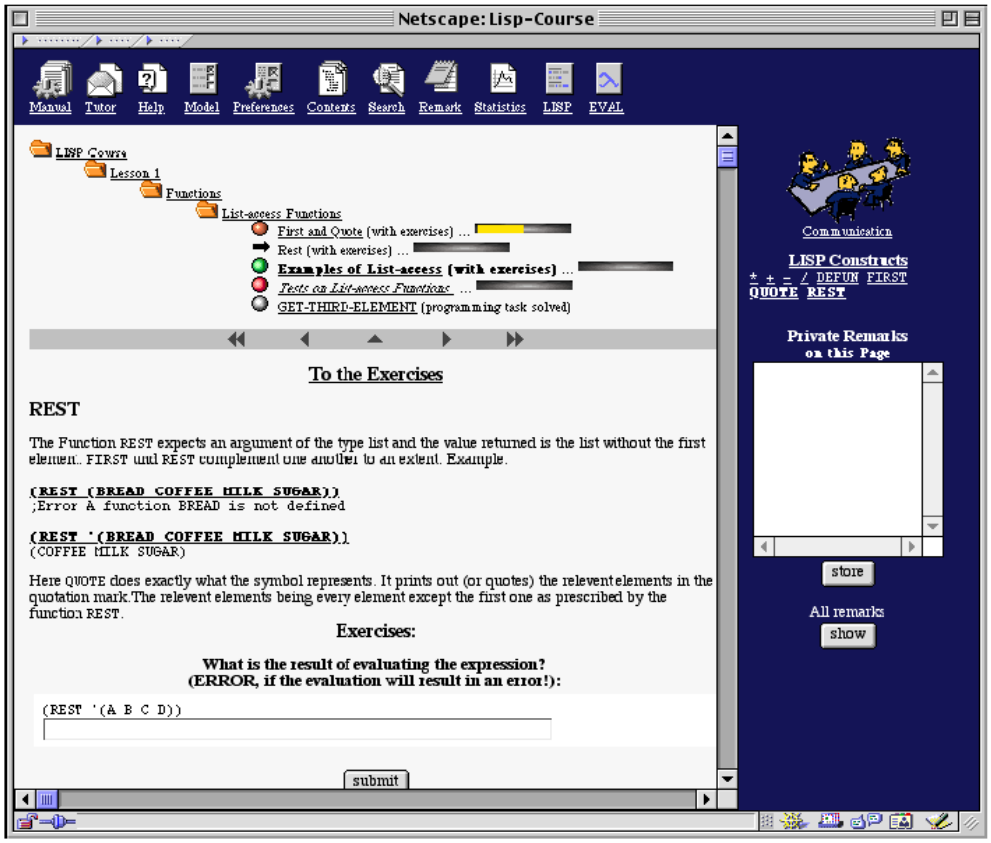


Figure 13:ELM-ART

4.5.2 ALE – Adaptive Learning Environment

Adaptive Learning Environment is an environment or a toolset and framework for creating adaptive courses. It tracks students' progress through the course and annotates links using this information. Domain structure is represented using classical concept network.

4.5.3 INSPIRE: An INtelligent System for Personalized Instruction in a Remote Environment

The adaptive characteristics of an Educational Hypermedia System usually aim to both usability and learning. Based on the learning goal that the learner selects, INSPIRE generates lessons that correspond to specific learning outcomes accommodating learner's knowledge level and learning style. Thus, aiming at individualizing instruction, the system generates lesson plans tailored to the needs, preferences and knowledge level of each individual learner by making use of information about the learner gathered through their interaction. Furthermore, the system provides learners with the option to intervene, expressing their perspective about their own characteristics, or about the lesson contents, and accordingly formulate their interaction with the system, in an attempt to engage learners in the learning

process. In the beginning of the interaction, the domain knowledge presented to the learner is restricted and gradually it is enriched, following the internal structure of the domain (curriculum sequencing technique), while a navigation route is pro-posed based on learner's progress (adaptive navigation technique).The presentation of the educational material provided for each different level of performance, is mainly determined by the learning style of the learner (adaptive presentation technique). Thus, learners' preferences that usually guide systems' adaptation are determined based on their learning style. The proposed system also supports end-learner modifiability offering opportunities to the learners to intervene in different stages of the lesson generation process, as well as on the construction of their learner model. Thus, learners have the option to activate or deactivate the lesson generation process of the system. In case of activation, they have the option to guide system's instructional decisions by updating accordingly their characteristics on their model, i.e. their knowledge level on the different concepts of the learning goal and their learning style.

INSPIRE is comprised of five different modules (see Figure below): (i) the Interaction Monitoring Module that monitors and handles learner's responses during his/her interaction with the system, (ii) the Learner's Diagnostic Module, which processes data recorded about the learner and decides on how to classify the learner's knowledge, (iii) the Lesson Generation Module that generates the lesson contents according to learner's knowledge goals and knowledge level, (iv) the Presentation Module that generates the educational material pages sent to the learner, and (v) the Data Storage, which holds the Domain knowledge and the Learner's Model.

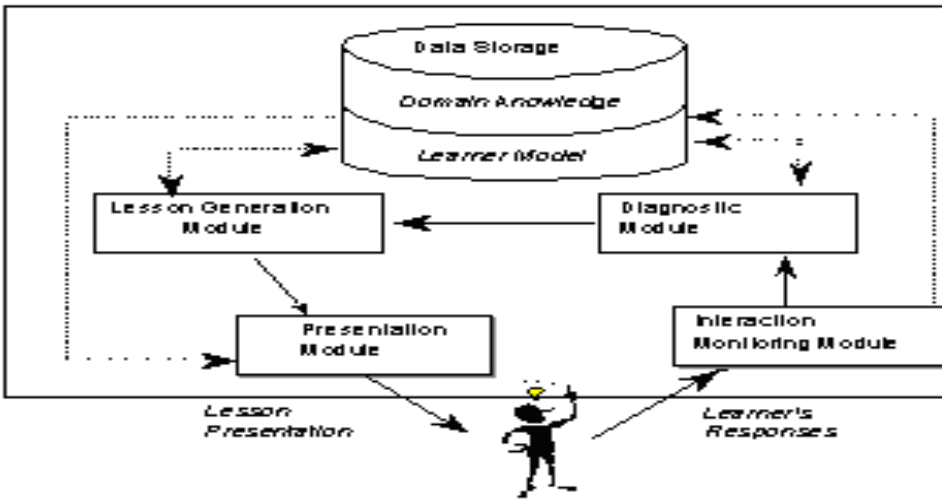


Figure 14:INSPIRE modules

After the lesson contents have been specified by the Lesson Generation.
Module using information on the knowledge level of the learner, the Presentation

Module takes over to reflect these contents as a navigation route in the domain and to decide on the presentation of the educational material based on information on the learning style of the learner.

Adaptive Presentation: Learners with different learning styles view different presentations of the educational material. The main objective is to support learners, following their preferred way of studying. To this end we exploit the information of their learning style in order to guide decisions on the instructional approach proposed to each individual learner.

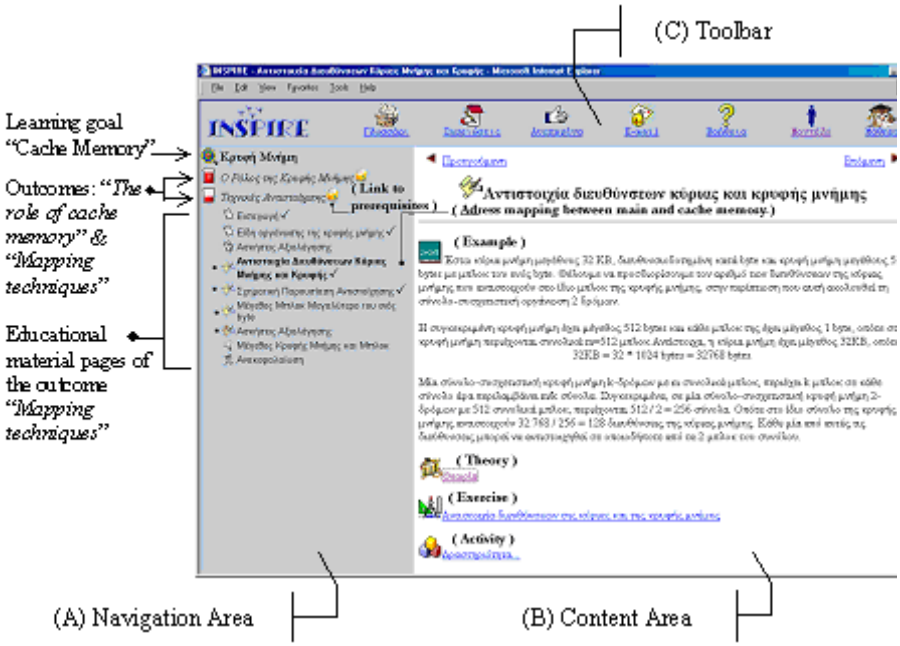


Figure 15:INSPIRE's main screen

INSPIRE's main screen presenting the educational material page "Address mapping between main and cache memory" of the outcome concept "Mapping Techniques" of the learning goal "Cache Memory". The screen is divided into three areas:

(A) Navigation Area, which includes the contents of the lesson in a hypertext form as links (for clarity purposes the colored icons are denoted by a bullet), (B) Content Area, which presents the contents of the page that the learner selects from the Navigation Area, and (C) Toolbar, which includes several tools that offer learners easy access to various facilities. In the Content Area, different knowledge modules comprising the page of educational material as viewed by Reflectors. Example: description of an application example; Theory: link to hints from the theory; Exercise: link to an exercise;

Activity: link to an activity based on a computer simulation.

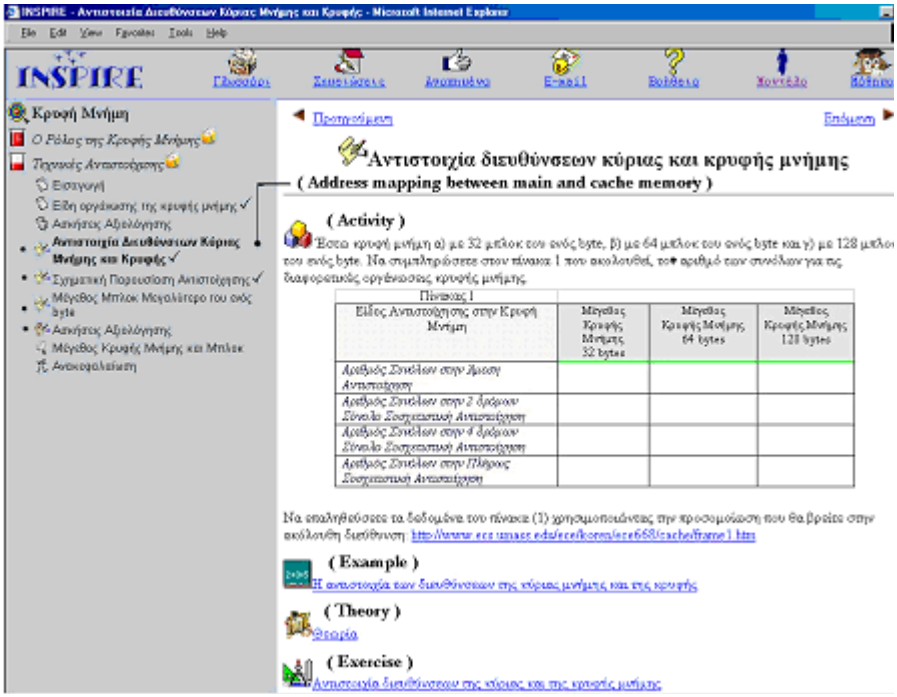


Figure 16:INSPIRE's screen

Different knowledge modules comprising the educational material page "Address mapping between main and cache memory" of the outcome concept "Mapping Techniques" of the learning goal "Cache Memory" as viewed by Activists. Activity: description of an activity in a computer simulation.

Adaptive Navigation Support: The system supports learner's navigation and orientation in the lesson contents by annotating the links that appear in the Navigation Area. Additional information is provided to the learner through the INSPIRE use of icons next to the names of concepts and the educational material. Different icons are used to distinguish between the outcome and the prerequisite concepts, as well as the educational material provided for each level of performance (notice in Figure below, the different icons in the Navigation Area). Especially on the outcome concepts, the filling of a measuring cup is used as a metaphor denoting learner's progress. Furthermore, two state icons accompany the prerequisite concepts and the educational material of the outcomes reflecting the instructional decisions of the lesson generation process on the educational material that the learner should study next. Thus, colored icons accompany the links that lead to the material that the system proposes the learner to study next, while black and white icons appear next to the rest of the links (see in Figure below the icons in the Navigation Area the colored ones are denoted by a bullet). Finally, a history-based mechanism has been developed so that, as each page is visited, a check mark appears next to its link in the Navigation Area (see Fig below- Navigation Area).

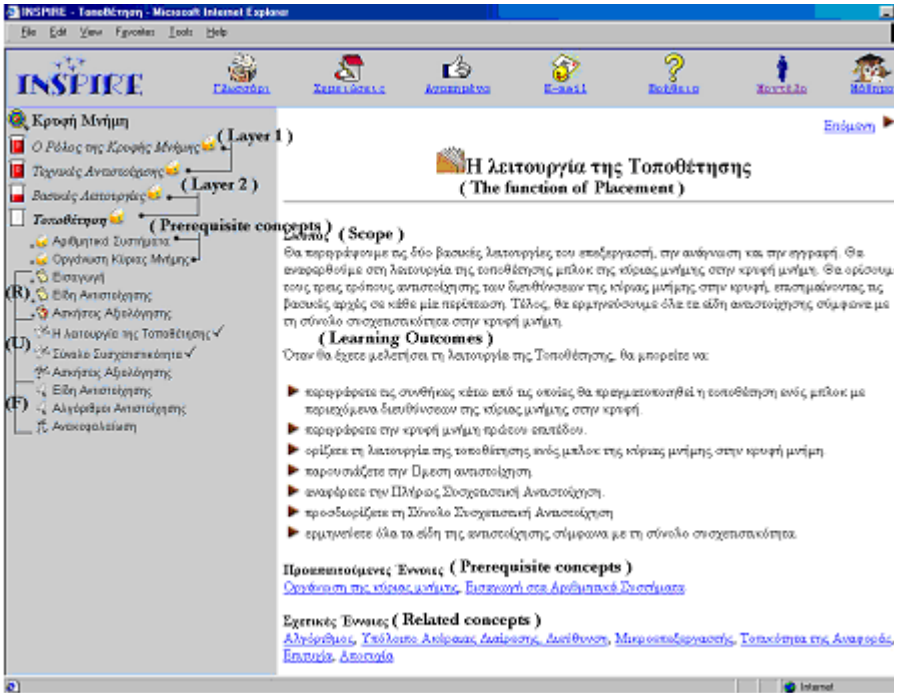


Figure 17:INSPIRE :Navigation support

4.5.4 AN ADAPTIVE ELECTRONIC TEXTBOOK

InterBook is a tool for creation and presentation of adaptive electronic textbooks on the World Wide Web. InterBook provides a technology for developing electronic textbooks from a plain text to a specially annotated HTML. InterBook also provides an HTTP server for adaptive delivery of these electronic textbooks over WWW. For each registered user, an InterBook server maintains an individual model of user's knowledge and applies this model to provide adaptive guidance, adaptive navigation support, and adaptive help. InterBook applies some results of research in the area of Adaptive Hypertext and Hypermedia. These researches demonstrate that adaptive navigation support can make hypermedia browsing more productive and protect users from "being lost" in hyperspace. to provide students with these guidance as well as providers of learning materials with standards and authoring tools for an efficient utilization of the WWW as an intelligent learning support media. Adaptive navigation support techniques applied in InterBook proved to be efficient for educational

applications of hypertext and hypermedia. InterBook is used to deliver several adaptive Web-based courses.

Users register with the system and based on this registration and on the user's session, the InterBook server builds and stores a model of the user's knowledge which it then uses to sequence material, provide guidance, navigation support, and adaptive help. The system consists of both a domain model and a user model which is based on an estimation of the user's knowledge level. Domain structure is modeled using a concept network, where each concept represents an elementary part of knowledge. Each content unit (a page) can have prerequisite concepts and outcome concepts. The system monitors student’s progress and keeps track of how much he knows about each concept - this is called an overlay student model. The system uses this information to recommend pages with all prerequisites known. It offers adaptive link annotation and direct guidance as well as automatically generated glossaries and indexes. A glossary can provide a description of a concept and links to all book sections which introduce the concept. A built-in indexing component allows the system to know which concepts are present on each page and which concepts must be acquired before the learner begins a new page. Links to all textbook units on a particular concept are dynamically generated to reflect the user's current state of knowledge of the concept. A further interactive component of Interbook is its use of icons, fonts, and colours to distinguish , for example, whether the page is ready to be learned, or whether some prerequisite knowledge is first required. This information is dynamically generated on the basis of the user model.

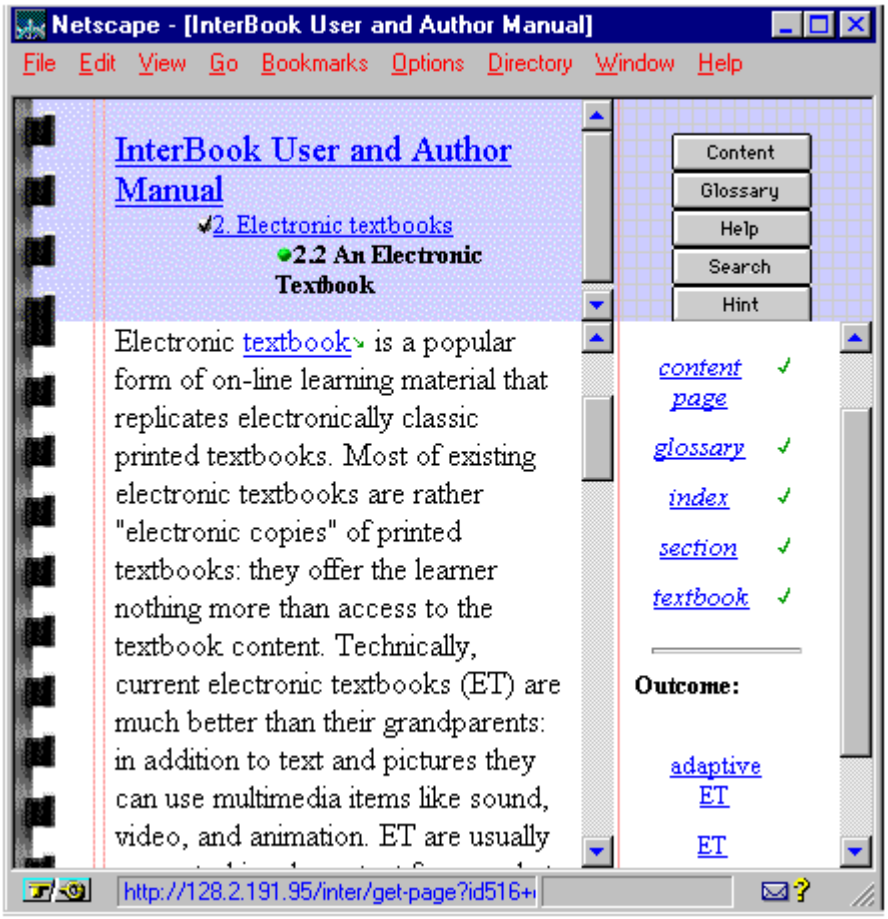


Figure 18 :InterBook example a

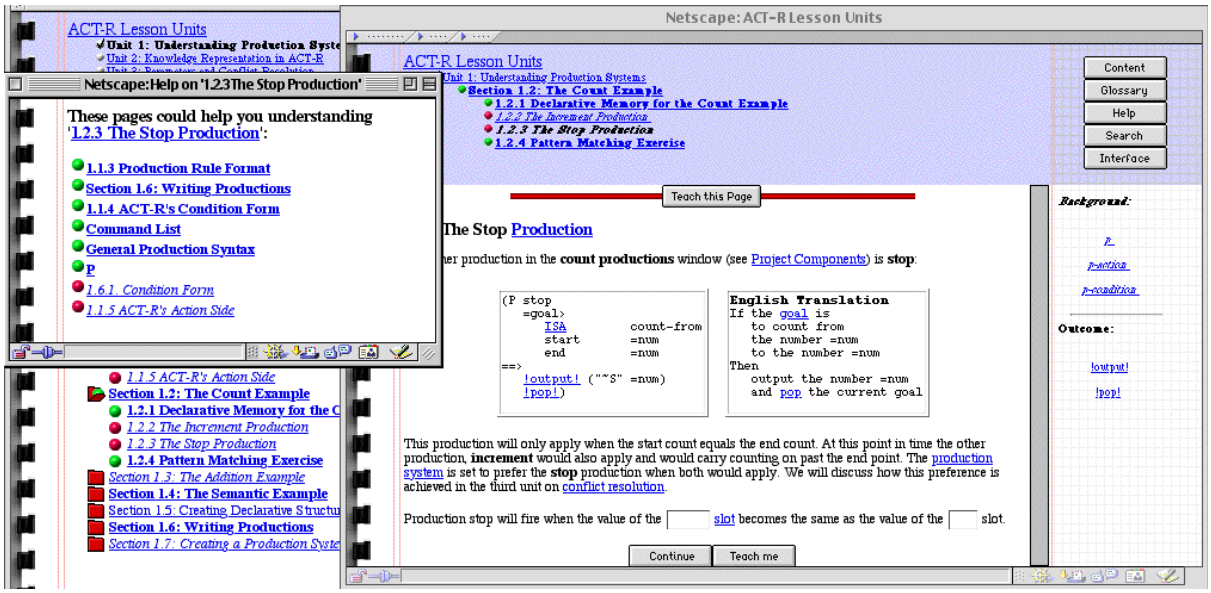


Figure 19:Interbook example b

InterBook has refined the ideas of the adaptive electronic textbook and the traffic light metaphor for adaptive navigation support in educational hypermedia. A study of InterBook has shown that adaptive navigation support encourages non-sequential navigation and helps users who follow the system's guidance to achieve a better level of knowledge

4.5.5 PEBA-II: AN ADAPTIVE HYPERTEXT SYSTEM

The Peba-II Text Generation System uses a natural language generation system to dynamically and interactively produce hypertext descriptions of animals in the form of World Wide Web pages. Peba-II uses a taxonomic knowledge base to produce descriptions of animals that vary depending on whether the user is a novice or expert. Future versions of such systems might provide descriptions based on other characteristics such as age or previous interactions with the system or the domain knowledge.

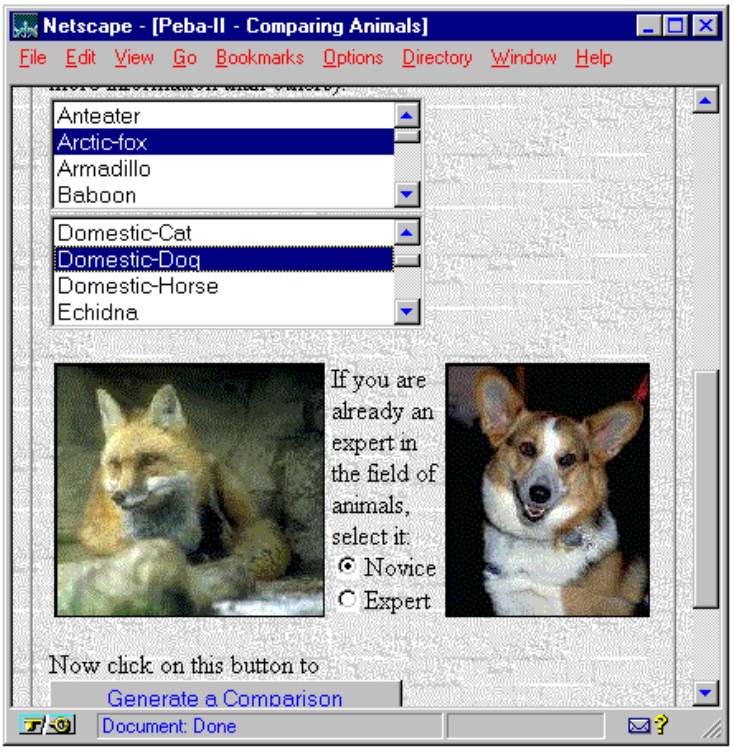
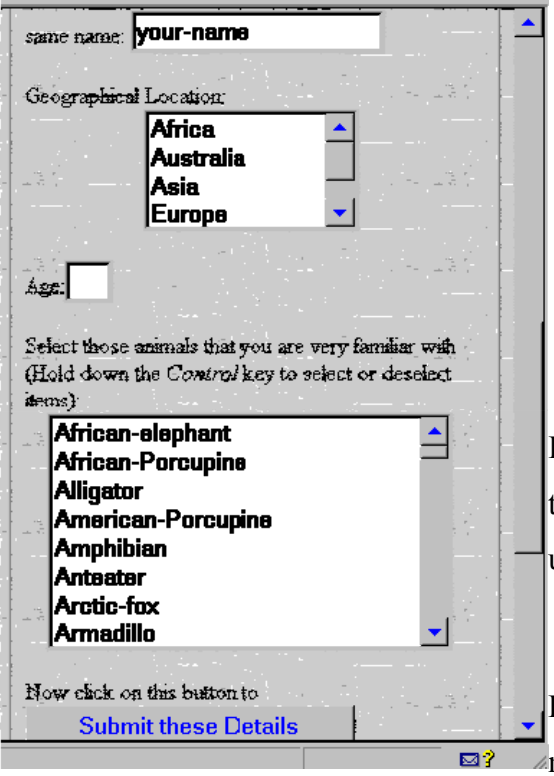


Figure 20:Peba-II

Peba-II is a natural language generation system which dynamically produces hypertext descriptions of animals. The descriptions of animals that you see do not already exist on the computer like normal World Wide Web (WWW) pages. Instead, Peba-II dynamically creates them as you ask for them."



If you would like the system to remember who you are and to tailor descriptions to your knowledge, then you might like to set up a user profile before beginning.

Because Peba-II produces descriptions as you ask for them, it can modify what it tells you based on what it thinks you already know. You can inform the system of your existing knowledge by filling in the user profile below. At this stage your age and geography don't affect the text, but we will be implementing that fairly soon.

4.5.6 AES-CS: Adaptive Educational System based on Cognitive Styles

The main characteristic of AES-CS is that it can be adapted to the cognitive style and to the level of knowledge acquired by the student.

The system is organized in the form of three basic modules: the domain model, the student model, and the adaptation module.

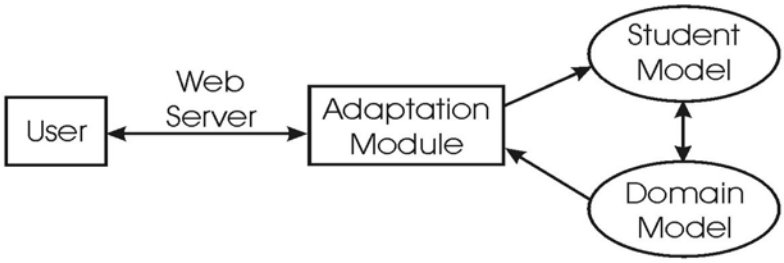


Figure 21: AES-CS basic modules

These three components interact to adapt different aspects of the instructional process.

Domain model

It serves as a basis for structuring the content of AES-CS. Each concept is structured into a set of liked topics.(basic pieces of knowledge)

Student model

Three different categories of information are built-in in the student model: personal profile, cognitive profile and an overlay student knowledge profile.

Adaptation module

To support adaptivity, AES-CS uses the 'adaptive presentation technique' that aims to adapt the information presented to the user according to his/her cognitive style and knowledge state.

With the conditional text technique, a page is divided into chunks. Each chunk of information is associated with a condition indicating which type of user should be presented with it.

With page variants technique, each variant of the page presents information in a different style according to FD/FI dimension.

'Adaptive navigation support' is a specific adaptive hypermedia technology that aims to help users to find an appropriate path in a hypermedia-learning environment (manipulating the selection and the presentation of links)an annotation mechanism is used to show several levels of student's knowledge on each domain model concept.

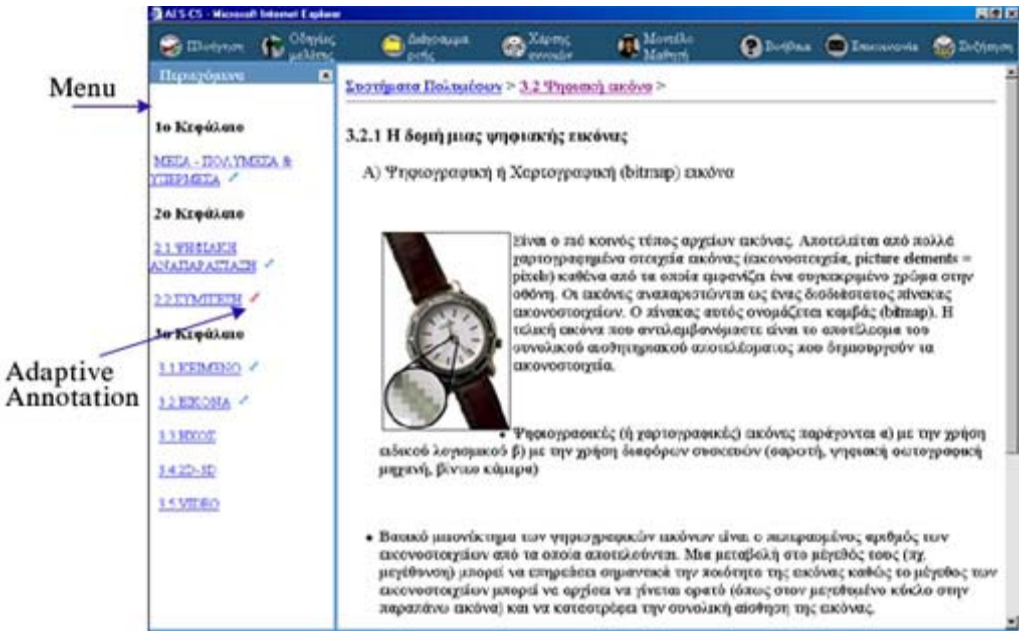


Figure 22: System screen with the initial adaptation for FI learners

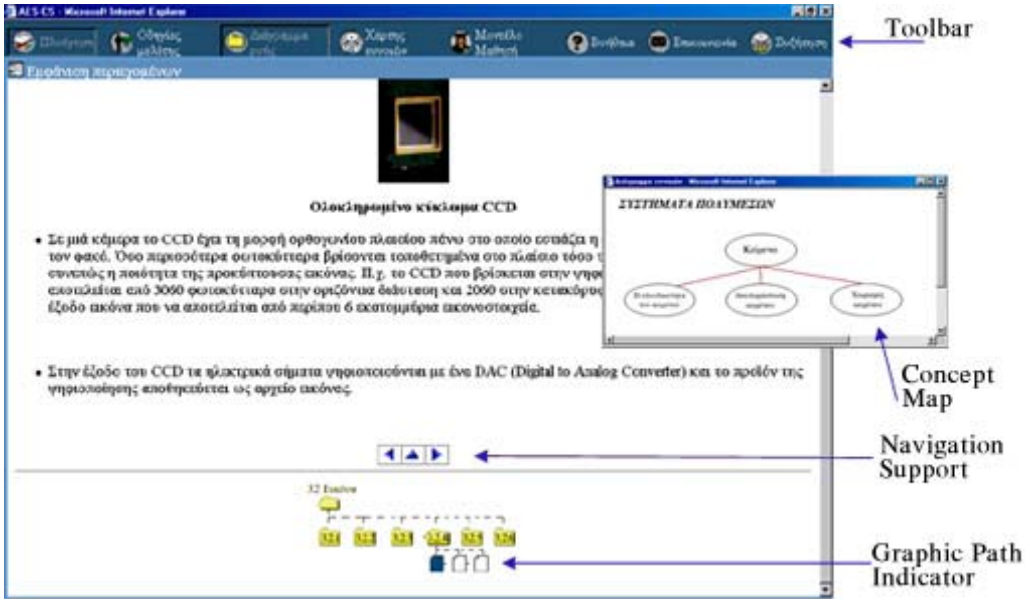


Figure 23: Initial adaptation for FD learners

AES-CS (Adaptive Educational System based on Cognitive Styles), was developed to support the course "Multimedia Technology Systems" which is typically offered to fourth year undergraduate students in Computer Science Department at the Aristotle University of Thessaloniki, Greece.

A preliminary analysis of the data collected from the evaluation of the system showed that the subjects were satisfied with the adaptation based on cognitive style. In addition, they felt that the system was clear and easy to understand and after working with it they had a better understanding of the area studied.

Chapter 5

System

In this chapter we are going to see in detail the system, which its aim is to monitor the emotional state of the user. Then depend on this measurement and the user characteristics (cognitive,learning style,knowledge,memory) we adapt the web learning environment. Also we descript with detail the components of the system and their operation.

5.1 Requirements and system specifications

At this point will going to see the requirements and system specifications that needed to implement the system. This system depends on the Adaptive web system.

5.1.1 Profile Construction

The profile of the user is created and stored in the component of Profile Construction of Adaptive Web. The Profile Construction of Adaptive Web component is responsible for creating the profile. The creation of the profile is based on the system's specification. The user completes, except from the username and password which are used for access to the system, some "traditional" characteristics such as age, gender, profession etc. Also the Profile Construction of Adaptive Web exports the psychological profile of the user. To export the psychological profile of the user he must answer to some questionnaires which are concerning the learning style of the user and his working memory.

5.1.2 Export of certain biometric signals

With the appropriate devices will going to export certain biometric signals, the signals that we want to export are heart rate, blood volume pulse and skin conductance. With the appropriate software will are going to save the measurements on computer.

5.1.3 Admin management-user profile management:

The admin through a form field inserts the id of the user and this id is posted as a parameter to a url .This url is communicate with Profile Construction component of the Adaptive Web, when this component gets the parameter which represents the id of the user, it will going to return an xml file which has the traditional and cognitive characteristics of the user such as if he is wholist/analist or visualizer/verbalizer etc. After that the xml file read and then the information's about the user are stored in the database of our system. Then we retrieve from the database the learning content and the user characteristics (cognitive style, memory, learning style) and according from that data we adapt the web interface of the user.

5.1.4 Admin management-import sensor file:

After the managing user profile operation the admin of the system must manage the sensor file of the user. The admin must upload the sensor profile to the server .The name of the file is the user identification. While the uploading is happened the data (metrics about heart rate, blood volume pressure and skin conductance) from the file are read and are stored in the database of our system (Intelisense).

5.1.5 Human-Computer Interaction Web

At the end we create the environment in which the user is going to navigate in .All the information of learning environment hold to the database .Before user starts navigate in the environment he contract his traditional and cognitive profile with the Profile Contraction of Adaptive Web also his biometrical signals are export to a file through sensors software. All previous data are hold in the database and according to them we adapt the learning environment that he will navigate in.

5.2 Design and implementation of the system

At this point we going to see the design of the system and according to these design is based the implementation of the system. First we will see one general view of the system and then will descript in detail the components of the system.

5.2.1 Architecture of the system

We will go to see a general view of the system and his components. The general view of the system just like it descript above is shown in figure 24.

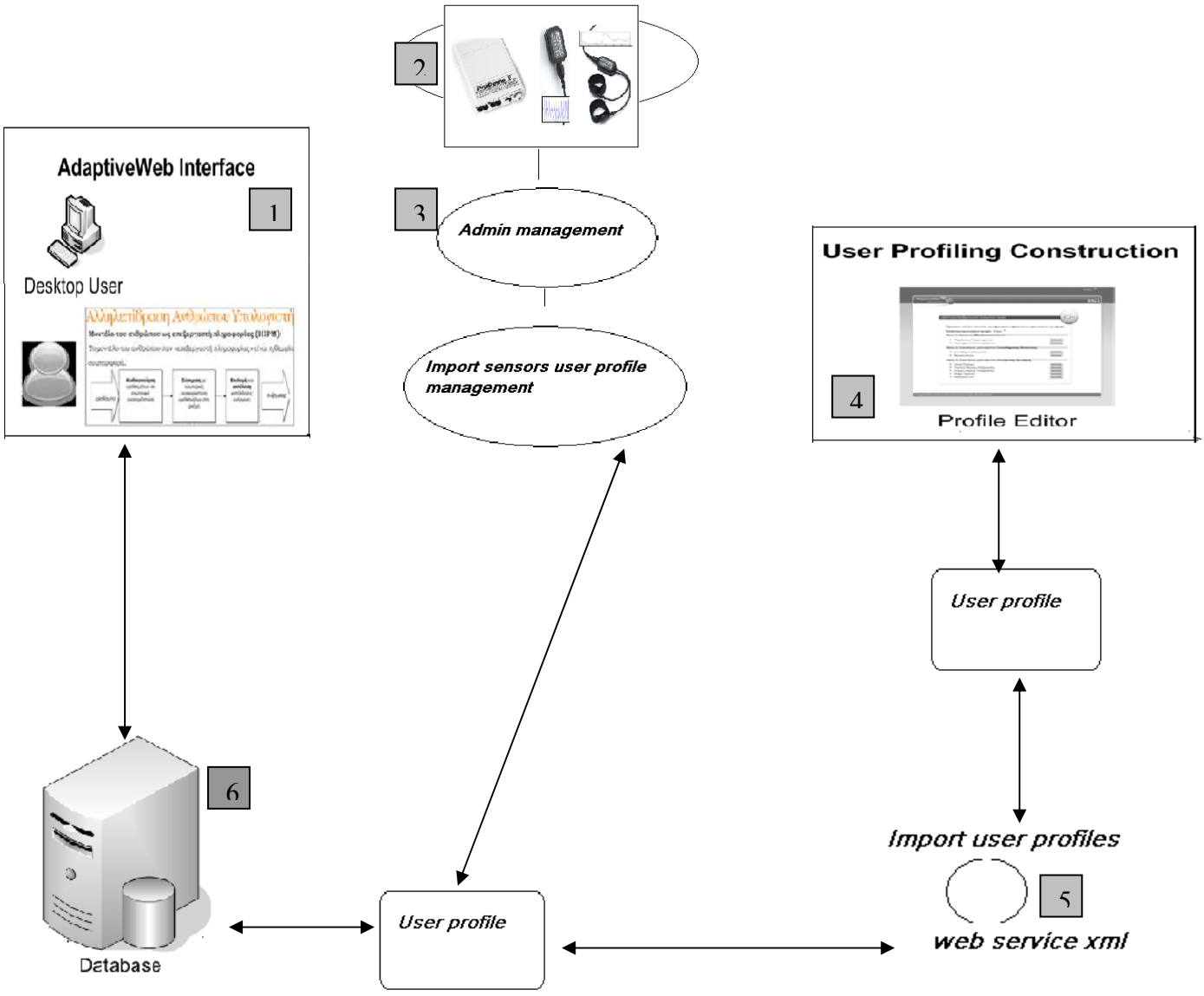


Figure 24: Architecture of the system

The current system it is composed of 5 related components:

1. **Human-Computer Interaction Web**

At this point the environment for user navigation is creating. All the information's about the learning environment are placed to the database .Also in the database we hold the user cognitive characteristics and sensor measurements .According to these measurements and from the cognitive characteristics of the user we adapt the learning environment that he will navigate in. The chosen environment is a learning environment in which user reads the course Human-Computer Interaction.

2. **Export of certain biometric signals**

This component is responsible for export of certain biometric signals of the user. To make the extraction of signals appropriate sensors are placed in the user's hand before starts navigates in the environment. After that we export the measurements of the user from the sensors database to computer desktop. With these sensors will going to export certain biometric signals, the signals that we want to export are heart rate, blood volume pulse and skin conductance. With the appropriate software will are going to save the measurements on computer. All the measurements for the certain user are saved in the database of the Intelisense system.

3. **Admin management-import sensor file:**

After the managing user profile operation the admin of the system must manage the sensor file of the user. The admin must upload the sensor file to the server .The name of the file is the user identification. While the uploading is happened the data from the file are read and are stored in the database of our system (Intelisense).

4. **Profile Construction**

The profile of the user is created and stored in the component of Profile Construction of Adaptive Web. The Profile Construction of Adaptive Web component is responsible for creating the profile. The creation of the profile is based on the system's specification. The user completes, except from the username and password which are used for access to the system, some "traditional" characteristics such as age, gender, profession etc.Also the Profile Construction of Adaptive Web exports the psychological profile of the user. To export the psychological profile of the user must answer to some questionnaires which are concerning to his learning style and working memory.

5. **Admin management- User profile management:**

The admin through a form field inserts the id of the user and this id is posted as a parameter to url .This url is communicate with Profile Construction component of the Adaptive Web ,when this component gets the parameter which represents the id of the user, it will going to return an xml file that has the traditional and cognitive characteristics of the user such as if he is wholist/analist or visualizer/verbalizer etc. After that the xml file read and then the information's about the user are stored in the database. Then we retrieve from the database the learning content and the user characteristics (cognitive style, memory, learning style) and according from that data we adapt the web interface of the user.

6. **Database:**

The database of the system holds information about the user characteristics (username,password,visualizer/verbalizer,wholist/analyst) and the content for each page of the learning environment. We use database to success validation of login of the user and for adaption of the learning environment. We implement the database using the MySql language.

5.2.2 Design and implementation of system components

At this point we are going to see the design of the system components in detail.

5.2.2.1 Export biometric signals

To export the biometric signals that we needed we use sensors. For the purposes of our investigation, we needed sensors for measuring heart rate, blood volume pulse and skin conductance. The device that we used is : Procomp 2 (2 Channel – Thought Technology):The ProComp2™ is a compact yet powerful two-channel device that allows

the capture of data from a variety of sensors including EMG, goniometers or force sensors . This device connects through a USB adapter with the computer.

Figure 25: Pro Comp 2 Device

With the BioGraph Infiniti software you can record two types of session: Open Display and Script. Open display sessions are generally used for biofeedback training, when flexibility is important and you need to be able to rapidly change session parameters depending on the client's reactions. Script sessions, on the other hand, are important for recording assessment or follow-up sessions, where a standardized and constant approach is more appropriate. While both open display and script sessions can be used for trend reports, script sessions generally generate more comparable sessions.

With the Pro Comp 2 device we can use the following sensors:

1. HR/BVP Sensors :

Figure 26: HR/BVP Sensors

The HR/BVP sensor is a blood volume pulse detection sensor (otherwise known as a PPG sensor) housed in a small finger worn package, to measure heart rate (HR) and provide BVP amplitude, BVP waveform, HR and heart rate variability feedback. Used for:

1. Stress Assessment
2. HRV Biofeedback

How we can use it :

An elastic strap is provided with the sensor. Place the sensor against the fleshy part of the first joint of any finger. The middle finger is recommended for better compatibility with the other sensors when they are all placed on the same hand(Figure:).

Figure 27:place HR/BVP sensor

2.Skin Conductance Sensor :

Figure 28: Skin Conductance Sensor

The Skin Conductance sensor measures the conductance across the skin, and is normally connected to the fingers or toes. Supplied with two finger bands. Used for:

1. Stress Assessment
2. Biofeedback

There are two finger straps attached to the skin conductance sensor. The conductive electrode in each finger strap should be placed against the inside part of the finger.

A good choice for placement is to use the index and ring finger. Close the hook and loop fasteners around the fingers so that contact is snug yet comfortable. Placement with the cables directed inwards (shown) is practical for keeping the cables out of the way.

Figure 29:place skin conductance

The user before starting navigates in the learning environment he needs to wear the sensors in his hand. The sensors correspond to the biometric signals: heart rate, blood pressure and skin conductance. Before the user start navigating in the web environment, we take his biometric signals .After the measurement we conclude about the stress of the user and according to this conclusion and from the user characteristics we adapt the user interface. In order to export these signals we put the appropriate sensors in the user's hand as he navigates in the learning environment. The sensor’s device has the appropriate software wherewith we can save the measurement of specific session of the user on computer desktop.

5.2.2.2 Admin management

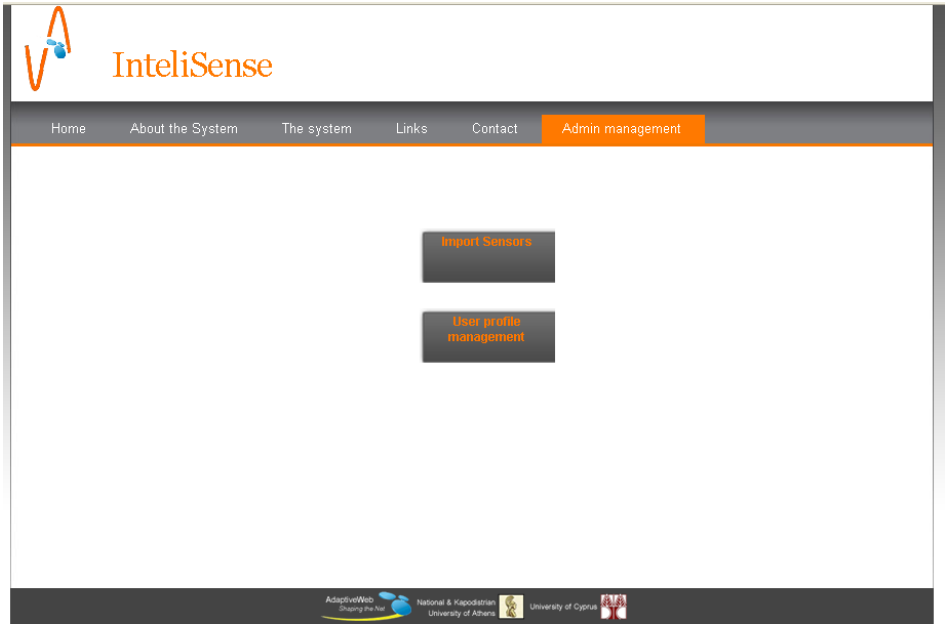


Figure 30:Admin management page

The admin has two operations:

1. To manage user profile
2. To import sensors file of the user

5.2.2.2.1 Managing user profile

The admin can insert the user id to a form and through a url can get the profile characteristics that exist in the database of Adaptive Web. Then these characteristics are saved in the system database.

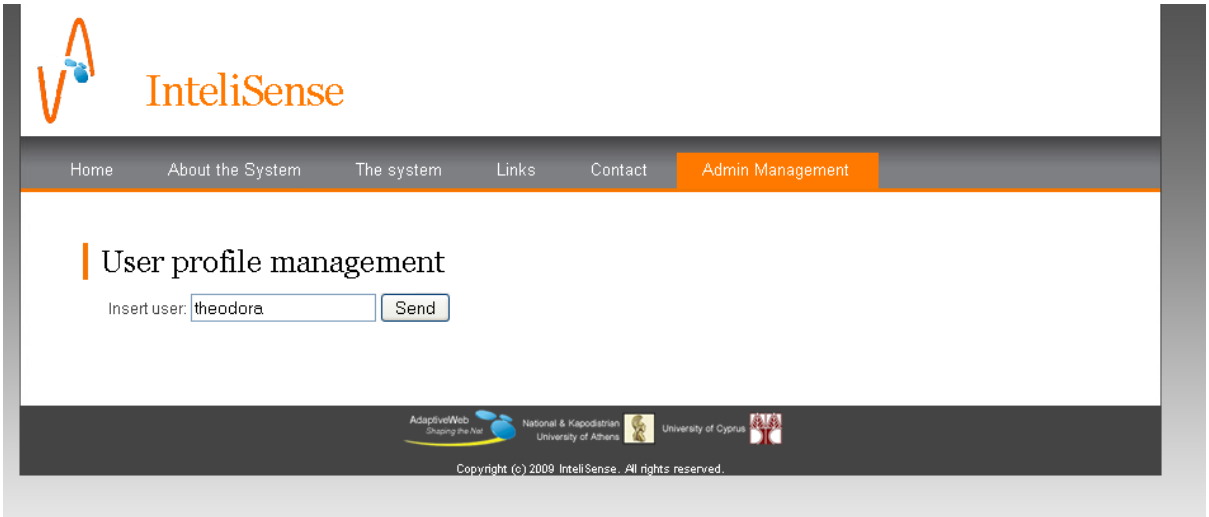


Figure 31: form which admin inserts id

Give the user id (for example theodora).Then this id is sent as a parameter to an url which is connected with the profile construction of the Adaptive Web. This url returns an xml file with the user characteristics. When the xml file is returned, the user characteristics (user_id,cognitive styles, working memory) read and are added to the USERS table of the database.

Cs1: visualizer/verbalizer (1 for visualizer ,2 for verbalizer,3 for intermediate)

Cs2: analyst/wholist(4 for wholist ,5 for analyst and 6 for intermediate)

Memory: working memory (1 for low working memory and 0 for high working memory)

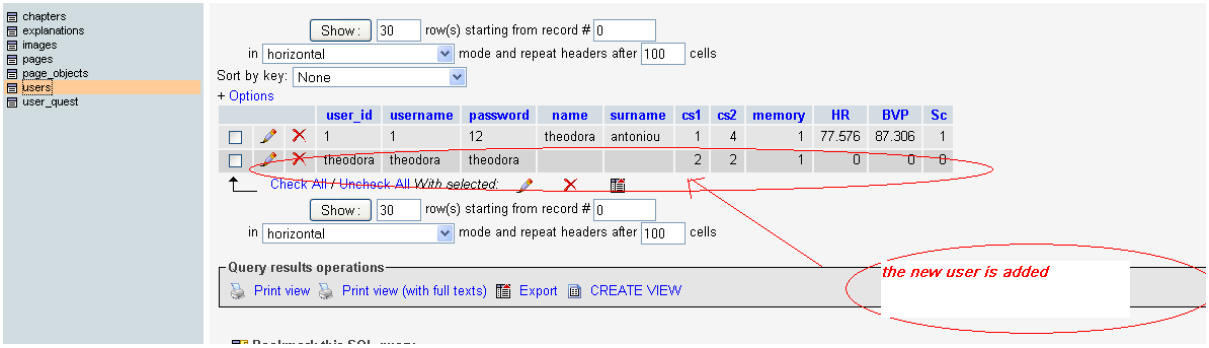
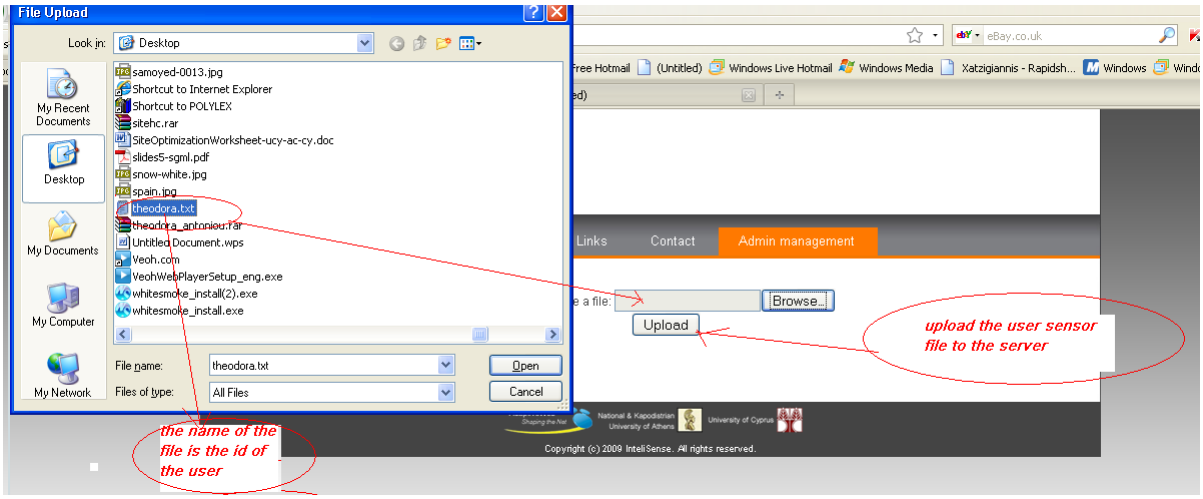


Figure 32: USERS table after admin inserts the new user

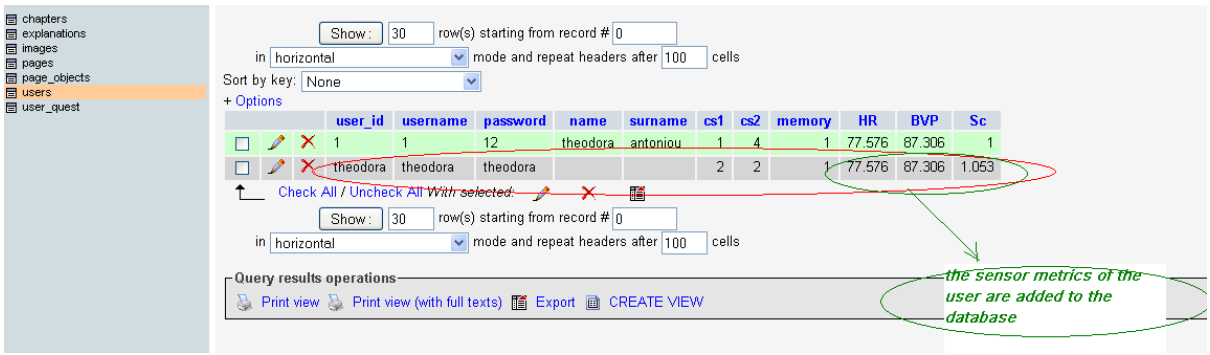
5.2.2.2.2 Import sensors file of the user

After the management of user profile the admin has the ability to upload to the server the file that exports from the database of sensor system (Figure 33 (a)). While the upload is happening, the sensor metrics that exist in this file are read and saved in the USERS table of the system database (to the appropriate user)(Figure 33 (b)).

The name of the sensor file must have the user id.



a) Upload sensor file of the user



b)the user record after the

Figure 33

5.2.2.3 Interface of Human-Computer interaction

At first we must build the learning environment that the user is going to navigates in.

The main aim of this system is to adapt and personalize the content of the user according to profile characteristics of the user and his Physiological measurements.

This system is a Web application used for personalized and adapted a web content .The learning environment includes a course named “Human-Computer Interaction” is an e-learning environment that aims to provide students ways that Human-Computer Interaction will be more efficient.

First when the users want to interact with adapt learning system they have to log in so the system retrieves his profile. They exist two different types of cognitive styles, the one if the user is visualizer or verbalizer , this type refers to content presentation and the analyst/wholist type which refers to navigation support. The visualizer type is the type of the user that prefers more pictures in the learning content in contrast with verbalizer that prefers text in his learning environment. The analyst type of a user has the ability to set his own goals but the wholist wants guidance to achieve his goals. Also in the profile of the user exists the memory attribute, this attribute set us if user has low or high memory working. Working memory is a system for temporarily storing and managing the information required to carry out complex cognitive tasks such as learning, reasoning, and comprehension. Working memory is involved in the selection, initiation, and termination of information-processing functions such as encoding, storing, and retrieving data. One test of working memory is memory span, the number of items, usually words or numbers, that a person can hold onto and recall.

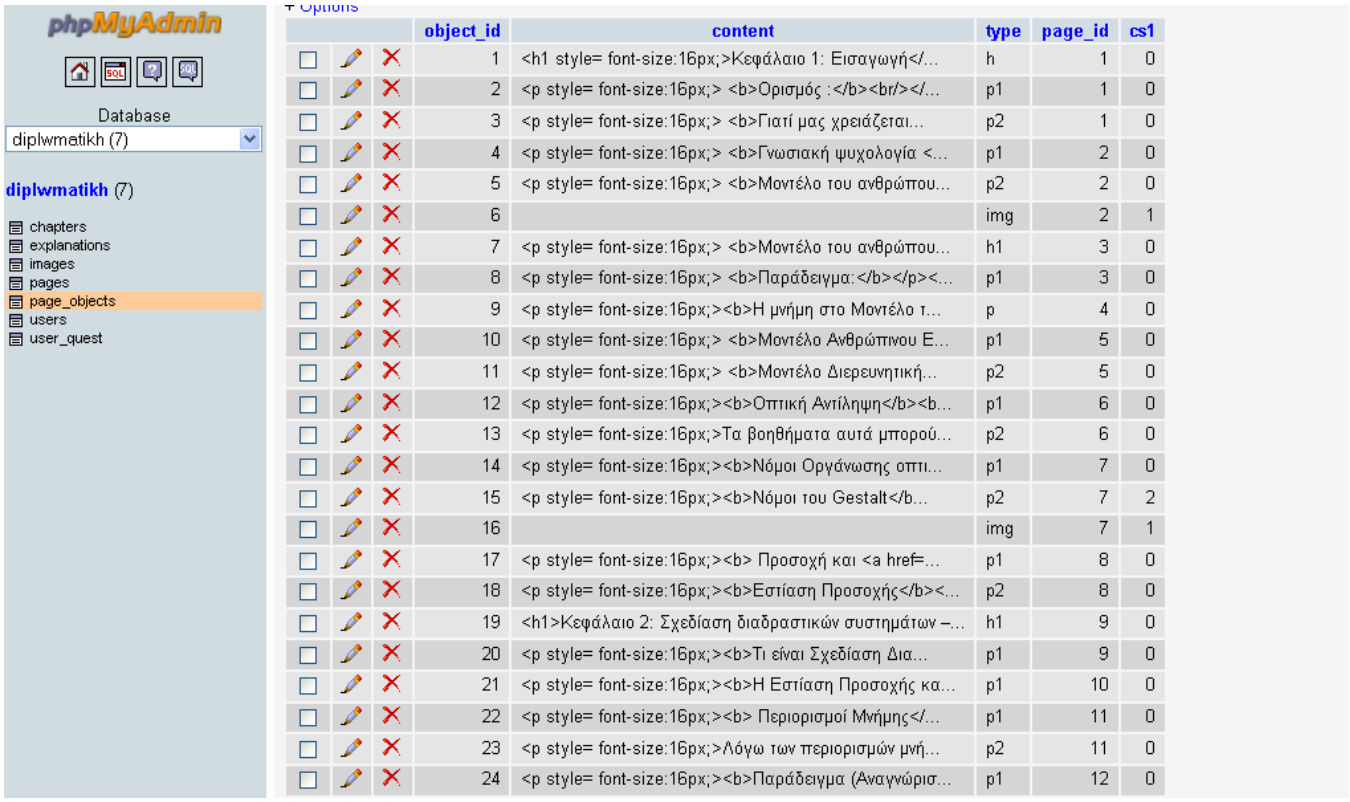
5.2.2.3 .1 Construct content of the learning environment

a) Content presentation

Until now we have we have all the information we need for adapting the content; the user profile and the page content. Next we must map the profile characteristics of user with the web page’s content and give to user the appropriate content.

Every Web-page is detached into standalone objects, each one having special characteristics. All this objects are saved in the database to the page_objects table (Figure).For example if the user wants go to the web page x ,first we retrieve from the database the information’s for the page x which are i)the page details like the id of the page, an abstract description, the title of the page etc ii)the objects that included at page x. The page objects are classified in the database as follow:if the page object has an image in its content then this object it will be selected for visualiser user

(identify by 1) (Figure) otherwise if the user cognitive style is verbalizer or intermediate (identify by 2) then we selected the corresponding text of the image(Figure). Also object contents that with cognitive style 0 are selected for all cognitive styles. In addition each page object is associated with the page which is included(page id).The page objects are selected according the page which are included in and according to the cognitive style of the user.



			object_id	content	type	page_id	cs1
☐	✎	✕	1	<h1 style= font-size:16px;>Κεφάλαιο 1: Εισαγωγή</...	h	1	0
☐	✎	✕	2	Ορισμός : </...	p1	1	0
☐	✎	✕	3	Γιατί μας χρειάζεται...	p2	1	0
☐	✎	✕	4	Γνωσιακή ψυχολογία <...	p1	2	0
☐	✎	✕	5	Μοντέλο του ανθρώπου...	p2	2	0
☐	✎	✕	6		img	2	1
☐	✎	✕	7	Μοντέλο του ανθρώπου...	h1	3	0
☐	✎	✕	8	Παράδειγμα: <...	p1	3	0
☐	✎	✕	9	Η μνήμη στο Μοντέλο τ...	p	4	0
☐	✎	✕	10	Μοντέλο Ανθρώπινου Ε...	p1	5	0
☐	✎	✕	11	Μοντέλο Διερευνητική...	p2	5	0
☐	✎	✕	12	Οπτική Αντίληψη<b...	p1	6	0
☐	✎	✕	13	Τα βοηθήματα αυτά μπορού...	p2	6	0
☐	✎	✕	14	Νόμοι Οργάνωσης οπτι...	p1	7	0
☐	✎	✕	15	Νόμοι του Gestalt</b...	p2	7	2
☐	✎	✕	16		img	7	1
☐	✎	✕	17	Προσοχή και <a href=...	p1	8	0
☐	✎	✕	18	Εστίαση Προσοχής<...	p2	8	0
☐	✎	✕	19	<h1>Κεφάλαιο 2: Σχεδίαση διαδραστικών συστημάτων –...	h1	9	0
☐	✎	✕	20	Τι είναι Σχεδίαση Δια...	p1	9	0
☐	✎	✕	21	Η Εστίαση Προσοχής κα...	p1	10	0
☐	✎	✕	22	Περιορισμοί Μνήμης</...	p1	11	0
☐	✎	✕	23	Λόγω των περιορισμών μνή...	p2	11	0
☐	✎	✕	24	Παράδειγμα (Αναγνώρισ...	p1	12	0

Figure 34:page_objects table in the database

Γνωσιακή ψυχολογία

Η γνωσιακή ψυχολογία είναι η μελέτη και κατανόηση των λειτουργιών του ανθρώπου όταν αυτός αντιδρά σε ερεθίσματα που του προκαλούν γνωστικές διεργασίες και η διεργασία μέσω της οποίας καταλήγει σε ενέργειες για να επιτύχει τους στόχους του.

Μοντέλο του ανθρώπου ως επεξεργαστή πληροφορίας (HIPM)

Το μοντέλο του ανθρώπου σαν «επεξεργαστή πληροφορίας» είναι η θεωρία που εξηγεί την ανθρώπινη συμπεριφορά.

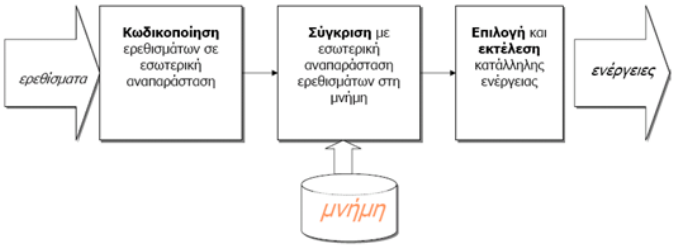


Figure 35:content page for visualizer

Γνωσιακή ψυχολογία

Η γνωσιακή ψυχολογία είναι η μελέτη και κατανόηση των λειτουργιών του ανθρώπου όταν αυτός αντιδρά σε ερεθίσματα που του προκαλούν γνωστικές διεργασίες και η διεργασία μέσω της οποίας καταλήγει σε ενέργειες για να επιτύχει τους στόχους του.

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Τέσσερα Στάδια:

- Κωδικοποίηση
- Σύγκριση
- Επιλογή
- Εκτέλεση

Figure 36:content page for verbalizer

b) Navigation support

For the navigation support we hold to the database the chapter and page tables which have descriptions for the subject for each chapter and page.

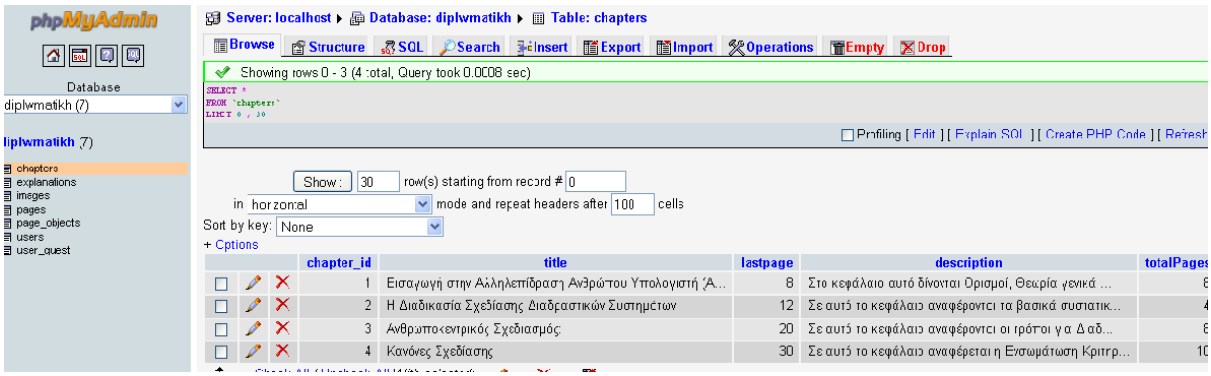


Figure 37: chapter table

Figure 38: page table

If the user is wholist or intermediate user the title that is in more detail for the page and chapter is selected otherwise if the user is analyst the simple title for the subject description of the chapter and for the page is selected. The chapter and page titles are shown in navigation menu(figures).

There exist three different types of navigation support :

1) The navigation support for the analyst user

2) The navigation support for the wholist user

3) The navigation support for an intermediate user

1) The navigation support for the analyst user

When the user is analyst and visualizer the adaptation has as follow: We show to the user more images than text .Regarding to the navigation support the user has the ability to set his own goals this means that he can access any page of the content whenever he wants .Also on the navigation menu exist a table with some link words, the analyst user has the ability to see the explanations of these words. When the user clicked the link word in this table a pop up window appears with explanation of the word. Also if the user clicks this word in the content of learning environment the pop up window will be appear also. If the user is analyst we select the simple title for the subject description of the chapter and the page.

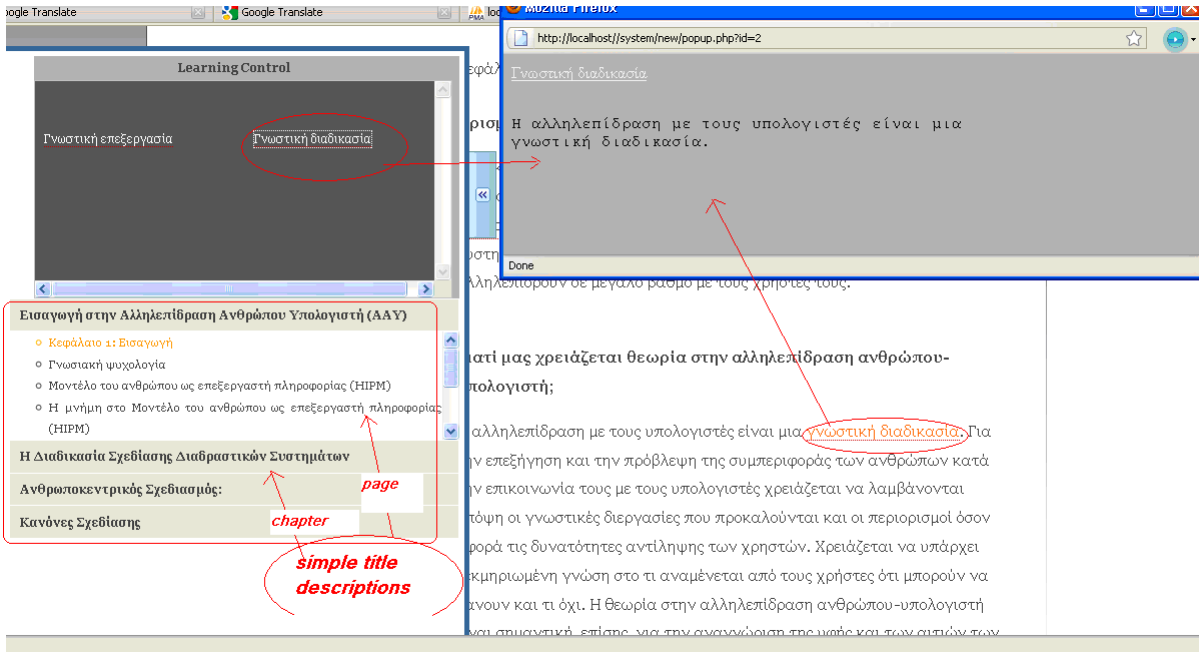


Figure 39: Analyst navigation support and learning control

2) The navigation support for the wholist user

When the user is wholist and verbalizer the adaptation has as follow: We show to the user more text .Regarding to the navigation support the user wants guidance to achieve his goals.This means that the navigation menu doesn't led the user to access any page but he must access the pages in order .Also wholist user doesn't have table with the link words but if he wish to see the explanations of the link words of the content he must mouse over the word in the content and then a tooltip with the explanation will appear. If the user is wholist or intermediate user we select title that has more detail description for the page and chapter.

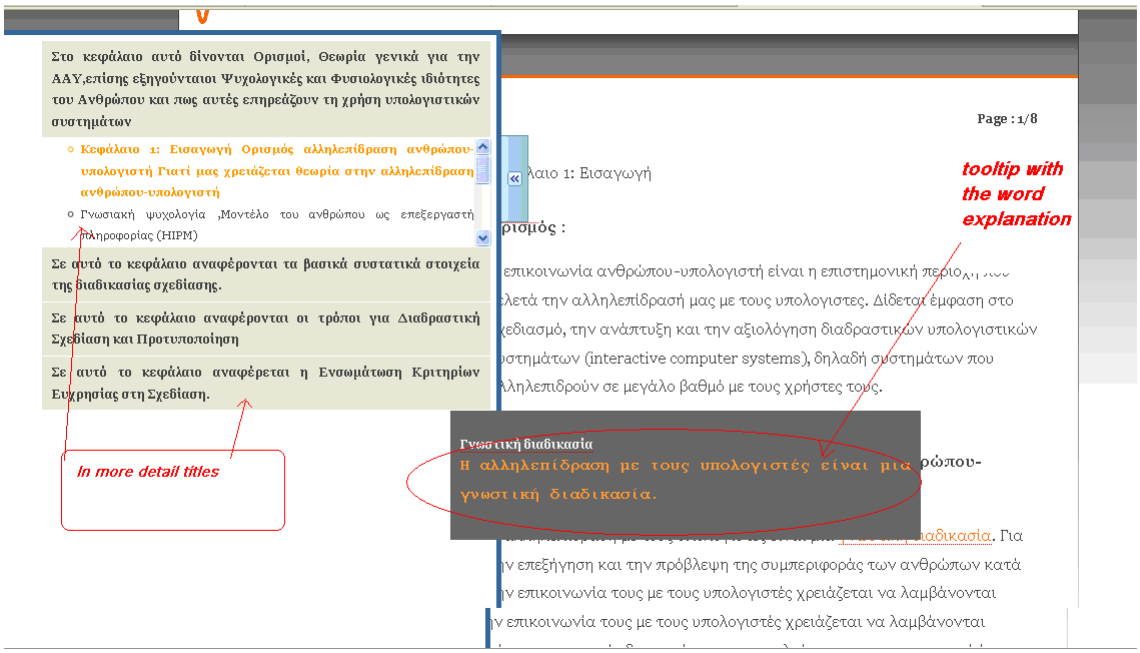


Figure 40: Wholist navigation support

3) The navigation support for an intermediate user

Regarding to the navigation support the user has the ability to set his own goals this means that he can access any page of the content whenever he wants .Also on the navigation table exist a table with link words, the analyst user has the ability to see the explanations of these words. When the user clicked this link word a pop up window appears with explanation of the word. Also if the user clicks this word in the content of learning environment the pop up window will be appear again. Also if the user is intermediate we select the more detail title for the subject description of the chapter and page.

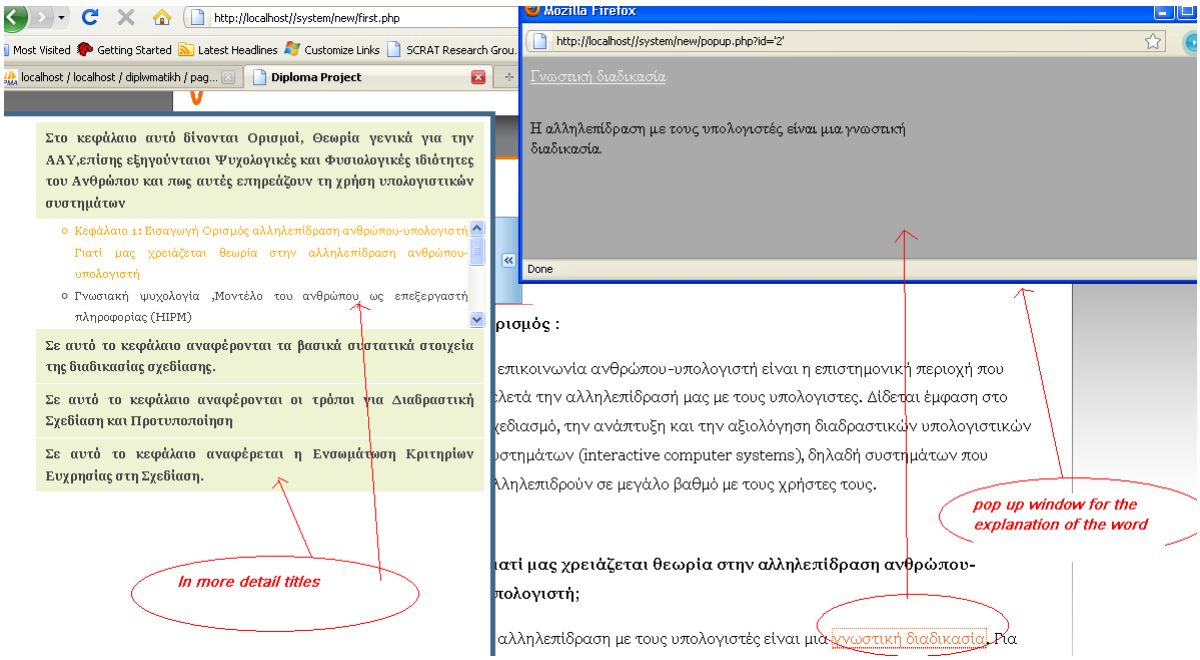


Figure 41: intermediate user

c) Content according to working memory of the user

If any type of user has low working memory then the content of each page is split up and the half content appears to the user .If he wish to see the rest content he must click the continue button.

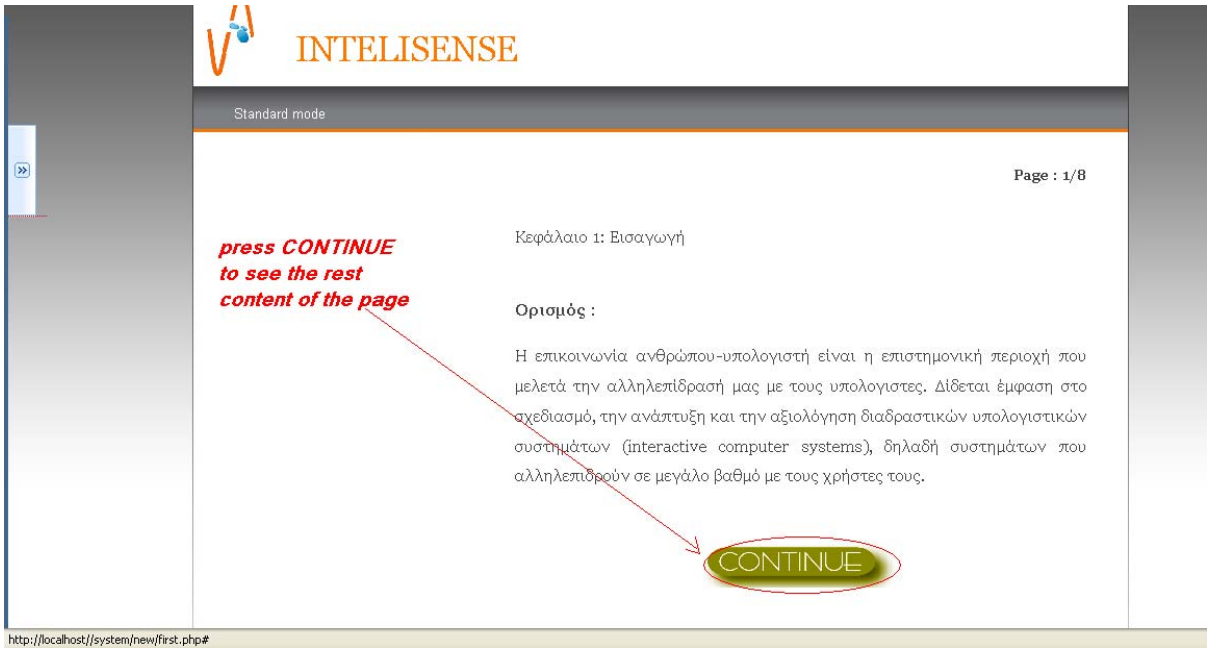


Figure 42: content for user with low working memory

Algorithm for working memory

Function workoMemory(pg_id){

//select the page that user wants

$pages= "SELECT * FROM pages WHERE page_id=pg_id

$page=mysql_query($pages);

//object numbers that the page has

$num_of_objects=$rpage['page_content'];

//select all the objects of the requested page according to cognitive style of the user(visualizer/verbalizer)

$sql="SELECT * FROM page_objects WHERE page_id='".$q."' and (cs1='".$cognitive_style1."' or cs1=0)" ;

$result=mysql_query($sql);

If user has low working memory then

{Divide the objects of the page}

Else

{nothing}

while($row = mysql_fetch_array($result))

  {

Print the half objects of the page

  }

//if user press the Continue button

```
while($row = mysql_fetch_array($result))
  {
Print the rest objects of the page
  }

}
```

d) Standard mode of the content

Additionally the user has the ability , before personalize the learning environment ,to see it in standard mode.

Figure 43: Standard mode of the user

If he wishes to personalize the environment he must press Personalize me link and then he will be transfer to the log in page.

e) Adapting content base on the user stress:

In the system we have a mechanism for the adaptation of the content according to user stress. As was said above the metrics that we capture from the sensor device are saved for each user to the database .The system reads this metrics from the database when the user is logged in and according to some rules we decide if the user is stressful or not .If he is stressful we adapt the environment appropriate. We change the font color and size for all the definitions and headers of the content.

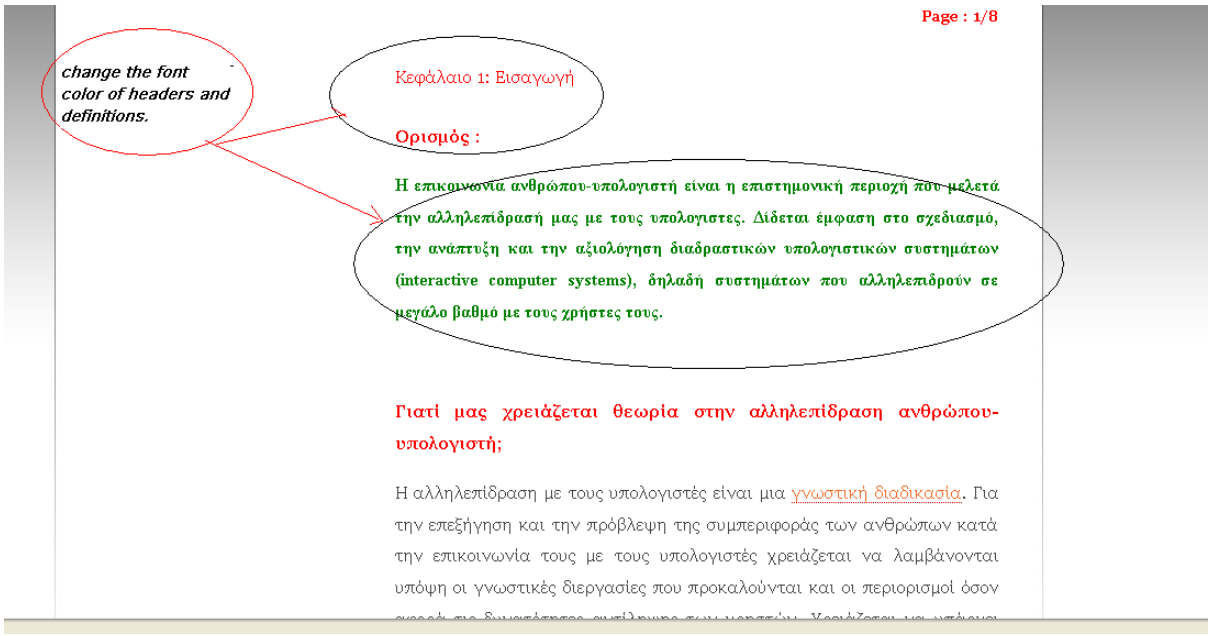
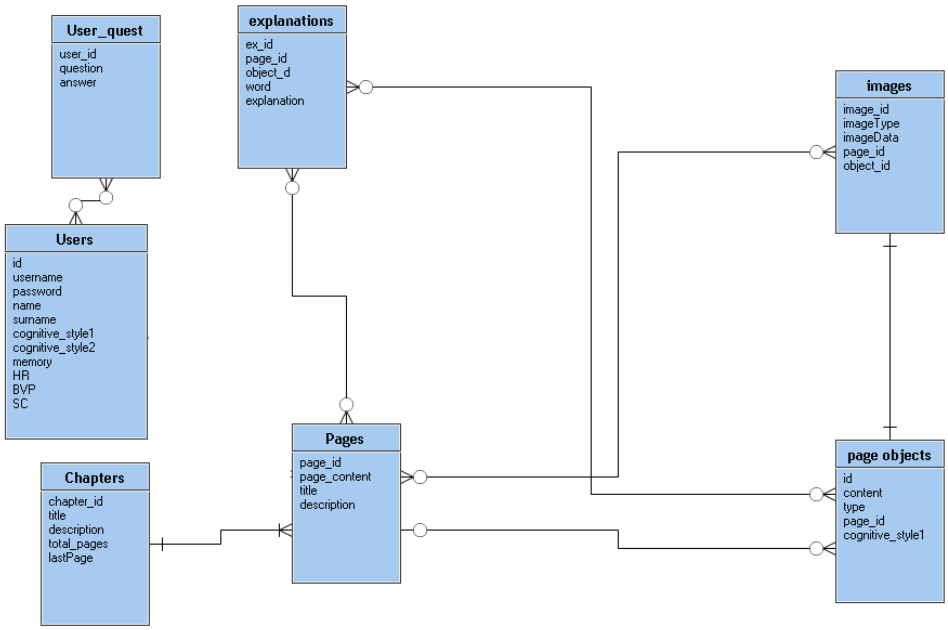


Figure 44:Adaptation according to stress

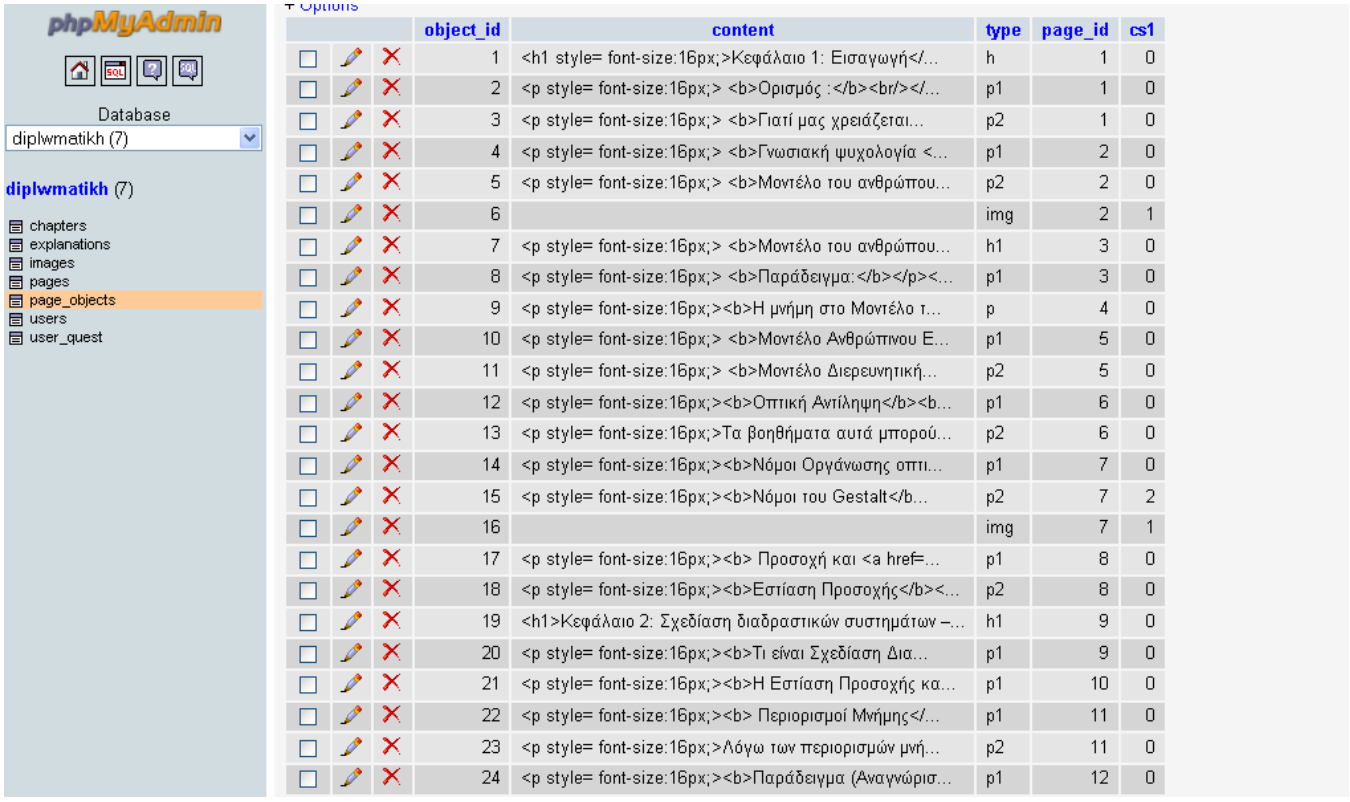
5.2.3 Entity Relational Diagram of my Database :



The seven tables that are included in my database are:

1. Users: The table Users holds all traditional information of a user .The attributes that are included in the table are : id of user (primary Key),username, password, name ,surname, cognitive style1(that is 1 for visualizer,2 verbalizer),cognitive style2(that is 4 for wholist,5 for analyst) and memory attribute(that is 0 for low memory and 1 for regular memory). The attributes username and password are checked for validity login in my system. The attributes cognitive style1, cognitive style2, memory are used to adapt the web interface appropriate. Also the attributes HR (heart rate),BVP(blood volume pressure) and SC(skin conductance) are hold the measurements that we take from the sensors.
2. Pages: The table Pages holds information for each page of the learning environment. The attributes that are included in the table are: page_id (primary Key), page_content, title of the page and description of the page. The page_content is how page objects have the page, and each page has a title and a small description this two attributes are helpful for the index of the learning environment. If the user is wholist or intermediate user we select title that is in more detail for the page otherwise if the user is analyst we select the simple title for the subject description for the page.
3. Page_objects : Each page of the learning environment has many objects. The page_objects table is related with Page table with a foreign key page_id. The other

attributes that included in the table are :id of the object(primary Key), content and the type of object (for example if it is a table, a heading ,paragraph or other page objects) and cognitive style 1(visualizer/verbalizer).The content of each page object is printed in the corresponding page. Every Web-page is detached into standalone objects, each one having special characteristics. All this objects are saved in the database to the page_objects table.For example if the user wants go to the web page x ,first we retrieve from the database the information's for the page x which are i)the page details like the id of the page, an abstract description, the title of the page etc ii)the objects that included at page x.The page objects are classified in the database as follow:if the page object has an image in its content then this object it will be selected for visualiser (identify by 1) user cognitive style(Figure) otherwise if the user cognitive style is verbalizer or intermediate (identify by 2) then we selected the corresponding text of the image(Figure). Also object contents that with cognitive style 0 are selected for all cognitive styles.Also each page object is associated with the page which are included(page id).The page objects are selected according the page which are included in and according to the cognitive style of the user.



	object_id	content	type	page_id	cs1
	1	<h1 style= font-size:16px;>Κεφάλαιο 1: Εισαγωγή</...	h	1	0
	2	Ορισμός : </...	p1	1	0
	3	Γιατί μας χρειάζεται...	p2	1	0
	4	Γνωσιακή ψυχολογία <...	p1	2	0
	5	Μοντέλο του ανθρώπου...	p2	2	0
	6		img	2	1
	7	Μοντέλο του ανθρώπου...	h1	3	0
	8	Παράδειγμα: <...	p1	3	0
	9	Η μνήμη στο Μοντέλο τ...	p	4	0
	10	Μοντέλο Ανθρώπινου Ε...	p1	5	0
	11	Μοντέλο Διερευνητική...	p2	5	0
	12	Οπτική Αντίληψη<b...	p1	6	0
	13	Τα βοηθήματα αυτά μπορού...	p2	6	0
	14	Νόμοι Οργάνωσης οπτι...	p1	7	0
	15	Νόμοι του Gestalt</b...	p2	7	2
	16		img	7	1
	17	Προσοχή και <a href=...	p1	8	0
	18	Εστίαση Προσοχής<...	p2	8	0
	19	<h1>Κεφάλαιο 2: Σχεδίαση διαδραστικών συστημάτων –...	h1	9	0
	20	Τι είναι Σχεδίαση Δια...	p1	9	0
	21	Η Εστίαση Προσοχής κα...	p1	10	0
	22	Περιορισμοί Μνήμης</...	p1	11	0
	23	Λόγω των περιορισμών μνή...	p2	11	0
	24	Παράδειγμα (Αναγνώρισ...	p1	12	0

Database page_objects table

4. Images: The table images holds information for each image of the learning environment. The Images table is related with page table and page object table with foreign keys page

and object id respectively. . The other attributes that included in the table are: id of the image(primary Key),type of the image(e.g. png, jpg) and image data(here I saved each image as blob type)

5. Explanations: The table Explanations holds information for each phrase that has a further explanation,each phrase has a unique value ex_id(primary key).The Explanations table is related with page table and page objects table with foreign keys page and object id respectively.The word is saved to database as link.When we want to retrieve the explanation of the word we use the id of the explanation and with a query to explanation table we select the explanation of the word. The other attributes that included in the table are: word (is the phrase that has explanation) and explanation(is the explanation of the phrase).For example if an analyst /wholist user clicks to the word that has a further explanation then a pop window or a tooltip appears with the explanation of that word. The explanation of this word is in this table.

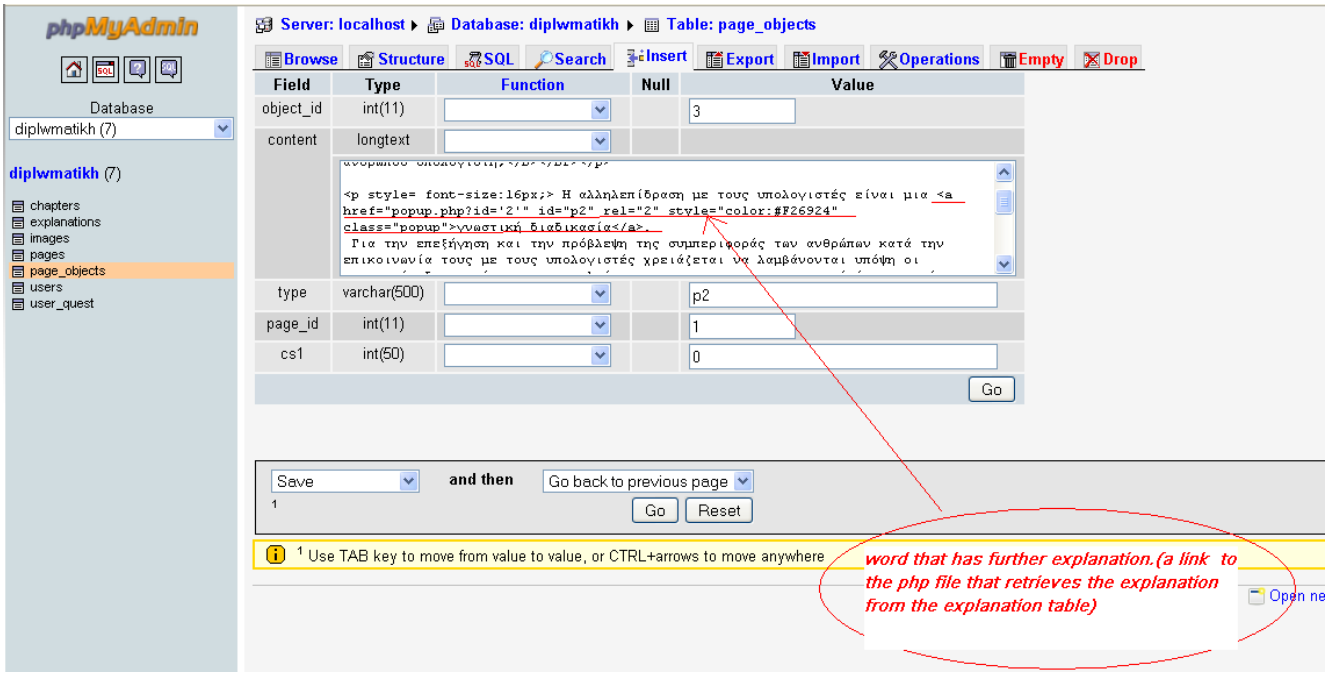


Figure 45:Page_object table

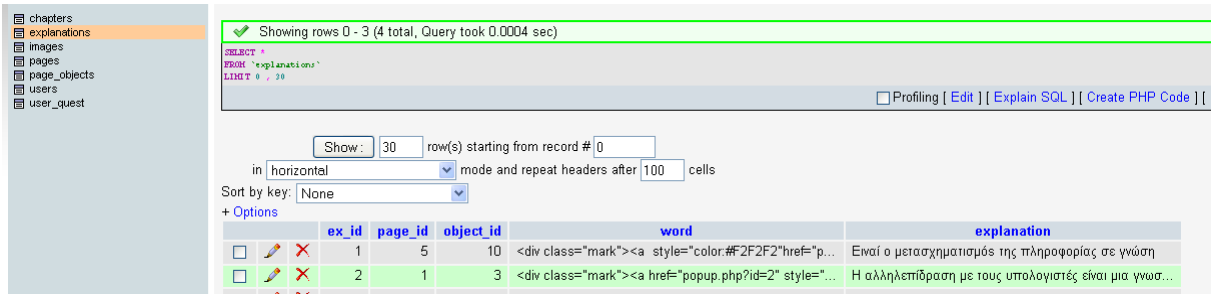


Figure 46:Explanations table

6. Chapters: The table Chapters holds information for each chapter of the learning environment ,each chapter has a unique value chapter_id(primary key).The Chapter table is related with page table with foreign key lastpage ,this attribute identifies which is the last page of each chapter.

7. Users_quest: The table Chapters holds the answers of the questionnaire. After user learns the lesson the user must answer a questionnaire for the content of the lesson. The answer of user is uniquely determined with the attributes user and question.

Note: Tables Pages and Page_objects are useful for adaptation of the learning environment that user navigates in.

5.3 Technologies

We choose mySQL to implement the Database. MySQL is a database. The data in MySQL is stored in database objects called tables. A table is a collection of related data entries and it consists of columns and rows. A database most often contains one or more tables. Each table is identified by a name. Tables contain records (rows) with data. A query is a question or a request. With MySQL, we can query a database for specific information and have a recordset returned. The MySQL database is very often used with PHP.

The implementations of the webpage's are done with PHP. PHP is a powerful tool for making dynamic and interactive Web pages. PHP is the widely-used, free, and efficient.
AJAX offers users a seamless way to work with your interface, no waiting for whole pages to load. jQuery has a set of tools to make it super simple to implement. We will walk you through how to use jQuery to connect to PHP so you can step up your user interface.
AJAX is a short hand for asynchronous JavaScript and XML. Which means that instead of waiting for the whole page to load, you can load only what you need to. So if you only need to update one small text part of your site, you don't have to worry about loading everything else on that page. A vast majority of sites use this technology now. Probably one of the most popular uses is an auto complete feature for the search box at Google and Yahoo.AJAX is based on JavaScript and HTTP requests and is a type of programming made popular in 2005 by Google (with Google Suggest).

XML (Extensible Markup Language) is a set of rules for encoding documents electronically. XML's design goals emphasize simplicity, generality, and usability over the Internet. It is a textual data format, with strong support via Unicode for the languages of the world. Although XML's design focuses on documents, it is widely used for the representation of arbitrary data structures, for example in web services.

There are many programming interfaces that software developers may use to access XML data, and several schema systems designed to aid in the definition of XML-based languages.

Chapter 6

System Evaluation

After the implementation of the system, the next step is evaluation. This chapter will describe the experimental evaluation of the system, which includes both the procedure followed and the results of evaluation.

6.1 Procedure

The experimental system evaluation took place 8 students, three males and five females. The first step is to construct their profile. For this purpose, they complement their 'traditional' characteristics and three questionnaires which determine their learning style and memory working. Then before proceeding we place the sensors in their hands. Specifically, the sensor for the measurement of the heart rate and blood volume pulse was placed on the middle finger of the left hand, while the sensor for measuring skin conductance was placed on the index and the third finger of left hand. We take measurements for 5 minutes .Then we record details of individuals in an excel file for each student such as age, profession, and computer knowledge level and anxiety declaration. After that each student navigates in the learning environment. When he finishes reading, the user proceeds with the exam, which he have to answer 12 multiple choice questions. Upon completion of examination process is completed.

6.2 Evaluation results

For each individual we capture his biometrical signals through sensors.

user_id	username	password	name	surname	cs1	cs2	memory	HR	BVP	Sc
konstantinou	konstantinou	konstantinou			1	5	1	0	0	0
philippos	philippos	philippos			2	6	1	76.8	70.486	1.52
cs06cg1	cs06cg1	cs06cg1			3	4	1	92.53	99.936	0.286
dorothi	dorothi	dorothi			1	5	0	72.113	68.842	3.381
marsty5	marsty5	marsty5			2	6	0	43.268	90.625	4.286
cs07on2	cs07on2	cs07on2			3	5	0	0	0	0
cs07cc8	cs07cc8	cs07cc8			3	6	1	0	0	0
grigoris	grigoris	grigoris			2	2	1	77.576	87.306	1.053

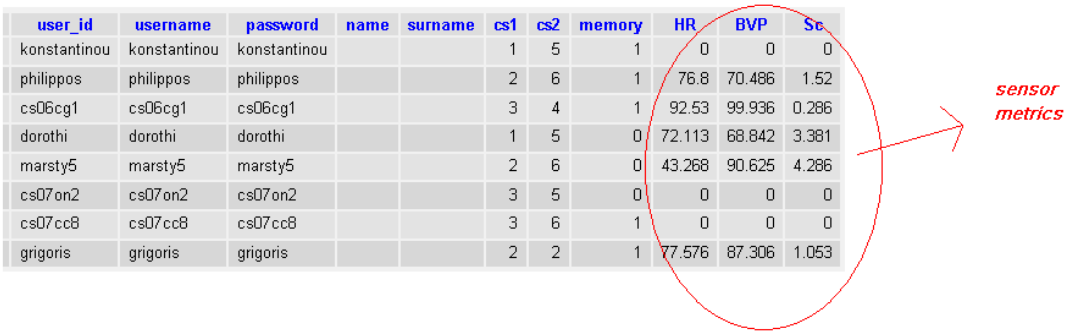


Figure 47 a): table with the biometrical signals for each user

After that they answer to learning style and working memory questionnaires from which we received the following information for each person.

Name	Age	Profession	Knowledge	Stress	Learning Time	Memory	visualizer/verbalizer	wholist/analyst	Grade/12	username	Gender
Maria Stylianou	21	4+ Year Student epl	High	Low	60 min	high	Verbalizer	Intermediate	9	marsty5	Female
Dora Grigoriou	23	Post-Student	High	Low	30 min	High	Visualizer	Analyst	6	dorothi	female
Filippos Antoniou	23	4+ Year Student	Low	Intermidiate	45 min	Low	Verbalizer	Intermediate	6	filippos	male
Georgia Christodoulidou	21	4+ Year Student epl	High	Low	30 min	Low	Intermidiate	Wholist	9	cs06cg1	female
Nicolas Odysseos	22	4+ Year Student epl	High	Low	60 min	High	Intermidiate	Analyst	8	cs07on2	Male
Constantina Constantin	20	3rd Year Student epl	High	Low	60 min	Medium	Intermediate	Intermediate	10	cs07cc8	Female
Grigoris Grigoriou	20	3rd Year Student	High	Low	30 min	Medium	Verbalizer	Intermediate	6	grigoris	male
Marios konstantinou	18	1st Year Student	Medium	Low	60 min	Low	Visualizer	Analyst	5	konstantinou	Male

Figure 47 b):the data for each user

The recorded data are: knowledge of computers (low-high), determine the current stress of the user, reading lesson duration ,working memory of the user(high,intermediate,low),his learning style(visualizer/verbalizer ,wholist/analyst) and the score that the user took from the lesson test(grade out of 12).

Chapter 7
Conclusions and Future Work

7.1 Conclusions

This paper describes the design and development of Intelisense System that includes accommodations for cognitive styles and the measurement of sentimental situation of a user in order to improve student interactions and learning outcomes. Also this research is attempt to examine some of the critical variables, which may be important in the design of an adaptive hypermedia system based on student's cognitive style, about the use of sensors in such system and includes information's about affective systems in general.

Based on the above evaluation we see that each person has his own way of learning and retention of the knowledge. The results of the course test are pretty good for each individual. Therefore, the presentation and the adaptation of the content for each type of user are helpful and productive. We note that the students read the lesson for the first time. For example if a user was visualizer shows images instead of text but if he was verbalizer shows text instead of images .Now if he is analyst we left him to navigate where he wants but if he is wholist then serve as a guide to navigation. Finally if he has low working memory we split up the content.

7.1.2 Future Work

The system can be extended in future by adding other courses such as Logic in Computer Science, Database Systems. At this points we have the mechanism of adaptation based on stress but is not integrated. At future we can find some scientific rules about how the stress is associated with heart rate, blood volume pulse and skin conductance. These rules determine whether the user is nervous**.** Also we can find content adaptations which reduce the stress of the user. If the user is stressed then we adapt the web environment with aim to reduce of user's stress.For example the adaptation of the content can be done a follows: if the user is stressed and visualizer we can view more pictures and if the user is stressed and verbalizer we change the font color and size for all the definitions and headers of the content.If the user is stressed and analyst we can guide the navigation of the user so we not let him to have access anywhere.

Appendix A

PHP codes

```
//if the working memory of the user is low then this function is called
 function
memo($q,$memo,$mcontent,$objects,$result,$sensor,$cognitive_style2,$totalp,$c){

  $count=0;
  //we select the half page objects of the requested page
while($row = mysql_fetch_array($result))
  {
if($memo==1){          ////if the working memory of the user is low then
   $count++;
    //we check if the user is anxious then we do the appropriate
    //adaptation on the content
    if($sensor==1)  {
    echo $row['content'] ;
    echo "<script>
    $('p.def').addClass('bT sT');
    var title = $('p').attr('id');
    $('h1').addClass('colorT');
    $('b').addClass('colorT');
    // $('p#p1').addClass('colorT');
    </script>";

    }
    else
      echo "<p style= font-size:16px;> " .$row['content']."</p>" ;

       $object_id=  $row['object_id'] ;
        echo"</br>";
        echo"</br>";
        if($row['type']=="img"){
        $page=$row['page_id'];
              $object_id=$row['object_id'];
              Print '<img src="insert.php?q='.$page.' & object='.  $object_id.'">';
```

```
        echo "<br/>";
        }
      }
 if($count==$objects)//if the count variable is equal with the half objects of the page
 break;                          //then stop printing objects

}

//if the user is wholist then the explanation of a link word
//appears in a tooltip
   if($cognitive_style2==4){

   echo "<script >
   $('a.popup').tooltip({cssClass:'tooltip-red'});
   </script> ";
   }
   //if the user is analyst or intermediate then the explanation of a link word
   //appears in a pop window
  else if($cognitive_style2==5 || $cognitive_style2==6){

  echo "<script type='text/javascript'>

  $('.popup').popupWindow({
  height:200,
  width:700,
  top:50,
  left:50
  });
   </script> ";
 }}

//if the working memory of the user is low and the user wants to
//to see the rest page objects of the requested page then this function is called
 function more($q,$memo,$mcontent,$objects,$result,$sensor,$cognitive_style2){
        $count=0;
        //we get the rest page objects of the requested page
```

```
        while($row = mysql_fetch_array($result))
        {
         if($mcontent==1)
          $count++;
          //echo"more";
        //echo  $count;
//print the rest objects, the object variable holds the number of half page objects
    if($count>$objects)  {

        echo "<p style= font-size:16px;> " .$row['content']."</p>" ;
         //we check if the user is anxious then we do the appropriate
         //adaptation on the content
         if($sensor==1)  {

            echo "<script>
            $('p.def').addClass('bT sT');

            var title = $('p').attr('id');
            $('h1').addClass('colorT');
             $('b').addClass('colorT');
             // $('p#p1').addClass('colorT');
              </script>
              ";

         }
         $object_id=  $row['object_id'] ;
         echo"</br>";
         echo"</br>";
         if($row['type']=="img"){
         $page=$row['page_id'];
               $object_id=$row['object_id'];
               Print '<img src="insert.php?q='.$page.' & object='.          $object_id.'">';
         echo "<br/>";
         }
       }
  }
```

```
//the content of the popup window or tooltip
expWord($id){
//the requested explanation is selected from the explanations table of the database
$pages= "SELECT * FROM explanations WHERE ex_id=$id";
$page=mysql_query($pages);
$rpage= mysql_fetch_array($page);


   //while($rpage= mysql_fetch_array($page){
 //}

echo "<p style='font-family:courier new; color:#000000; font-size:16px;'>".
$rpage['word']." </p>";
echo "<script type='text/javascript'>
$('a.word').attr ('href', '#');
</script>";
echo "  <div style='width:450px; height:178px; overflow:auto;'><p  font-size:14x;'>".
$rpage['explanation']."</p></div>";
}


//this function is called to show the title for each chapter and page
//this function gets the parameters:chapter id or page id,the cognitive style of the user
// and one flag .
function index($q,$cs2,$f){
//if the flag is 1 then the q variable identifies the chapter
//which the belonging to the requested page
if($f==1){
//we select the appropriate chapter
$chapters= "SELECT * FROM chapters WHERE chapter_id='".$q."'";
$chapter=mysql_query($chapters);
$rchapter= mysql_fetch_array($chapter);
//if the user is analyst then we select the simple title of the chapter
if($cs2=='5')
echo $rchapter['title'];
```

```
//if the user wholist or intermediate then we select the detailed title of the chapter
else if($cs2=='4'||$cs2=='6')
echo $rchapter['description'];
}
else{ //if the flag is 0 then the q variable identifies the requested page
$pages= "SELECT * FROM pages WHERE page_id='".$q."'";
$page=mysql_query($pages);
$num_of_objects=$rpage['page_content'];
   while($rpage= mysql_fetch_array($page))
      //if the user is analyst then we select  the simple title of the page
      if($cs2=='5')
      echo "<div id='exp' style='font-size:11px'>". $rpage['title']."</div>";
      //if the user wholist or intermediate then we select the detailed title
       //of the page
      else if($cs2=='4'||$cs2=='6' )
      echo "<div id='exp' style='font-size:11px'>". $rpage['description']."</div>";
  }
 }

Mechanism to adapt content based on stress
//this function is called when we want to check if the user is stressed
Function sensor ($user) {
 //*********************************************************************
 //From the USERS table of the database we select the record of the user
 //who logged in after that we get the sensor metrics which are in the
 //database
 //*********************************************************************
  $users= "SELECT * FROM users WHERE user_id='".$user."'";
  $r=mysql_query($users);
  $rus=mysql_fetch_array($r);
  //************************************************************
  //here is used a dummy condition to see if the user is anxious
  //here is checked the heart rate,the blood volume pulse and the
  //skin conductunce of the user
  //************************************************************
  if($rus['HR']>170 || $rus['SC']>5 || $rus['BVP']>90)  {
```

```
    return 1;
     }
 else
    return 0;
 }
```

ADMIN MANAGEMENT

```
//code for upload the sensor file of the user
 $target = "new/upload/";  //the file is upload to this path
 //the file name is saved in the variable $s
 $s=$_FILES['uploaded']['name'];
$file = basename($s, ".txt");
//echo $file;
//echo"</br>";
 $target = $target . basename( $_FILES['uploaded']['name']) ;
 $ok=1;
 if(move_uploaded_file($_FILES['uploaded']['tmp_name'], $target))
 {
 echo "The file ". basename( $_FILES['uploadedfile']['name']). " has been uploaded";
 }
 else {
 echo "Sorry, there was a problem uploading your file.";
 }

    //this function take the id of the user and the sensor metrics and
      //saved them in the system database
  function rulesB($user,$hr,$bv,$sc){
       // Connect to server and select databse.
       $con=mysql_connect("$host",     "$username",     "$password")or     die("cannot
connect");

       $heartR=floatval($hr);
       $bv1= floatval($bv);
      $sc1= floatval($sc);
      //sensor metrics are placed in the user table in database
```

```
      $result = mysql_query("UPDATE users SET HR='".$heartR."' ,BVP='".$bv1."' ,
Sc='".$sc1."'WHERE user_id='".$user."'")or die(mysql_error());
      $result = mysql_query("SELECT * FROM users")
      or die(mysql_error());
      // get the first (and hopefully only) entry from the result
      $row = mysql_fetch_array( $result );
      echo $row['user_id'];

      mysql_close($con);
      }

//the below code reads the metrics from the sensor file
$name=$file.".txt";
 $filename="new/upload/".$name;
$fh = fopen($filename, 'r');

$list=array();
 $theData="";
 while (!feof($fh)) {
       $theData = fgets($fh);
   list($BV, $HR, $SC)= explode(",",$theData);

    for ($i=0;$i<strlen($SC);$i++) {
     if (is_numeric($SC[$i]) || $SC[$i]=='.') {
     $sc=$sc.$SC[$i];            //read the value of ski conductunce
} }
       if (is_numeric($HR)){
            $H=$HR;  //read the value of heart rate
     }
        if (is_numeric($BV)) {
      $b=$BV;                 //read the value of blood volume pulse
     }}

 //call function to insert the metrics to the database
 rulesB($file,$H,$b,$sc);
```

```
//*****************************************************************
//This function is called when we want to import user profiles in the database
//this function gets the following parameters:the user id,if he is
//visualizer/verbalizer ,analyst/wholist and his memory working
//*****************************************************************
function addTo($user,$cs1,$cs2,$memo){
      // Connect to server and select databse.
  $con=mysql_connect("$host", "$username", "$password")or die("cannot connect");
  mysql_select_db("$db_name")or die("cannot select DB");
  die('Could not connect: ' . mysql_error());
  }
 $users= "SELECT * FROM users WHERE user_id='".$user."'";
 $r=mysql_query($users);
 $rows=mysql_num_rows($r);
 //echo $rows;
   //$rows=1;
   //if the user isn't in the database then the user and his characteristics are inser in the database
  if($rows==0){
  $sql="INSERT INTO users (user_id,username,password,cs1,cs2,memory) VALUES('$user','$user','$user','$cs1','$cs2','$memo')";
if (!mysql_query($sql,$con))
 { die('Error: ' . mysql_error()); }
 }
 else {
 //echo "user already exist";
  mysql_query("UPDATE users SET user_id='".$user."',username=".$user."',password=".$user."',cs1=".$cs1."',cs2=".$cs2."',memory=".$memo."'WHERE user_id='".$user."'")or die(mysql_error());
 }
 mysql_close($con);
  }
 //this url is communicate with Adaptive web
 //this url return an xml file with the characteristics of the user
```

```
//$url= " http://www4.cs.ucy.ac.cy/ekpaideion/getProfile.aspx?profileID=".$q;
$url="http://www4.cs.ucy.ac.cy/ekpaideion/getProfile.aspx?profileID=".$q;
  $objDOM = new DOMDocument();
 // the xml file is loaded
 $objDOM->load($url);
 $grade;

 //we get the data from the xml file
 $traditionalChars = $objDOM->getElementsByTagName('traditionalChars');
  foreach($traditionalChars as $value ){
  $gender = $value->getElementsByTagName("gender");
  $gen= $gender ->item(0)->nodeValue;
 $dateOfBirth = $value->getElementsByTagName("dateOfBirth");
  $db= $dateOfBirth ->item(0)->nodeValue;
  $profession = $value->getElementsByTagName("profession");
  $pr = $profession->item(0)->nodeValue;
   $computerKnowledge = $value->getElementsByTagName("computerKnowledge");
  $ck = $computerKnowledge->item(0)->nodeValue;
  }

 $uppcChars = $objDOM->getElementsByTagName('uppcChars');
  foreach($uppcChars as $value ){
    $styel = $value->getElementsByTagName("imagerVerbalizer");
  $s1= $styel ->item(0)->nodeValue;
       $stye2 = $value->getElementsByTagName("wholistAnalyst");
  $s2= $stye2 ->item(0)->nodeValue;
  $memo = $value->getElementsByTagName("workingMemory");
  $m  = $memo->item(0)->nodeValue;
  }

 //this function is called to insert the user characteristics to the database
  addto($q,$s1,$s2,$m);
```

Appendix B

In this appendix is the examination which the students must answer as completing the course material of human-computer interaction.

1. Με ποια σειρά γίνονται οι ενέργειες σύμφωνα με το μοντέλο του ανθρώπου ως επεξεργαστή πληροφορίας (HIPM);
    - Σύγκριση, Κωδικοποίηση, Επιλογή και Εκτέλεση
    - Κωδικοποίηση, Σύγκριση, Επιλογή και Εκτέλεση
    - Κωδικοποίηση, Επιλογή και Εκτέλεση , Σύγκριση
    - Σύγκριση, Επιλογή και Εκτέλεση, Κωδικοποίηση
    -

2.Σε ποια φάση της γνωστικής επεξεργασίας αντιστοιχεί το κινητικό υποσύστημα του ανθρώπου;
    - Κωδικοποίηση ερεθισμάτων
    - Σύγκριση/επιλογή απόκρισης
    - Εκτέλεση απόκρισης

3. Στη βραχύβια μνήμη:
    - η πληροφορία συντηρείται για μεγάλο χρονικό διάστημα
    - η πληροφορία συνητρείται για μερικά δέκατα του δευτερολέπτου
    - φυλάσσονται οι γνώσεις και οι εμπειρίες μας
    - η πληροφορία συντηρείται για μερικά δευτερόλεπτα

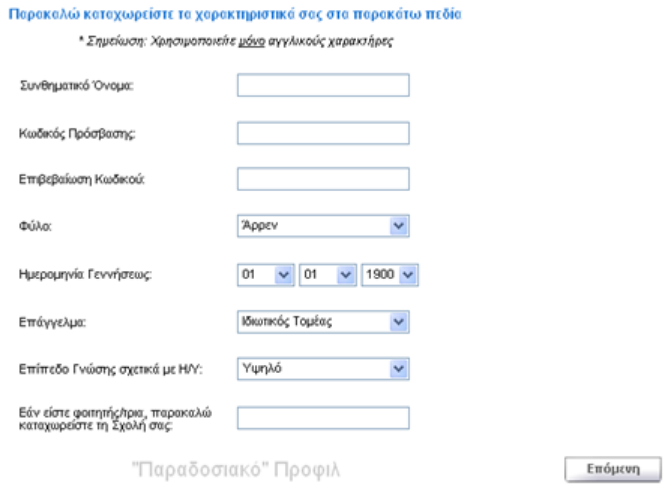
4. Ποιος από τους νόμους του Gestalt απεικονίζεται πιο κάτω:
    - Συμμετρία
    - Ολοκήρωση
    - Ομοιότητα
    - Συνέχεια

5. Λόγω των περιορισμών μνήμης, είναι καλύτερο η σχεδίαση διεπιφανειών να γίνεται με τέτοιο τρόπο ώστε να απαιτείται από το χρήστη αναγνώριση και όχι ενθύμιση. Για το σκοπό αυτό, χρησιμοποιούνται:
    - Μενού επιλογής
    - Εικονίδια
    - Εντολές
    - Όλα τα πιο πάνω
    - Μόνο τα (α) και (β)

6.Ποιες από τις πιο κάτω μεθόδους χρησιμοποιούνται για να επιτευχθεί η εστίαση της προσοχής του χρήστη κατά τη σχεδίαση διεπιφανειών:
    - η χρήση κίνησης και υπογραμμίσεων
    - η χρήση παραθύρων και χρωματικών βοηθημάτων
    - η χρήση ηχητικών σημάτων
    - όλα τα πιο πάνω
    - μόνο τα (α) και (γ)

7. Ένας από τους κανόνες σχεδίασης και δημιουργίας σωστών μοντέλων είναι η ταύτιση, που σημαίνει ότι:
    - τα αντικείμενα υπαινίσσονται τη χρήση τους
    - υπάρχει σαφής αντιστοιχία μεταξύ χειριστηρίων-λειτουργιών
    - τηρούνται οι φυσικοί - σημασιολογικοί περιορισμοί που αφορούν τα αντικείμενα
    - παρέχεται ανάδραση ως προς την κατάσταση του συστήματος όταν αυτή δεν γίνεται άμεσα αντιληπτή από το αποτέλεσμα του απευθείας χειρισμού

8. Ποιο στυλ αλληλεπίδρασης απεικονίζεται πιο κάτω:



- Πλαίσιο διαλόγου
- Φυσική γλώσσα
- Φόρμα
- Μενού επιλογής

9. Σύμφωνα με το μοντέλο διερευνητικής εκμάθησης, κατά την εκμάθηση μιας νέας συσκευής ή ενός υπολογιστικού συστήματος διακρίνονται τέσσερις επαναλαμβανόμενες φάσεις. Ποια από τις παρακάτω δεν ανήκει στις φάσεις του μοντέλου αυτού;

- Φάση Κωδικοποίησης
- Φάση Ορισμού Στόχων
- Φάση Εξερεύνησης
- Φάση Επιλογής
- Φάση Αποτίμησης-Εκτίμησης

10. Ποια από τις πιο κάτω ενέργειες γίνεται κατά τη φάση ανάλυσης αναγκών-απιτήσεων στη μεθοδολογία LUCID;

- Επέκταση των βασικών οθονών σε πλήρες σύστημα
- Οι χρήστες χωρίζονται σε ομογενείς ομάδες και γίνεται ανάλυση των χαρακτηριστικών Τους
- Ορισμός επιχειρησιακού στόχου
- Εκπαίδευση χρηστών για τη λειτουργία του συστήματος

11. Σε ποια φάση στη μεθοδολογία LUCID γίνεται η δημιουργία οδηγού στυλ αλληλεπίδρασης;

- Ανάπτυξη συστήματος
- Ανάπτυξη αρχικής ιδέας του συστήματος
- Ανάλυση αναγκών και απαιτήσεων
- Σχεδιασμός προϊόντος με πρότυπη βασική οθόνη

12. Η διαμορφωτική αξιολόγηση:

- γίνεται αφού ολοκληρωθεί η ανάπτυξη του συστήματος ώστε να μετρηθεί η ευχρηστία του σε σχέση με τις προδιαγραφές ευχρηστίας
- γίνεται πριν τεθεί σε λειτουργία το σύστημα ώστε να μετρηθεί η ευχρηστία του σε σύγκριση με άλλα ανταγωνιστικά συστήματα
- έχει ως στόχο τη βελτίωση της ευχρηστίας του συστήματος και γίνεται κατά τη φάση ανάπτυξης του προϊόντος
- αφορά το ολοκληρωμένο προϊόν και γίνεται συνήθως πριν τεθεί σε λειτουργία το σύστημα

Bibliography

[1] Juan Mart_ınez-Miranda, Arantza Aldea, “Emotions in human and artificial intelligence”, Computers in Human Behavior 21 (2005) 323–341.

[2] Robin Kaiser, Karina Oertel, “Emotions in HCI – An Affective E-Learning System”,Australian Computer Society, Inc, Conferences in Research and Practice in Information Technology (CRPIT), Vol.56.

[3] Jenni Anttonen, Veikko Surakka, “Emotions and Heart Rate while Sitting on a Chair”, CHI 2005, PAPERS: Affect and Intimacy April 2–7, Portland, Oregon, USA.

[4] Hua Wang, Helmut Prendinger, Takeo Igarashi, “Communicating Emotions in Online Chat Using Physiological Sensors and Animated Text”, CHI 2004, Late Breaking Results Paper 24-29 April, Vienna, Austria.

[5] Richard L. Hazlett, “Measuring Emotional Valence during Interactive Experiences: Boys at Video Game Play”, CHI 2006 Proceedings, Novel Methods: Emotions,Gestures, Events April 22-27, 2006, Montréal, Québec, Canada.

[6] Gabriel Y., Griffiths D.S., “Emotion, learning and organizing”, The Learning Organization, Vol. 9, Num. 5, 2002, pp. 214-221.

[7] Kevin N. Ochsner and James J. Gross, “The cognitive control of emotion”, TRENDS in Cognitive Sciences Vol.9 No.5 May 2005.

[8] Karpouzis K., Drosopoulos A., Ioannou S., Raouzaiou A., Tsapatsoulis N. and Kollias S., “Facial and Body Feature Extraction for Emotionally-Rich HCI”, Mehdi Khosrow-Pour (ed.), Encyclopedia of Information Science and Technology, Idea Group Publishers, pp. 1180 - 1185, 2005.

[9] Catherine L. Wang, Pervaiz K. Ahmed, “Emotion: the missing part of systems methodologies”, Journal: Kybernetes, 2003, Volume: 32, Issue: 9/10, Page: 1283 – 1296

[10] R.D. Ward, P.H. Marsden, “Physiological responses to different WEB page designs”,Int. J. Human-Computer Studies 59 (2003) 199–212.

[11] N. Fragopanagos, J.G. Taylor, “Emotion recognition in human–computer interaction”, Neural Networks 18 (2005) 389–405.

[12] Keith Oatley, “The bug in the salad: the uses of emotions in computer interfaces” Interacting with Computers 16 (2004) 693–696.

[13] Picard R., Klein J., “Computers that recognize and response to user emotion: theoretical and practical implications”, Interacting with Computers 14 (2002) 141-169.

[14] Klein J., Moon Y., Picard R.W., “This computer responds to user frustration: Theory, design and results”, Interacting with Computers 14 (2002) 119-140.

[15] Eerik Vesterinen, “Affective Computing”, Interacting with Computers 14 (2001)

[16] Evangelos Triantafillou, Andreas Pomportsis, Elissavet Georgiadou, AES-CS: “Adaptive Educational System based on Cognitive Styles”,

[17] Evangelos Triantafillou1, Elissavet Georgiadou2, Anastasios A. Economides3, “Adaptive Hypermedia Systems: A review of adaptivity variables”, Technologies of Information and Communication Technologies in Education, 2006.

[18] Rosalind W. Picard,” AFFECTIVE COMPUTING FOR HCI”,

[19] Cary Cherniss,” Emotional Intelligence: What it is and Why it Matters”, 2000

[20] Eklund,Zeiliger,”ADAPTIVE HYPERMEDIA & ONLINE LEARNING”, (1996)

[21] Kerry O’Regan, “EMOTION AND E-LEARNING”**,** Learning and Teaching Development Unit,University of Adelaide South Australia, Australia 2005,

[22] Robert Sylwester, “How Emotions Affect Learning”,

[23] Tomás Kubes ,”Adaptive Hypermedia e-Learning Systems”

[24] Panagiotis Germanakos, Nikos Tsianos, Zacharias Lekkas, Constantinos Mourlas1, Mario Belk, George Samaras, **“**Towards an Adaptive and Personalized Web Interaction using Human Factors”

[25] Juan Mart_ınez-Miranda *, “Arantza Aldea,Emotions in human and artificial intelligence”, Computers in Human Behavior 21 (2005) 323–341.

[26] Shlomo Hareli, Noga Shomrat and Nahum Biger, “The role of emotions in employees’ explanations for failure in the workplace”, Journal: Journal of Managerial Psychology, 2005, Volume: 20, Issue: 8, Page: 663 – 680.

[27] Jeffery D. Wilfong, “Computer anxiety and anger: the impact of computer use, computer experience, and self-efficacy beliefs”, Computers in Human Behavior 22 (2006) 1001–1011.

[28] John D. Mayer, Peter Salovey, “Emotional intelligence and and regulation of feelings”, Applied & Preventive Psychology 4:197-208 (1995).

[29] Moshe Zeidner, Inbal Shani-Zinovich, Gerald Matthews, Richard D. Roberts, “Assessing emotional intelligence in gifted and non-gifted high school students: Outcomes depend on the measure”, Intelligence 33 (2005) 369–391.

[30] K.V. Petrides, Norah Frederickson, Adrian Furnham, “The role of trait emotional intelligence in academic performance and deviant behavior at school”, Personality and Individual Differences 36 (2004) 277–293.