A·L·I·C·E
Adaptive Learning via Intuitive/Interactive Collaborative and Emotional systems

Project Number:	**257639**
Project Title:	ALICE: ADAPTIVE LEARNING VIA INTUITIVE/INTERACTIVE, COLLABORATIVE AND EMOTIONAL SYSTEMS
Instrument:	Specific Targeted Research Projects
Thematic Priority:	ICT-2009.4.2:Technology-Enhanced Learning
Project Start Date:	June 1st, 2010
Duration of Project:	24 +2 Months
Deliverable:	D2.2.2 – Management of Emotional-Affective feedback v2
Revision:	2.0
Work package:	WP2: Affective and Emotional Approaches
Dissemination Level:	Public
Due date:	January 31st , 2012
Submission Date:	January 31st , 2012
Responsible	CRMPA
Contributors:	UOC, TUG Contractors

PROJECT CO-FUNDED BY THE EUROPEAN COMMISSION WITHIN THE SEVENTH FRAMEWORK PROGRAMME (2007-2013)

SEVENTH FRAMEWORK PROGRAMME

Version History			
Version	**Date**	**Changes**	**Contributors**
0.1	24/02/2011	Initial version	CRMPA
0.2	28/03/2011	Changes in structure after internal revision	CRMPA
0.3	12/04/2011	Changes after incorporation of input provided by UOC	UOC
1.0	30/04/2011	Feedback from partner review	CRMPA
1.1	22/12/2011	Chapters 5 (Analysis of existing Questionnaires), 2.2.5 (Implicit Assessment)	TUG
1.2	15/01/12	Contribution to Chapters 2 and 5	UOC
2.0	31/01/2012	Final revision and finalization to review process	CRMPA

Table of Contents

1. Introduction

1.1 Purpose

This document presents the results as part of the activities carried out in Task 2.2, in particular of the Sub-tasks 2.2.1 and 2.2.2:

- *Sub-task 2.2.1: "Definition of models for emotions and affectivity representation";*
- *Sub-task 2.2.2: "Definition of methodologies for emotional and affective feedback management".*

The overall aim of Work Package 2 is to study models, methods and tools useful in the management of emotional-affective aspects in Intelligent Tutoring Systems (ITS). In particular, the objective is to recognize and stimulate the emotivity/affectivity of learners to improve their learning process and to enhance their learning efficiency. This document presents the results of Task T2.2 "*Management of Emotional-Affective feedback in the learning Experiences*". This task aims to study and analyze ITS-learner interactions. Moreover this task designs tools to support an Affective-Emotional-ITS. To achieve these objectives it is necessary to identify and to assess the current emotional state of a user and to interpret and characterize the information describing them for later use. Indeed, if an unfavorable affective / emotional state (regarding an efficient and sustainable learning process) is detected it is necessary to provide interventions that aim at enhancing the affective/emotional state.

1.2 Methodology

In order to achieve the aims of Task 2.2, we propose a model to represent and manage affective / emotional feedback. This model represents a set of emotions which is assumed to play a major role for learning processes. The emotions are to be identified during the learning phase. To achieve these objectives, we have considered primarily:

- Methods and techniques to assess and identify affectivity/emotivity in ITS,
- Feedback management derived by the detection of user's affective states in ITS.

First of all we describe the main tools and techniques to assess and identify the emotional state of a user, afterwards the main techniques to manage feedback, and finally, we describe our model to represent emotivity/affectivity.

1.3 Document Overview

In Chapter 2 we present a review of the main methods and techniques to identify emotivity/affectivity in ITS, after presenting a brief introduction on modeling of emotions.

In Chapter 3 we present a brief overview of the current state of the art on feedback management derived by the detection of user's affective states.

In Chapter 4 we present our model to represent the state and to provide emotional feedback. Additionally we describe a method to identify the emotional state through questionnaires.

2 State of the art on techniques for emotion detection

2.1 Modeling Affect

Research literature has produced successful recognition techniques that classify physiological and neurophysiological signals, behavioural data and text/speech characteristics into different emotions. Many of the channels that people use to form impressions of each other's emotions have been explored (e.g. facial expressions, paralinguistic cues, gestures, choice of words and actions). Multimodal integration seems the likeliest key to real improvement concerning the validity of classification. By combining signals from different modalities, researchers try to mine patterns of emotions that classify sequences of affective events. Philip Goldin and his team [1] employed functional magnetic resonance imaging to examine the neural bases of two common emotions, amusement and sadness (figure 2-1). They used a set of nine 2 minutes long lasting film clips to induce amusementand sadness additionally to neutral film clips. Their findings shed light into the relationship between emotion-specific temporal dynamics and the sensitivity of different data analytic methods for identifying emotion-related neural responses.

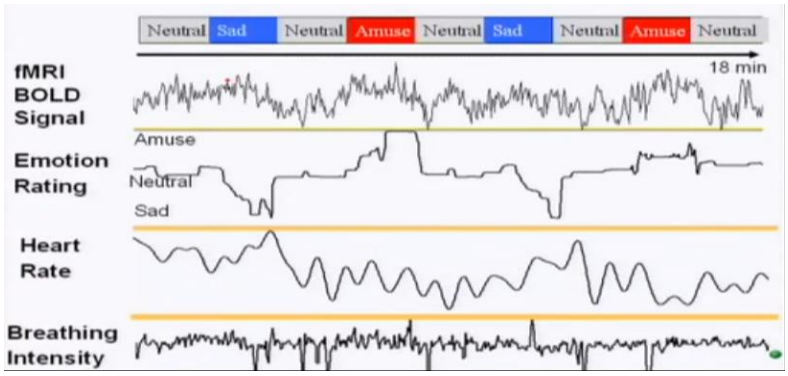

Figure 2-1- Four-channel emotion measuring (Goldin, et al. 2005).

Gratch & Marsella [2] have implemented a computational model of emotion called EMA (**EM**otion and **A**daptation). EMA processes by modelling a naturalistic emotional situation that involves both, rapid and slower emotional responses, respectively (see figure 2-2).

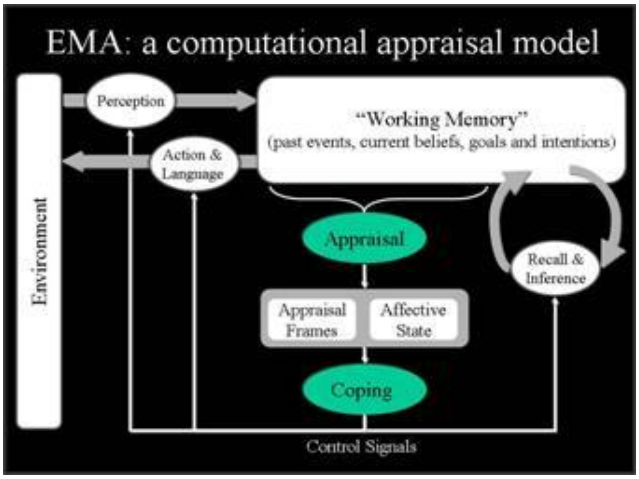

Figure 2-2 - EMA: A computational model of appraisal [2].

The emerging field of Affective Computing (AC) aims to glose the communicative gap between humans´s emotions and emotionally challenged computers by applying systems that recognize and adapt to the user´s affective states. (https://sites.google.com/site/flairs24affectivecomputing/)

Despite the vast literature on emotion and affective sciences [3], the AC literature was driven primarily by scientists and researchers in artificial intelligence who were agnostic to disputes concerning the underlying psychological theory. Instead, they focused their efforts on the technical challenges of developing affect-sensitive computer interfaces. However, ignoring the important debates leading to significant limitations as a practical application of AC can never be completely separated from the emotional theory on which it is based. The theory of emotions in the design of AC systems is not only informative, but probably necessary to expertly integrate more computer scientists. Effective design of these systems will rely on interdisciplinary collaboration and active participation of knowledge. New perspectives for the detection of emotion vary in many disciplines from psychology and neuroscience to computer engineering. Innovative research continues to address the perennial questions to understand what emotions are as well as questions relating to the accurate detection of emotions. In section 3.1 we briefly describe the perspectives used in the literature to describe this complex issue and fundamental scientific concept of emotions.

2.2 Methods and techniques for detection of Affectivity/Emotivity

In this section we focus on the main techniques to identify and assess affective / emotional state. These methods are numerous, e.g. voice, facial expression, physiology, body language, tests, etc… Each mode has advantages and disadvantages to its use as a vital channel of detection of affection. Some of the factors that enhance the value of a particular mode include:

1. The **validity** of the signal as a natural way to identify an affective state,
2. The **reliability** of signals in real environments,
3. The **temporal resolution** of the signal as it relates to the specific needs of the application,
4. The **costs and intrusiveness** to the user.

According to Zimmermann (2008) and Wong (2006), affect detection tools should ideally be:

1. *Objective*: The respondent's emotion assessment is not influenced by the emotion capturing process.
2. *Unobtrusive*: User's experience of the medium.
3. *Non-invasive*: Realistic use in education setting.
4. *In parallel with the task*
5. *Inexpensive*
6. *Need no expertise* to capture the emotion signals
7. *Language & Culture-free*: Can be used universally
8. *Clean*: No need for data-cleaning

Emotion Assessment tools - How to measure

Emotion measurement tools can be grouped into three areas (Feidakis, Daradoumis, & Caballé, 2011b): *Psychological, Physiological* and *Behavioural*. Each group has its strengths and weaknesses and the final choice depends on the *educational settings* (in lab, learning, class, test), the *issues* of measurement we want to cope with (*consciousness*, *duration*, *distinction*), the *time* and *money* that we are able to spent, and in some cases, the *independent variables* we wish to investigate (gender, student's academic level, location of residence, parents' educational level, etc.). In the majority of the studies, multimodal integration is preferred (combination of the three methods).

i. Psychological tools (self-reporting)

They originate from Clinical Psychology and employ verbal and non-verbal descriptions of emotions. They are inexpensive tools that measure the subjective experience of emotions in an unobtrusive and non-invasive. It is the only way to measure user's subjective feelings, although users are often reluctant to disclose their inner feelings to researchers in order to avoid embarrassment (Wong, 2006). They cannot be easily used in parallel with the user task, only in very specific cases where mannequins and imaginaries are used for quick and short answers.

ii. Physiological tools (use of sensors)

By using sensors, scientists are able to measure subject's physiological reactions. Usually, the subject's affective state is projected in an emotional space, determined by emotional dimensions (arousal, intensity, control etc.). Research findings, however, have shown that they are more reliable for arousal than for emotional valence (Zimmermann, 2008). Most of these measures based on recordings of electrical signals produced by brain, heart, muscles, and skin.

iii. Motor-Behavioural tools (observation)

Motor-behaviour expression is the most common way humans employ to evaluate one's affective state in everyday life (Wong, 2006). These tools measure behavioural expressions and changes in physical body states that communicate one's emotion experience. Their major asset is that they provide the ability to evaluate subject's affective state by using traditional devices like a PC camera or a microphone, or the traditional mouse and keyboard, though special software is needed (Zimmermann, 2008). This area also uses sensors that are less obtrusive and invasive and more discreet than the physiological tools.

Time factor-When to measure

Despite the few attempts to understand and define *emotion*, *affect* or *mood,* scientists are still lacking from a widely acceptable definition. *Emotion* is usually an intense experience of short duration -

seconds to minutes - and the person is typically well aware of it. *Affect* is a synthesis of all likely effects of emotion. *Feeling* may have various levels of intensity, and its duration depends on the length of time that the representation of the object remains active in the mind of the individual. *Mood* tends to be subtler, longer lasting, less intensive, more in the background, giving the affective state of a person a tendency in positive or negative direction (Davou 2007; Zimmermann, 2008).

In respect to *state* Vs *trait* emotion, the former are usually characterized by short times and scalability, whereas the latter are more long-lasting and more difficult to change.

The user's affective state can be evaluated into three time-shares:

- *Prospective - before the task*: In this phase, we are more interested in the respondent's mood, and disposition. For example, positive mood fosters holistic, creative ways of thinking (Pekrun, 2011). On the other hand, negative mood create a pessimistic perceptual attitude, diverting the learner's attention to aspects irrelevant to the task, which activate intrusive thoughts that give priority to a concern for a well-being rather than for learning (Boekaerts, 1993). Self-reporting is the best way to measure the user's subjective feelings, their inner perceptions, and although lacks in objectivity, it is still an easy, inexpensive, and rapid way to evaluate mood. Groups and roles in subsequent collaborative tasks can be based on the prospective assessment of their affective state.
- *Real-time - in parallel with the task:* Identifying the emotional state of the respondent who accomplishes a task. Sensors or cameras are often occupied to capture emotion signals though are considered obtrusive or even invasive. On the other hand, self reporting diverts the user's attention to aspects irrelevant to the task. Non-verbal tools that provide short answers are highly recommended.
- *Retrospective – after the task or in deferred time (past sessions):* This is the evaluation of the user's affective state after the accomplishment of the task. Deferred time usually refers to the identification of the respondent's emotional state by his/her content only. Sentiment Analysis & Opinion mining techniques can classify posts based on their affective content.

2.2.1 Facial Expression

This technique of detection of affect is generally based on a consideration of emotions as a behavioral aspect. Most research has focused on this method of detection of affect to determine the emotional state of an individual. This methodology is based on the consideration that each distinct emotion is related to basic facial expressions [4] [5]. Ekman and Friesen [6] have built a facial action coding system (FACS) to measure the activity of the facial with AU[1] (Action Unit, see figure 2-3) that is objective components of facial movements. With this technique they describe facial expressions with six basic emotions: joy, anger, surprise, disgust, fear and sadness.

[1] Action units (AUs) represent the muscular activity that produces facial appearance changes --defined in Facial Coding System by Ekman and Friesen[6].

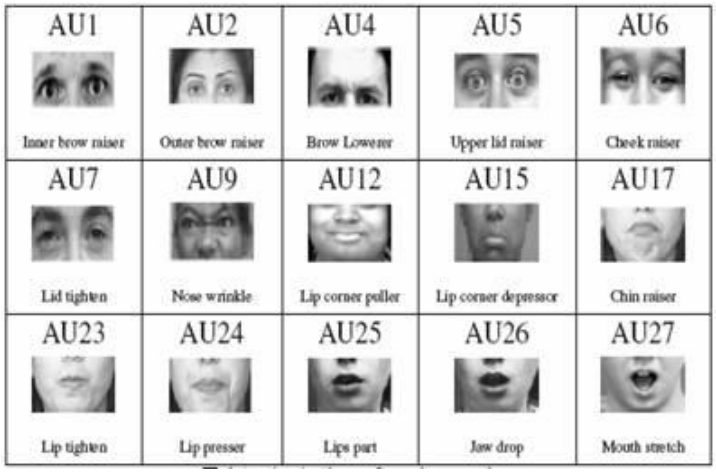

Figure 2-3 Examples of some action units extracted from Cohn and Kanade's database [59]

One area of recent progress in this area is the search through the video analysis to identify the Action Unit. This field, although progress had faced considerable difficulties because of the enormous amount of time required to segment the video and compare the AU with a series of static images representing expressions.

Recently, Zeng et al. [7] have made a review of the 29 most recent vision-based detection methods of affect. which highlights important information about the current detection systems based on the vision of affect. First, this analysis showed that all systems are focusing solely on the six basic emotions, regardless of whether or not they may be important for affective computing. Another important observation is that most systems are based on facial expressions, making it difficult to apply this detection method to real-world scenarios.

Finally, the most serious limitation of the systems analyzed is the fact that only 6 of the 29 systems could operate in real time, which is an obvious prerequisite for the practical applications of AC.

2.2.2 Voice

The voice sends explicit messages of emotional information through either through the content of what has been said or through paraverbal information characterising how it has been said (e.g. tone, speed, etc.). An extensive analysis of the literature on voice communication of emotion has produced some conclusions with important implications for AC applications [8], [9]. First, the affective information can be encoded and decoded through verbal and paraverbal cues of language. The most reliable finding is that the tone appears to be an index of arousal. In addition, the accuracy rate in detecting the love with your voice is slightly lower than the accuracy rate of facial expression detection. Sadness, anger, fear are the emotions which are recognized with high accuracy through voice, disgust is the worst. Finally, there is ambiguity about how different paraverbal characteristics communicate different emotions. The recent review of different audio based affect recognition applications by Zeng et al. [7] shows that systems based on speech recognition are more likely to meet the needs of real-world applications.

2.2.3 Body Language and Posture

The detection systems prefer voice over body language and posture although there are some advantages of using posture as a mean to diagnose a user's affective states [10], [11] [12]. In fact, Human bodies are relatively large and have more degrees of freedom, giving them the ability to take on a myriad of unique configurations [13], and all the positions and gestures are potential cues of

affective communication. One advantage of the detection of affect through the analysis of posture, movements and gestures is that it is not as susceptible to influence as facial expressions or voice. The first who considered this type of analysis were Mota and Picard [14] with their "*Tekscan Body Pressure Measurement System (BPMS)*" that allows to infer the emotional state of a user in a learning environment. The application fieldof this kind of dection-system to be growing [15] [16]. The analysis of posture and non-intrusive monitoring are a fertile field for research, but the costs of equipment to implement this type of analysis makes it difficult to spread even if the recent progress of gestural interfaces can open up new opportunities.

2.2.4 Text

The first work to understand how people express emotions through written text, or how provided text which triggers different emotions, was conducted by Osgood et al. [17] [18]. Osgood has used multidimensional scaling (MDS[2]) to create displays emotional words and their classification based on the similarity between words. The set of words have been provided to and rated by people from different cultures. The words can be thought as points in a multidimensional space, and similarity is operationalized by the distance between a pair of words. MDS designs these distances of points in a small space (usually two or three dimensions).

The dimensions that emerge, as found by Osgood were: "evaluation," "potency," and "activity". The evaluation quantifies how a word refers to an event that is pleasant or unpleasant. Thus, this dimension is similar to hedonic valence. The power quantifies how a word is associated with a level of intensity, particularly a level of intensity strong against a weak. The activity relates to whether a word is active or passive. These dimensions are qualitatively similar to the circumplex model of emotion [59] which includes valence and arousal. These two dimensions are considered as fundamental for describing affection [19], [20].

More recently, Samsonovich and Ascoli [21] have used French and English dictionaries to produce *"conceptual maps of value"*, a kind of *"cognitive map"* similar to Osgood and found the same set of underlying dimensions as [17] [18]. Another line of research concerns the lexical analysis of text to identify words that are predictive of emotional states of speakers or writers [22] [23] [24] [25] [26] [27]. Many of these approaches are based on linguistic research. For example, the Linguistic Inquiry and Word Count (LIWC) [29] is a validated computer tool that analyzes the body text using the dictionary-based categorization.

Methods of affect-detection based on LIWC attempt to identify specific items that are expected to reveal the emotional content in the text [22] [24] [27]. For example, first person singular pronouns in texts (e.g., "I" and "me ") have been linked to negative feelings [28] [30].

Sentiment analysis

Text is an important modality for sensing affect because the bulk of computer user interfaces today are textually based (Valitutti, Strapparava, & Stock, 2004). In sentiment analysis, opinions with regards to an entity are classified on a scale similar to the valence used in emotion models (Calvo, 2009). Text is classified by its overall sentiment, for example determining whether a review is positive or negative.

A typical approach to sentiment analysis is to start with a lexicon of positive and negative words and phrases. In these lexicons, entries are tagged with their a priori prior polarity. Second step of the

[2] Multidimensional scaling (MDS) is a term encompassing a family of algorithms that allow a given set of stimuli to be analyzed, when the data take the form of differences perceived between pairs of stimuli. A general goal, shared by MDS methods, is to represent the stimuli as points in a spatial model—a map—so that the distances between points correspond as closely as possible to dissimilarities between stimuli.

analysis goes deeper in the *contextual polarity* of a phrase in which a word appears may be different from the word's prior polarity. Contextual polarity may be influenced by (Wilson, Wiebe & Hoffmann, 2005):

- Negation: local (e.g., not good), or longer-distance dependencies such as the negation of the proposition (e.g., does not look very good) or the negation of the subject (e.g., no one thinks that it's good). In addition, certain phrases that contain negation words intensify rather than change polarity (e.g., not only good but amazing).
- Modality (e.g., whether the proposition is asserted to be real (realis) or not real (irrealis) – no reason at all to believe is irrealis, for example)
- Word sense (e.g. "Environmental Trust" versus "He has won the people's trust").

Affective text sensing systems are programs for assessing the affective qualities of natural language. Analysis is taken place either in document level or in per subject-spot or phrase and word level. For example, ReviewSeer (Dave, Lawrence, & Pennock, 2003) is a document level sentiment classifier, while Sentiment Analyzer (Yi et al., 2003) and the GATE annotation system (Wilson, Wiebe & Hoffmann, 2005) classify the contextual polarity of sentiment expressions. In Liu et al. (2003), the affect of the text, at the sentence level, is classified into one of six basic categories of emotion.

In their Sentiment Analyzer, Yi et al., (2003) detect all references to the given subject, and determine sentiment in each of the references using natural language processing (NLP) techniques.

In GATE, Wilson, Wiebe and Hoffmann (2005) have suggested a two-step process that employs machine learning and a variety of features. The first step classifies each phrase containing a clue as neutral or polar. The second step takes all phrases marked in step one as polar and disambiguates their contextual polarity (positive, negative, both, or neutral). In their experiments they have added contextual polarity judgments to existing annotations in the Multi-perspective Question Answering (MPQA) Opinion Corpus. They have also developed the GATE annotation scheme for marking the contextual polarity of subjective expressions.

The Wordnet Affect (http://wndomains.fbk.eu/wnaffect.html) is a hierarchical thesaurus of affective domain labels in which affective concepts are annotated. It is an extension of WordNet Domains, a large scale Lexical Knowledge Base (LKB). It is provided free of charge for educational and research purposes, under a strict licensing scheme.

2.2.5 Implicit Assessment

The aim of an implicit assessment technique is to assess the learner´s emotional state without disturbing the learning process. The rationale behind this is that learning might be interrupted if emotional states are assessed by, e.g., self-report measures, because they pop up while the individual is pre-occupied with the learning material. As a consequence, the otherwise successfully going learning process is interrupted. The kind of implicit assessment we have in mind, also known as non-obtrusive or non-invasive assessment is based on the observation and interpretation of the learner´s actions and interactions with the e-learning application. Examples for such e-learning environments are serious game and learning management systems such as the Intelligent Web Tutor (IWT). These actions and interactions are called Behavioural Indicators. This kind of implicit assessment has been applied in the context of game based learning and described by [60], [61], and [62].

The prerequisite for making use of such Behavioural Indicators in order to carry out an implicit assessment of the emotional state is that the IWT component tracks the learner´s (or user´s) actions and interactions by means of Log-files. This tracking of the user's behaviour within the management system can be realized with built-in mechanisms, routines, or components, respectively. The

component extracts and interprets the relevant Log-files. When we talk about interpretation of the Log-files, we mean that the Behavioural Indicators are assessed and subsequently mapped onto the emotional model. Finally, as it will be described in section (assessment procedure) it is necessary that one single component or a set of more components carry out quite simple calculations, including statistical analyses (e.g., means, standard deviations, etc.). However, first of all we will start with a description of the underlying emotional model.

2.2.5.1 Emotional Model

The implicit assessment described by [60], [61], and [62] measures emotional states based on the circumplex model of emotion proposed by [63]. The circumplex model consists of the two continuous dimensions: Pleasantness and Activation. Pleasantness, also called valence or hedonic value [64] is considered as a bipolar dimension with the two poles pleasantness and unpleasantness. Activation, also called arousal, is considered as a unipolar dimension with the poles of low and high activation [65]. Each emotional or affective state can be described in terms of these two dimensions. For example, the emotional state of excitement could be characterized as a combination of a highly activated and pleasant state [63]. The effect of emotion as state (in particular valence) on learning and memory processes is quite complex and further described by [66]. However, referring to activation, research indicates unambiguously that a medium level of activation leads to a superior learning process in terms of efficiency and sustainability as contrasted with too high or too low activation levels [67]. The circumplex model of emotion is shown in **Errore. L'origine riferimento non è stata trovata.**, with 2 dimensions resulting in four basic (prototypical) emotions or emotional states.

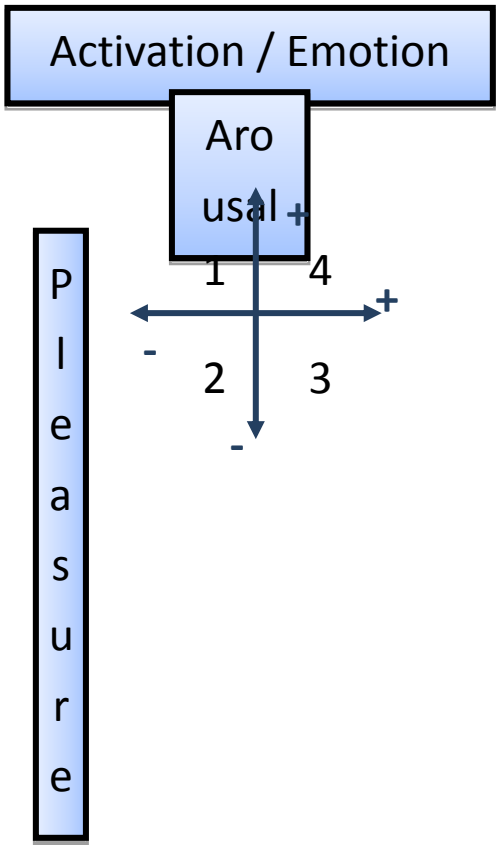

Figure 2-4 Basic Emotions resulting from the Factors Pleasure and Arousal

(1): High arousal / displeasure:

The learner is stressed.

(2): Low arousal / displeasure:

The learner is depressed or bored.

(3): Low arousal / pleasure:

The learner is relaxed.

(4): High arousal / pleasure:

The learner is positively excited.

In this case, the emotional model is continuous, i.e. there are - at least theoretically - an infinite number of emotional states in the bi-dimensional space possible. In ALICE, the emotional model is based on the assessment of a finite set of distinct emotions. Although the approach of assessing distinct emotions by dimensional ratings might seems problematic at first sight, the problem evades on a closer look which reveals that those two approaches are not necessarily incompatible. For example, if it is planned to apply a model based on distinct emotions, the model shown in **Errore. L'origine riferimento non è stata trovata.** can be "mapped" on a set of distinct emotions. Each distinct emotion (e.g. anger) can be described as a particular point (or area) in the bi-dimensional space (it is likely in the field (1) in the figure above; i.e. anger is an unpleasant and aroused emotional state). Examples of such mappings are provided in the following figures.

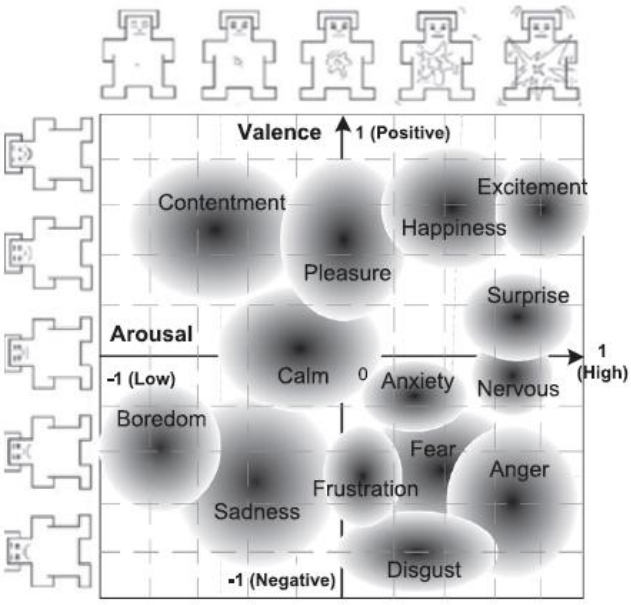

Figure 2-5 Emotion rating map with Self-Assessment Manikin (figure taken from [68])

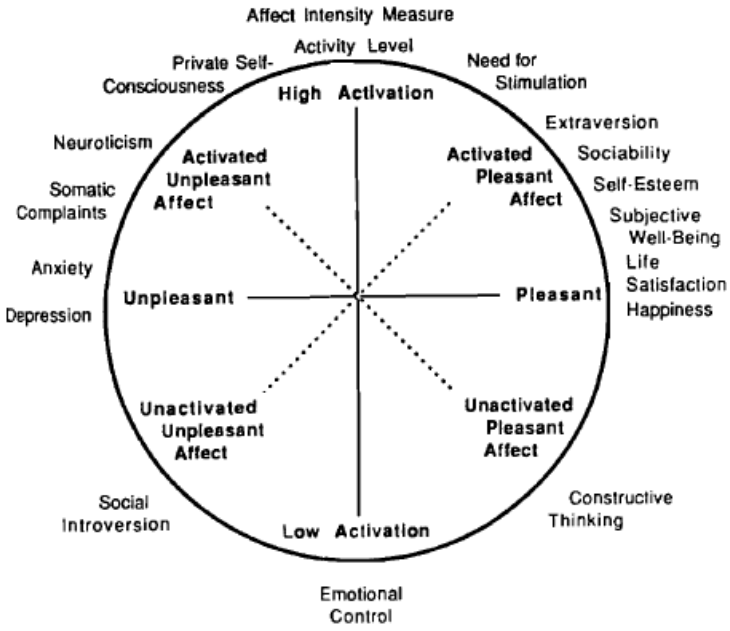

Figure 2-6 Location of Personality Variables (i.e. emotions as traits) in the circumplex space (figure taken from[63].

2.2.5.2 Behavioural Indicators

As mentioned above, we understand Behavioural Indictors (BIs) as actions and interactions of the learner within the IWT platform. Those actions and interactions are observed and interpreted in terms of the underlying emotional state, i.e. the BIs deliver the input variables for the assessment of valence and activation.

The basic (simplified) assessment procedure is as follows. The raw values of the BIs (e.g., engagement times, latency times, total amount of actions/interaction, etc.) are registered and saved in Log-files over a certain, predefined period of time. This period of time is called “time-slice”. The overall time the learner is engaged with the IWT is divided into equally long lasting time slices (e.g. 30 seconds for each time slice). The first time slice starts when the learner accesses the IWT and consecutive time slices of 30 seconds are created throughout the IWT session. Within each time slice, the BIs are observed and “stored”. At the end of each time slice, BIs are summarized and one score is calculated for further analyses. This score is used to estimate the levels of activation and valence per time slice. This method ensures that the changes in the emotional states can be registered and interpreted. A more detailed description of this assessment procedure is provided in section 4.5.

A majority of the BIs are derived from the Information Foraging Theory [67]. Thus, we start with a short description of this theory and its underlying principles.

2.2.5.3 Concepts of Information Foraging Theory

The theory of information foraging [67] aims at describing and understanding the strategies that people employ in order to seek, gather and consume information, for instance during the task of finding relevant information in an Learning Management System (LMS). Human search behaviour is regarded as adaptive to our environment in order to extract or gain information from external sources effectively and efficiently. External sources are called patches, for example documents (such as presentations or documents in the IWT). Especially in the context of ill-defined problems (e.g. acquiring appropriate knowledge for writing a scientific paper), an ideal information forager maximizes the rate of gaining valuable information by seeking for a balanced ratio of explorative and exploitative search behaviour. In order to acquire knowledge efficiently, available time has to be divided into the

search for new sources bearing valuable information (e.g. a scientific paper) as well as into the elaborate processing of these items to extract relevant information (e.g. at least reading through the abstract, introduction, and discussion). While the time spent on exploration is called *Between-Patch* processing, the time spent on exploitation is termed *Within-Patch processing*. By solely concentrating on one single patch (e.g. a single paper) valuable information of external resources won't become available. To the contrary, an excess of exploration (e.g. searching through the LMS or the web) might lead to ignorance of important details or the ignorance of even more valuable patches (this could be considered as opportunity costs).

We assume that indicators reflecting this allocation of time among Between- and Within-Patch processing can help to make inferences about emotional aspects of a learner's state during his or her interaction with a LMS. Learners who balance well between efficient exploration and exploitation, increasing the rate of information gain are assumed to be both, aware of a current problem state and interested / excited / encouraged to solve the problem or to learn. Thus, even if the theory of information foraging has been initially developed in the context of navigation on the web, we apply the principles and adapt some of the indicators to the area of LMS (i.e. the IWT) because i) the learner has to search for several documents or Learning Objects in order to master the course ii) it is assumed that a successful information forager experiences a positive emotional state more often than an unsuccessful one.

In the case of the IWT there are several tools and resources available. We have divided those tools and resources into two major groups: i) the first group of tools and resources provide and possess pieces of information which are related to how to use the tools or the IWT in general. For example, this would be the case when the learner clicks on "FAQ" or uses the course "IWT for students". Those resources aim to enhance the learner´s "competence to use the IWT" (respectively parts of it) or in other words: The skills necessary to make use of the platform or to use the tools. ii) The second group of tools and resources provide pieces of information which are related to the learning domains. I.e. they can be considered as learning objects which support the learner´s development of according concepts (such as logic, math, etc.).

The time the user spends on using the IWT should be divided into:

i) "Between-patch processing", i.e. the time the learner spends on searching for learning objects (such as the PowerPoint Slides which are already part of the IWT platform),

ii) Inactivity (i.e. the amount of time the learner doesn´t do anything implicit measurable, i.e. if the learner doesn´t move the mouse or doesn´t use any tools),

iii) Within-usage-patch processing (i.e. the time the learner spends on consuming tools or learning objects designated to clarify how to use the IWT platform or particular tools).

iv) Within-patch processing (i.e. the time the learner spends on consuming tools or learning objects designated to learn the concepts and competences to be developed; e.g. Logic etc.).

The following table indicates the different tools and their assignment to the four kinds of activities or usage of time described above.

Table 1: Tools of the IWT and the assigned processes (inactivity, between patch processing and within patch processing)

Tools (Resources)	Activity
My courses (Logics for Mathematicians , Logics for Computer Scientists, etc)	Within-patch processing

My courses (IWT for Student)	Between-patch processing
Utility (FAQ)	Within-usage-patch processing
Utility (Search)	Between-patch processing
Utility (Search People)	Between-patch processing
Share / cooperate (Notice-board)	Within-patch processing
Share / cooperate (Users)	Between-patch processing
Share / cooperate (Agenda)	Between-patch processing
Share / cooperate (Videoconference)	Not assigned since it seems impossible - at least at the moment - to automatically extract the content of discussions and to assign it unambiguously to a particular activity or usage of time. I.e. it could be assigned to Between-patch processing if the learners are discussing about how and where to find valuable patches, it could be assigned to Within-patch processing if the learners discuss and reflect upon the content learned so far or it could be assigned to Within-usage-patch processing if the learners discuss upon how to use the IWT or particular tools.
Share / cooperate (Wiki)	Within-patch processing if the learner reads articles focusing on learning content Within-usage-patch processing if the learner reads articles providing explanations on how to use the IWT in general or specific tools in particular.
Share / cooperate (Forum)	Within-patch processing if the learner reads articles focusing on learning content Within-usage-patch processing if the learner reads articles providing explanations on how to use the IWT in general or specific tools in particular.
Share / cooperate (Blog)	Within-patch processing if the learner reads blog-entries focusing on learning content Within-usage-patch processing if the learner reads blog-entries providing explanations on how to use the IWT in general or specific tools in particular. In this case, no Natural Language Processing would be necessary. It is just necessary to provide the opportunity that learners can tag the content of the blog entries or that learners can choose from predefined tags. In this case, the IWT platform could benefit from the “wisdom of the crowds”. Additionally, it could make the Between-patch processing much more efficient (since learners have the opportunity to search more focused based on tags).
Share / cooperate (Chat)	Not assigned (for the same reason as for Videoconference, Natural Language Processing would be necessary).
Share / cooperate (Audio conference)	Not assigned (for the same reason as for Videoconference).

As mentioned above, the overall time of the learner´s engagement with the IWT platform is divided into equally long lasting and consecutive time slices. Let´s consider the following example with a predefined length of 30 seconds for each time slice to exemplify how to receive the raw values for BIs related to the theory of information foraging:

1) The 4th time slice starts and the learner is currently just finishing reading through a presentation on logics for computer scientists (i.e. he or she uses the “tool” or component “My courses”). This process has started in one of the previous time slices and ends in the current time slice after 13 seconds. Thus, the overall time so far the learner spends on Within-patch processing is 13 seconds.

2) The learner spends some time on searching for other content related courses (e.g. he or she scrolls through the list of courses and reads only the titles). This process may last for 7 seconds and is assigned as Between-patch processing.

3) The learner makes a short break to think about what to do next. During this period of time the learner doesn´t move or scroll the mouse and doesn´t press any keys. Since no actions or interactions with the IWT platform are observed, it is interpreted as “Inactivity”. Let´s assume that this process lasts for 5 seconds.

4) It comes to the mind of the learner that he or she could also use other tools and sources to gather valuable pieces of information. Therefore, he or she decides to take a look at the presentation “IWT for students”. This process is assigned as Within-usage-patch processing and might last for several minutes. However, the current time slice ends after 5 seconds (since the length of the time slices is fixed at 30 seconds). Therefore, the “raw value” for the BI Within-usage-patch processing for this particular time slices is 5 seconds.

So far we have the raw values for the following BIs:

Within-patch processing T_W : 13 [sec.]

Within-usage-patch processing T_{WU} : 5 [sec.]

Between-patch processing T_B : 7 [sec.]

Inactivity I_A : 5 [sec.]

Another variable derived from Information Foraging Theory is G, which is the total amount of information gained G. This variable can be calculated by equation 1,

$$G = \lambda \cdot T_B \cdot g \qquad (1),$$

where λ is the prevalence, i.e. the average rate of encountering patches (e.g. courses) and g is the average gain per patch. The prevalence λ is simply given by equation 2,

$$\lambda = 1/t_b \qquad (2),$$

where tb is the average time in seconds between processing patches. Referring to the example above, where the player spends only once on Between-patch processing which lasts for 7 seconds. Since this process occurred only once in this time slice the average time of Between-patch processing is also 7 (seconds). The prevalence λ is therefore 0.143 (=1/7).

The higher tb, the lower is λ, the rate of encountering patches. Finally g represents the average gain per patch (i.e. the amount of valuable information extracted per patch).

The variable g represents to some extend the “quality” of the learning objects (in this case the presentations of “My Courses”). The amount of quality (and in consequence, the actual value g_i for

each learning object i) could be assigned by making use of the “wisdom of the crowds”. I.e. the idea is that learner´s have the opportunity to rate the value of all learning objects (or the quality in terms of how much information can be extracted) after being engaged with them. This is similar to already existing platforms such as Amazon (where the products can be rated in terms of their overall judgement / likeability) or Wikipedia. This kind of information can be then used as starting point for providing a more sophisticated and valid recommender system. I.e. based on the wisdom of the crowds and their judgments, the IWT could recommend the most valuable learning objects. Additional pieces of information to be taken into account for such recommendations should be considered (i.e. age, learning preferences, etc. of the learner).

In order to include an indicator, which reflects some kind of efficiency the learner is able to gather valuable information, we make use of the variable R, representing the rate of gain of valuable information per unit cost. It is given by

$$R = G / (T_{SL}) \qquad (3),$$

while the parameter G has been described above and T_{SL} is the length of the time slice (e.g. 30 sec.), included in this equation, have already been described.

Finally, the so called Profitability π can easily be calculated that is the ratio of gain per patch to the cost of within-patch processing and given by

$$\pi = g/tW \qquad (4).$$

Hence, in case of ALICE, π stands for the efficiency of a learner’s search behaviour: how many information does she/he actually extracts from the existing learning objects, and how much time does she/he needs for this process.

2.2.5.4 Operationalization of Behavioural Indicators

The functions representing the operationalizations of the behavioural indicators are provided in the following table. While some of the indicators are self-explanatory (e.g. BI #1) or have already been explained in section 4.3 (e.g. BI #14), some further examples for the remaining indicators (#3 - #6; #13) are provided below the table.

Table 2: Operationalization of Behavioural Indicators

#	Behavioural Indicator	Operationalization and Explanation
1	Click rate	*cr =* Number of mouse clicks per time slice
2	Length of mouse movements	Let`s consider that e.g. every ten milliseconds the coordinates of the mouse pointer is recorded. The Euclidian distance between the position t and t + 10ms can be calculated. The sum of all Euclidian distance per time slice is the variable of interest.

#	Behavioural Indicator	Operationalization and Explanation
3	Relative exploitation of available tools	Number of used tools divided by the total number of available tools per time slice (*regarding definition of "tools", see* Table 1 *above)*
4	Frequency of tool-usage (all available tools)	$ft = \frac{fT_1 + \ldots + fT_n}{n} \cdot \frac{T_W}{Tts}$ (*n indicates the amount of tools, T_{ts} indicates the length of the time slice*)
5	Frequency "my course" tool-usage	Frequency of "my course" usage per time slice
6	Inactivity	Number of seconds the learner doesn`t press any keys and doesn`t move the mouse.
7	Within-patch processing	Number of seconds the learner spends on consuming tools or learning objects designated to learn the concepts and competences to be developed (i.e. "my courses" and the according learning objects).
8	Within-usage-patch processing	Number of seconds the learner spends on consuming tools or learning objects designated to clarify how to use the IWT platform or particular tools
9	Between-patch Processing	Number of seconds the learner spends on searching for learning objects (such as the PowerPoint Slides which are already part of the IWT platform),
10	Information gained	*see example in the previous section* – equation (1)
11	Profitability	*see example in the previous section* – equation (5)
12	Rate of information gain	*see example in the previous section* – equation (4)

Additional Explanation regarding Behavioural Indicator #4 (**Frequency of tool-usage**; ft):

$$ft = \frac{fT_1 + \ldots + fT_n}{n} \cdot \frac{T_W}{Tts}$$

During a particular time-slice (with Tts = 30 seconds), 14 tools may be available (see Table 1 above). At the beginning, the learner may use the Wiki (T1) for 5 seconds, then she may choose the Forum (T2) and afterwards, again the Wiki (T1). Overall, the learner spends 25 seconds on the tools and 5 seconds to switch between them. Thus fT1 = 2, fT1 = 1 and TW = Tts = 25 seconds. Inserting these values into the indicator's equation, results in the value ft = [(2+1)/14]*(25/30) = 0.1785.

2.2.5.5 Assessment Procedure

In this chapter we describe the procedure for the non-invasive assessment of the emotional state. We will start with a short overview:

The assessment is based on the measurement (i.e. observation) of ***behavioural indicators*** (BIs) which are continuously derived from the learner´s interactions with the IWT, recorded by log files.

The BIs as well as their operationalizations are described in the previous section 2.2.5.4 (Operationalization of Behavioural Indicators).

The **raw values** x_i for each of the BIs are registered and stored by means of Log-files for each time slice. As a starting point, the length of each time slice might be 30 seconds. (Validation studies or Pilot studies needed)

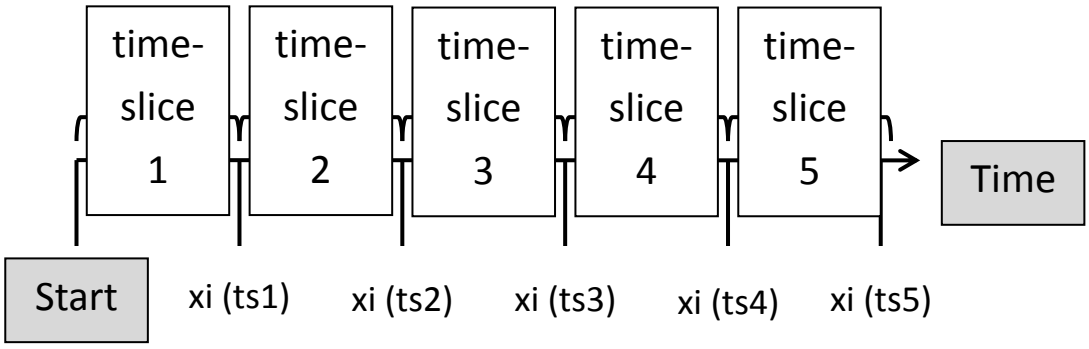

Figure 2-7 Time Slices

- For the sake of comparability, these raw values for each BI are standardized by z-transformation. The values resulting from this transformation are called **standardized values** and denoted by z_i.
- Afterwards, the standardized values are mapped onto continuous values between 0 and 1. These continuous values are called **probabilistic values** and denoted by $p(z_i)$.
- Finally, the probabilistic values for each BI serve as input variables for 2 **multiple regression equations**, one for each dimension of the emotional model (i.e. Activation and Valence). To be more precise, the input variables for each of the 2 regression equations are the probabilistic values of the BIs and their according weights.
- The results of the multiple regressions are the “final values” for each dimension (continuous values between 0 and 1 for activation and valence, respectively)

A more detailed description of the procedure to get from the raw values of the BIs to final values for each dimension is described in the following sections. A conceptual overview of the assessment procedure and the content of the following sections are provided by the following Figure 2-8 :

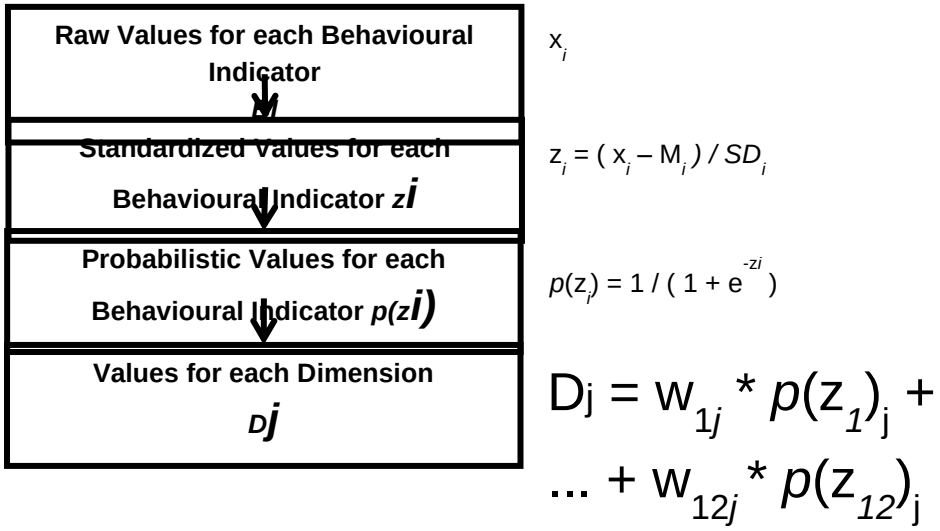

Figure 2-8 Conceptual Overview of the Implicit Assessment Procedure

2.2.5.6 Standardization of Initial Values

The interpretation of the learner´s current state with respect to a particular construct as indicated by the initial values x*i* depends on the comparison with a baseline. The baseline can be conducted either by the learner´s values in previous time slices (intrapersonal comparison) or by the values of other learners. The latter approach is feasible when an extensive database for interpersonal comparison is available. However, we prefer an intrapersonal comparison which takes the learner´s *learning history* into account since individual learner`s baselines may differ to a great extent.

The engagement with the IWT tool is divided into time-slices T_{SC}, each lasting for 30 seconds (see Figure 2-7). At the end of each time-slice, all indicators are summarized and scores are computed resulting in "initial values" x_i. Then, these values are standardized for the sake of comparability and by the help of the following equation (5):

$$z_i = \frac{x_i - M_i}{SD_i} \qquad (5),$$

with zi (and xi) representing the standardized (and raw values) of the Behavioural Indicator i, respectively. The average values of the indicator i, represented by Mi, is computed by averaging the raw values for each BI over all previous time-slices. Thus, Mi doesn't incorporate the raw values from the current time-slice. The variance of the indicator i, SDi, is computed by the help of the ordinary, standard deviation equation, i.e. by taking the second root of the indicator's variance. Since the validity of variance depends on the amount of data, the deviation of the current from the average values in terms of standard deviations should be taken into account not until the fourth time-slice has passed. Consequently, the computation of the standardized values of the indicators begins 120 seconds after the learner starts to engage with the IWT.

2.2.5.7 Transformation of Standardized Values

In order to gather manifestations of a continuous variable, whose values lie between 0 and 1, the standardized value zi (for each Behavioural Indicator) is inserted into the following logistic function (6):

$$p(z_i) = \frac{1}{1+e^{-z_i}} \qquad (6),$$

where p(zi) represents the value of the indicator i, after the logistic function has been applied. Figure 2-9 depicts the characteristics of this function, which is highly sensitive to values in the range from -2 to +2.

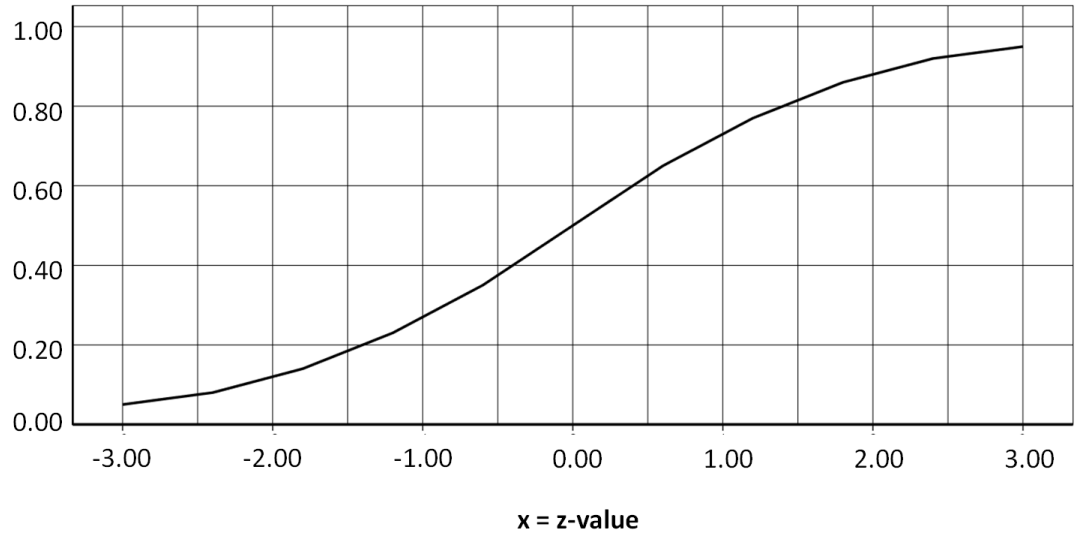

Figure 2-9 Logistic Function that is applied to Transform z_i into $p(z_i)$

2.2.5.8 Multiple Regression Equations

Both dimensions are assessed by a multiple regression equation, based on a particular sub-set of Behavioural Indicators. Among each of the 2 subsets (which might be overlapping of course) the indicators will probably differ with respect to their significance for the corresponding dimension.

For instance, the two indicators “Click rate” (BI #1) and “Relative exploitation of available tools” (BI #4) are both considered as indicators for the dimension *activation*, whereby the former one is regarded to be more predictive than the latter one (see Table 3). The values in Table 3 represent the assumed significance of the BIs for the accordingly dimensions (i.e. amount of predictive validity). These values, ranging from (-) 2 to 2, are estimations and should be considered as starting point. They are based on the evaluation of two experts in the field of cognitive psychology at TUGraz. Independent from each other, both experts evaluated the predictive validity of the behavioural indicators for each construct by a 5 point rating scale. The scale comprised the values (-) 2 (“high negative validity”, i.e. the higher the BI, the lower the value for the dimension), (-) 1 (intermediately negative validity), 0 (“low validity”), 1 (intermediately validity) and 2 (“high validity”). For the overall ratings presented in

Table 3 we took the lower one of both (absolute) values in case of divergent ratings, otherwise the mean.

Table 3: Assumed Significance of BIs for the Dimensions

#	Behavioural Indicator	Starting Point Weights for...	
		Activation	Valence
1	Click rate	2	0
2	Length of mouse movements	2	0
3	Relative exploitation of available tools	1	1
4	Frequency of tool-usage (all available tools)	2	1
5	Frequency “my course” tool-usage	1	1
6	Inactivity	(-) 2	(-) 1
7	Within-patch processing	1	2
8	Within-usage-patch processing	1	(-) 2
9	Between-patch Processing	0	1
10	Information gained	2	1
11	Profitability	1	2
12	Rate of information gain	2	2

The regression equations, for assessing a value Dj for each dimension j (i.e. Valence and Arousal) are multiple regression equations, initially consisting of the following “input-parameters”: i) the 13 predictors (i.e. the probabilistic values for each behavioural indicator per time slice), and ii) overall 16 weights wx for each predictor. This leads to the following equation 7:

$$D_j = w_1 * p(z_1) + w_2 * p(z_2) + ... + w_x * p(z_x) + ... + w_{12} * p(z_{12}) \quad (7).$$

As mentioned above, the predictors $p(z_x)$ are continuous values between 0 and 1. In order to receive a final value D_j for each of the two dimensions (i.e. the result of the regression equations), the sum of the weights has to be 1. As a starting point, these weights for each BI are based on the values v_{ij} listed in

Table 3. In order to receive the weights for the regression equations we have to calculate the following formula 8:

$$wij = vij / \Sigma \, I \, vij \, I \quad (8).$$

This leads to the following regression equations:

$D_{Activation} = 0.118 * p(z_1) + 0.118 * p(z_2) + 0.059 * p(z_3) + 0.118 * p(z_4) + 0.059 * p(z_5) + 0.118 * p(z_6) + 0.059 * p(z_7) + 0.059 * p(z_8) + 0.118 * p(z_{10}) + 0.059 * p(z_{11}) + 0.118 * p(z_{12})$ (9).

$D_{Valence} = 0.071 * p(z_3) + 0.071 * p(z_4) + 0.071 * p(z_5) + 0.071 * p(z_6) + 0.143 * p(z_7) + 0.143 * p(z_8) + 0.071 * p(z_9) + 0.071 * p(z_{10}) + 0.143 * p(z_{11}) + 0.143 * p(z_{12})$ (10).

As long as no validation studies for all behavioural indicators have been carried out, we use the values of

Table 3 as input parameters for calculating the weights w_{ij} for each behavioural indicators and dimension.

2.2.5.9 Conclusion and Outlook

An implicit assessment of emotional states has advantages compared to standard self-report measures. One way of implicitly measuring emotional states is to monitor the user's behaviour and interaction within the learning environment. Thereby, Behavioral Indicators can be derived which consists of engagement times, latency times, total amount of task switching and so on.

Building on the circumplex model of emotions, emotions can be understood as discrete emotional categories. In contrast, dimensional models understand emotions as a combination of other processes, such as levels of activation and valence. Mapping activation and valence levels, as measured by Behavioral Indicators, onto a discrete emotional category space, regression models are applied. The exact values for the model parameters depend on forthcoming pilot applications. With this method, the emotional state of the user can be determined and appropriate steps to reach an optimal emotional state for optimal learning performance can be taken.

2.2.6 Multimodal System

In addition to the methods of affect-detection described above, alternate approaches that recall the tradition of research in physiological psychology and psychophysiology have been applied [31]. These methods use machine learning techniques to identify patterns in the physiological activities that correspond to different expressions of emotions.

A face-to-face interaction between humans is by definition a multi-modal interaction in which participants potentially perceive constant stream of significant facial expressions, gestures, body postures, head movements, words, grammatical constructions etc. Many researchers believe that multimodal systems for the recognition of affection improve the recognition accuracy (sensitivity) of emotions and in consequence, the interaction quality between man and computer. For example, anger is manifested through specific facial expressions, voice and body, in addition to physiological changes (increased heart rate) and a particular type of posture. "Responses from multiple systems that are bound in space and time during an emotional episode are essentially the hallmark of basic emotion theory" [68]. There are three ways to combine signals from several sensors, each of which depends on the amount of information of the sensors:

Data Fusion is performed on the raw data for each signal and can be applied only when the signals have the same temporal resolution. For example, it can be used to integrate physiological signals from

devices such as recording of physiological signals, but it cannot be used to integrate a video signal with a transcript of the text.

Feature Fusion is performed on the set of features extracted from each signal. This approach is commonly used in affective computing. Characteristics for each signal are mainly the mean, median, standard deviation, maximum and minimum, along with some unique features from each sensor.

Decision Fusion is performed by merging the output of the classifier for each signal. Affective states are classified by each sensor and then integrated to produce an overview of the sensors. This is the approach most commonly used for multimodal systems [32] [33].

3 Feedback management derived by the detection of user's affective states

Affective elements in the analysis of human-computer interactions have become an increasingly prominent theme in recent years. Intelligent Tutoring Systems (ITS) are gradually enhanced with emotional awareness (detect and respond) capabilities. This might be due to a clear evidence of correlation between affect and learning. Research has focused on automated detection of student's emotion (enjoyment, hope, excitement, anxiety, fear, boredom, etc.) in a variety of learning contexts (during exams, in the class, while studying, in leisure time, etc.) showing promising results [34]. What the student actually wants and feels at a specific time and a particular place is appraised as valuable information that can lead into real personalised computers systems. Picard has distinguished four categories of real personalised computing [35]:

Computer	*Cannot express affect*	*Can express affect*
Cannot perceive affect	I	II
Can perceive affect	III	IV

Table 2.1: Four categories of affective computing, focusing on expression and recognition. Adopted from Picard [35].

Only category IV is providing truly "personal" and "user-friendly" computing with regards to emotions and affective states. The guiding principle of pleasing the user is greater than the guiding principle of maximal efficiency. For example, if a user expresses pleasure when the computer fixes his/her spelling, then the system should continue applying its spell-fixing behavior; if the user expresses annoyance, then the computer should consider asking the user if he/she would like that behavior turned off or adapted in some other way [35].

Classifying a learner's emotions is an essential step in building a tutoring system that is sensitive to his or her emotions. The other essential component is to build mechanisms that empower learning systems to intelligently respond to these emotions, as well as to the learner´s states of cognition, motivation, social sensitivity, and so on. The essential questions are how to ensure that an affect-sensitive ITS responds to the learner in a fashion that optimizes learning and engagement? How effective are interventions at changing specific emotional states? Can machine learning learn optimal policies for improved long-term student attitude and learning? [33].

An affect-sensitive ITS can incorporate assessments of the students' cognitive, affective, and motivational states into its pedagogical strategies to keep students engaged, and to boost self-confidence, heighten interest, and presumably maximize learning outcomes. For example, if the learner is frustrated, the tutor would need to generate hints to advance the learner in constructing knowledge, and make supportive empathetic comments to enhance motivation. If the learner is bored, the tutor should present more engaging or challenging problems to the learner [37] . In [38] the authors have shown that dynamically responding to a student´s emotional and cognitive states improves significantly learning during computer tutoring.

The question that rises is "how can humans design systems that decide how to best respond to a user's affective state when this is even difficult to determine in human-human interaction?" The system should have means of weighing this uncertainty with the potential risks and benefits of the available interventions in order to decide if a particular intervention should be provided [39]. In other words, we have to endow the system with the capability of performing risk/benefit analyses when reasoning about potential affective interventions.

3.1 Theoretical Perspectives

In general, there are no empirically proven "best-practice" approach to address the presence of emotions in learning, especially negative ones [37]. Therefore, possible tutor reactions to student emotions are derived from theoretical foundations in pedagogy/psychology/cognitive science, for example Control Value Theory, Attribution theory, (achievement-) Motivation, Cognitive Disequilibrium Theory, Politeness, Empathy, etc.). Or possible tutor reactions are solely based on recommendations made by pedagogical experts.

Appropriate feedback does improve learning in human-to-human instruction [36]. Feedback can reduce uncertainty about how well (or poorly) the student is performing and motivate strategies aimed at reducing that uncertainty [40]. Feedback also provides useful information for correcting inappropriate task strategies, procedural errors, or misconceptions. One general recommendation is based on the finding that immediate feedback for students with low achievement levels in the context of either simple (lower-level) or complex (higher-level) tasks is superior to delayed feedback; while delayed feedback is suggested for students with high achievement levels, especially for complex tasks.

3.1.1 Positive Vs Negative emotions

Despite the evidence of the positive effects of positive mood and emotions there is no simple relationship between emotion and learning such as: positive emotions foster learning, and negative emotions do have a detrimental effect on learning[41]. A student with a positive disposition (trait) would interpret an F on a math exam as evidence that he needs to work harder, while another may see it as evidence that he is stupid [42]. It is important to recognize that a range of emotions occurs naturally in a holistic learning process, and it is not necessarily the case that positive emotions are advantageously for the learning process. Expert teachers are very adept at recognizing and addressing the emotional states of students and, based upon impressions, taking some action that positively impacts learning [43].

Pekrun[44] [45] has conducted a variety of studies to research the impact of the so-called academic emotions (four positive: joy, hope, pride, relief and five negative: boredom, anger, anxiety, shame, hopelessness) in the context of academic achievement. According to his findings, positive mood foster holistic and creative ways of thinking, whereas negative mood proved to enhance an analytical, detail-focused way of processing information. Harmful effects can only be expected in situations where students are in a good mood and the learning topics are of less importance for them. In this case, positive emotion might detach them from learning.

Negative emotions, on the other hand, usually direct students' attention to themselves. Necessary attention for learning and task solving is lacking because they try to find ways to get rid of the bad feeling. Negative emotions, by creating a pessimistic perceptual attitude, divert the learner's attention to aspects irrelevant to the task which activate intrusive thoughts that give priority to a concern for a well-being rather than for learning [46]. However, curiosity and puzzlement may lead to investigate problems and frustration may lead to action, even though they are negative affects.

The state of confusion is sometimes considered positive for learning because students will be motivated to overcome the source of their misunderstanding. In the literature, uncertainty is encountered as an "opportunity to learn" [38]. It is also likely that if a student remains confused for an extended period of time, he/she may disengage and may no longer be interested in learning.

In [39] the authors support the finding that students have a strong tendency to remain in the same affective state across time. However, when transitions to alternate affective states occur, they followed

interesting patterns. For instance, frustrated learners were very likely to change to the state of confusion or fear and were particularly unlikely to enter a positive state such as flow or excitement. Students experiencing the positive state of flow were likely to change to confusion, which is still considered as positive for learning and were unlikely to change to the more negative state of frustration. Interestingly, confused learners were equally likely to change into flow and frustration. These findings suggest that the affective state of confusion and its antecedents and consequences are worth additional study to determine which factors contribute to a positive transition to flow or a negative transition into frustration.

3.1.2 Social and Emotional Learning (SEL)

Since 1980, hundreds of school-based programs have been developed aiming to assist students in gaining control of their emotions. These programs are better classified under the more general label *Social and Emotional Learning (SEL;* e.g. CASEL in the USA, SEAL in the UK, Framework of Values for schools in Australia, PATHs, Transaction Analysis, Social Development Curriculum, Resolving Conflict Creatively, Self Science, 6Seconds, SIY Project-Google Yourself). These examples comprise basic lessons of emotional intelligence in the form of school-based programs.
After a remarkable amount of studies in the field of SEL several models and theories that embody the dynamics of a learner's emotional state, have been put forth. SEL programs have reported to improve students' social-emotional skills, attitudes about self and others, connection to school, and positive social behaviour as well as students' academic achievement.

An example is the EC-funded projects AtGentive (Attentive Agents for Collaborative Learners). The objective of the AtGentive project is to investigate the use of artificial agents for supporting the management of the attention of young or adult learners in the context of individual and collaborative learning environments. Practically, this project consists in the design of artificial agents that are able to coach the learners in reaching higher level of performance in managing their attention in the learning process. These agents, which appear as embedded characters, are able to profile the state of the attention of the learners (short or long term) by observing their actions, to assess, to analyse and to reason on these states of attention, and to provide some proactive coaching (assessment, guidance, stimulation, etc.).

eCIRCUS will develop a new approach in the use of ICT to support social and emotional learning within Personal and Social Education (PSE).
This will be achieved through virtual role-play with synthetic characters that establish credible and empathic relations with the learners. To attain this, eCIRCUS investigates educational role-play using autonomous synthetic characters and involving the child through affective engagement, including the use of standard and highly innovative interaction mechanisms.

All these programs have tested the emotional behaviour of students and the impact of self-awareness, self-regulation, self-motivation, empathy in real-time and in school related context (class, exams). The empirical knowledge that has been obtained after 30 years of experimentation, can feed corpora of affective reactions.

3.2 Computer mediated Affective Feedback

An ITS that is privileged with Affective Feedback capabilities, is able to send appropriate affective or cognitive signals to the user, in response to affective state detection, ensuring in that way their emotional safety and their engagement or persistence in the learning experience. In line with

Hatcher's emotion's quality criteria (2010), the "appropriateness" of the response is further analysed by the following characteristics:

- The *Valence* of the response: positive (e.g. encouraging hints), neutral (e.g. task-based feedback) or no feedback at all. The case of negative response (e.g. to reflect on user's confusion for activation purposes) requires quite high speculation and caution.
- The *Arousal* of the response: activating (e.g. a drumbeat) or de-activating (e.g. spiritual music or a relaxing short story).
- The *Timing* of the response: immediately after or after particular time period.
- The *Duration* of the response: short (e.g. a very short sound revealing success like in computer games) or long (e.g. a funny animation clip).

Affective feedback techniques also incorporate knowledge of student group characteristics (e.g., profile of cognitive skills, gender) to guide interference. In [35] an agent tutor has been developed which customizes the choice of an intervention (i.e. the particular type of hint) individual students based on their cognitive profile, gender, spatial ability, and math fact retrieval speed.

3.2.1 Methods, Techniques and Good Practices

Although not extensive, the literature has remarkable studies that test methods and techniques of computer mediated affective feedback, and the impact they have on users. A rough classification of feedback techniques includes:

- *Dialogue moves* (hints, pumps, prompts, assertions, and summaries).
- *Immersive simulations* or *serious games*.
- *Facial expressions* and *speech modulations*.
- *Images, imagery, cartoon avatars, caricatures* or *short video-audio clips*

In some research studies, affect-adaptive computer tutors have been evaluated within a "Wizard of Oz" scenario, where a human "wizard" performs system tasks such as speech recognition, natural language understanding, and affect detection [38]. Wizarding the system in this way removes noise that might have potentially distracted from the dialogue interaction due to misrecognition of the user's utterance and/or affective state; thus the system design is tested under the best possible conditions.

In [36] the authors have used "*a variety of heuristic policies to respond to student's emotion. Machine learning optimization algorithms are applied in searching for policies for individual students, with the goal of achieving high learning and positive attitudes towards the subject" [36, p.9]*. They measured how feedback variables interact to promote learning in context (characteristics of the learner, aspects of the task). Instructional feedback is varied according to type (explanation, hints, or worked examples) and timing (immediately following an answer or after some elapsed time) [45].

The affective tutor's responses to student affect are summarizes in the following table:

Frustrated student	**Low motivation**	**Low confidence**	**Bored student**	**Fatigued student**
• Empathetic response: "That was frustrating. Let's move to something easier" • Give students control: "Would you like to choose the next problem? What kind would you like?"	• Agent changes voice, motion and gestures; • Presents graph, hints, adventures	• Provides encouragement; • Indicate student performance level • Link performance to student effort • Attribute failure to external (hard problem) and success to internal reasons (you are doing great)	• Increase challenge level of activities • Empathy messages: "Maybe you agree with me that this is quite boring? Let's move to something more challenging"	• Empathy message: "I am pretty tired of this. Let's switch to something more fun" • Change in scenario, e.g., adventures, animation, game

Not-frustrated No response	**High motivation** No response; Encouragement, praise.	**High-confidence** No response	**Not-bored** No response	**Not-fatigued** No response

Table 2.2: Responses of the tutor to student affect. Adopted from [36].

[39] report on the results of two studies that were conducted with students interacting with affect-informed virtual agents, evaluating somehow the agents' response to both positive and negative affective states. The agents could respond to student affect with either *parallel*, *reactive* empathetic or *task-based* feedback:

- In the case of *parallel* empathy, an individual exhibits an emotion similar to that of the target. This is typically based on an understanding of the target's situation and shows the empathizer's ability to identify with the target.
- *Reactive* empathy, in contrast, focuses on the target's affective state, in addition to his/her situation. Reactive empathizers will display emotions that are different from the target's, often in order to alter or enhance the target's own affective state.
- As a supplement to empathetic strategies, *task-based* feedback was incorporated into agent behaviour as an alternative method for supporting student affect. When positive affective state was detected, the agents provided feedback in the form of a summary of their current progress, to avoid interrupting this state, reinforcing, in parallel, previously learned material. However, if a student reported a negative state, the agent directed students towards information that would help them complete the goal, avoiding the risk of inappropriate, affective response.

The studies reveal that emotion-specific risk/reward information is associated with particular affective states. In both studies, agents' responses to negative emotions were rated significantly worse than agents' responses to positive emotions. This appears to be a reasonable explanation given that, with the exception of anger, all negative emotions are being met with responses that are deemed to be "poor" on average.

Positive emotions (flow, delight, boredom) appear to be particularly susceptible to the quality of feedback given. In these cases, caution should be exercised in the face of uncertainty to avoid negative consequences, since dropping from a positive state to any of the negative states, is highly undesirable event.

On the contrary, for particularly negative emotions such as frustration, the risks of inappropriate delivery are not large enough to warrant extreme caution when providing responses. Instead, it appears that any attempt to alleviate the frustration can only help the student, and consequently, strategies should be used regardless of certainty about their outcomes.

In [48], a human wizard performed speech recognition and natural language understanding in a spoken Reading Tutor, and then provided "emotional scaffolding" (e.g., "Good try") after detecting various affective states in student answers, including uncertainty. The emotional scaffolding resulted in increased student persistence, but did not yield improved learning.

In [49], a health assessment system responds with empathy to instances of user stress. Similarly, [50] described a gaming system that responds with sympathy and apology to instances of user frustration. In both of these studies, user satisfaction is considered a primary metric of system performance, and both studies successfully showed that users preferred to use the adaptive system over non-adaptive versions [38].

Wang et al. [51] implement a model of "socially intelligent tutoring" that achieved significant learning improvements, based on politeness theory in an online learning system. They conduct a series of Wizard of Oz studies in which students either used the socially intelligent system and received polite tutorial feedback after every turn, or used the control system and received direct feedback. The

socially intelligent system was found to yield increased student learning as compared to the control system.

In [52], an Emotional Intelligent Agent (EIA) was designed to reflect some emotional intelligence abilities such as: recognizing the current emotional state of the learner and addressing it. EIA consists of three modules: the perception module, which allows recognizing the current emotional state of the learner, the control module contains knowledge about when to intervene in order to influence the learner's emotion, and the action module contains actions to be activated to induce the optimal emotional state.

This agent is able to recognize the current emotion of the learner according to his/her choice of a sequence of colours. It's able also to identify the optimal emotional state for learning according to his/her personality and to induce it when a situation occurred producing a negative emotion. To induce this optimal emotional state for learners, it uses a hybrid technique which combines several psychological techniques for inducing emotion such as guided imagery, images and music.

An exemplar of affect-sensing and responding technology is AutoTutor. The sensed cognitive-affective states are used to select AutoTutor's pedagogical and motivational dialogue moves and to drive the behavior of an embodied pedagogical agent that expresses emotions through *verbal content*, *facial expressions,* and *affective speech*. The first version, called the Supportive AutoTutor, addresses the presence of the negative states by providing empathetic and encouraging responses. The Supportive AutoTutor attributes the source of the learners' emotions to the material or itself, but never directly to the learner. In contrast, the second version, called the Shakeup AutoTutor, takes students to task by directly attributing the source of the emotions to the learners themselves and responding with witty, skeptical, and enthusiastic responses.

The system adaptively manages the tutorial dialogue by providing feedback on the learner's answers (e.g. "good job", "not quite"), pumping the learner for more information (e.g. "What else?"), giving hints (e.g. "What about X?"), prompts (e.g. "X is a type of what "), correcting misconceptions, answering questions, and summarizing topics. The tutor also synthesizes affect via the verbal content of its responses and the facial expressions and speech of an embodied pedagogical agent. An experiment comparing the affect-sensitive and non-affective tutors indicated that *the affective tutor improved learning for low-domain knowledge students, particularly at deeper levels of comprehension.*

AutoTutor incorporates this 5 dimensional assessment of the student and responds with: (a) feedback for the current answer, (b) an empathetic and motivational statement, (c) the next dialogue move, (d) an emotional display on the face of the AutoTutor embodied pedagogical agent, and (e) emotionally modulating the voice produced by AutoTutor's text to speech engine

.

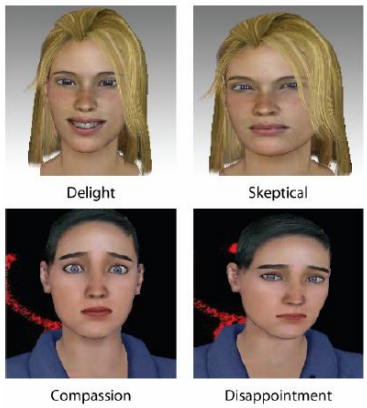

Figure 3-1: Affect synthesis by embodied pedagogical agents. Adopted from D'Mello [37].

Student Model	Tutor Action
Current Emotion	**Feedback**
boredom, confusion, frustration	positive, neutral, negative
Classification Confidence	**Empathetic and motivational statement**
high or low	
Previous Emotion	**Next Dialogue Move**
boredom, confusion, frustration	hint, pump, prompt, splice, assertion
Global Student Ability	**Facial Expression**
high or low	surprise, delight, compassion, skeptical
Quality of Current Answer	**Speech intonation**
high or low	pitch, intensity, speech rate, etc

Table 2.3: AutoTutor production rules to respond to learners' affective and cognitive States. Adopted from D'Mello [37].

Affective State	Pitch Range	Pitch Level	Speech Rate
Surprise/Delight	Wide	Very High	Fast
Empathy	Narrow	Low	Slow
Skeptical	Narrow	High	Slow
Disappointment	Narrow	Low	Slow

Table 2.4: Acoustic-prosodic correlates of tutors emotional expressions. Adopted from D'Mello [37].

3.2.2 Meta-Affective Skills

Feedback from recent neurological and psychological studies can shed light into our student's feelings and deep thoughts. "If a person is provided with real-time information about a certain aspect of their physiology, they can determine the way that their mental changes affect this state. Over time, the person can learn, consciously or subconsciously, how to control this aspect of their "bio-state." [53]. The latter is usually referred as *Biofeedback*.

Biofeedback is aiming at helping people understand and control their physical and mental states. This ranges from a simple understanding to conscious control of brainwaves, heart rate, specific sections of muscles, and blood flow many of which have significant therapeutic benefits [54].

R. Picard has promped for "emotion research by the people, for the people", to move emotion measurement to where people's emotions happen with what really matters to them. The vision includes involving participants in richer ways than as paid subjects, enabling people to learn about their own data and benefit directly from findings in a study, while also contributing to online analysis [35].

3.3 Conclusion

Research has recently focused on fortifying ITS with the necessary pedagogical and motivational strategies to address the cognitive and the affective states of the learner [37]. If we are able to recognize emotion and affection, the next step is to find out what to do with this decrypted information. The obvious next frontier in computational instruction is to systematically examine the relationship(s) between affective components in feedback and learning outcome (performance) [45].

Considering that there are no empirically proven strategies to address the appropriate affective feedback responses, possible tutor reactions to student emotions are derived from theoretical foundations of pedagogy/affect, and are often modeled on human tutors' responses. Literature is exhibiting remarkable studies (we have already mentioned some) though emotion-aware systems are still in a very early stage of development. The design of affective feedback components can be further fed by SEL paradigms and practices that employ long empirical knowledge. Research convergence from Neurology and Neuroscience can shield users with meta-cognitive and meta-affective skills, enabling them to learn about their own data.

Nevertheless, we can never be entirely certain that the dynamic affect-adaptive tutoring systems are delivering useful affective feedback. There will always be some risk of unintentional negative consequences when attempting to intervene to modify student affect [39] which has to be covered by evaluation studies.

4 Model representation of emotional state

Our objective are to establish a methodology through the steps that lead us to 'identification and quantification of the emotional state of a learner.

Following the study and analysis of the major paradigms and models for the management of emotion and affection in an ITS, we refer to those emotions suggested by Arrayo et al. in [55], which are important for learning. In their work, which is based on the categorization of emotions of Ekman, they have identified and selected four classes of basic emotions, we present their provisions along an axis as set forth below.

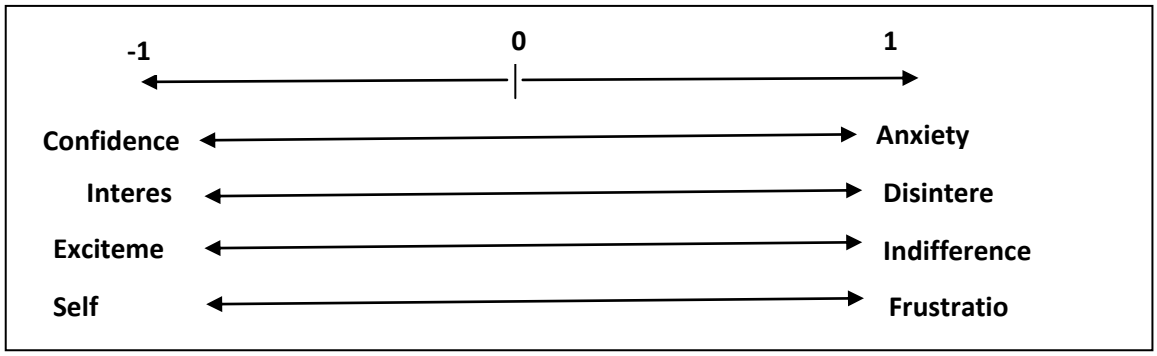

Figure 4-1: Class of emotion for Emotivity

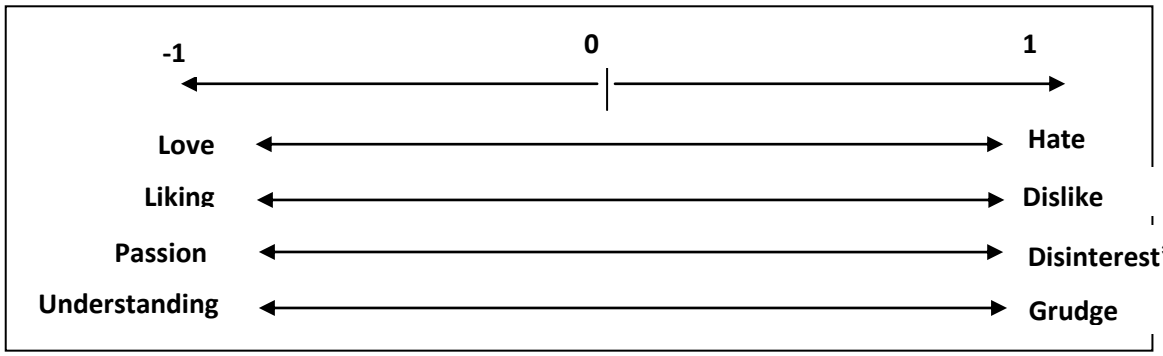

Figure 4-2: Class of emotion for Affectivity

* (To distinguish the term when referring to passionate person who has a connotation sensual / sexual passion for the things that is synonymous with love.)

The parts of assessment of affective and / or emotional state are designed as inputs that, as a result of choices made by the user, are able to give a value of the state's (character's emotion) on two levels:

1) State identification, which gives Boolean feedback (yes / no).

2) Measuring / quantification of the state (-1, 0. 1)

The assessment of emotions as Boolean types is achieved following a questionnaire with twelve questions, three for each axis that will lead us to assign a score in which the value -1 corresponds to an extreme; the value 1 at the other end, 0 corresponds to at indifference for emotion.

The quantitative emotional assessment, identified a specific emotion, will be mapped on a scale of 1 to 10 through 10 specific questions targeted and specified for each emotional class.

The approach we followed is shown in the following sections. Both the emotivity that the affectivity states are analyzed as distinct four-dimensional spaces.

4.1 Emotivity

4.1.1 Step Level 1: Stimulus-Response

The status of an individual is characterized by the tuple S = (A, B, C, D) in V, where S indicates the state and A, B, C, D are the components of the state and V is the four-dimensional space. The target is the stimulation of the user / learner with LE (Learning Experience) via the system to verify and pre-quantify its emotional state. We talk about pre-quantification because the output is trivalent (-1, 0, 1), that is qualitative and not quantitative. In other words, the output will tell if the student responds positively, negatively or indifferently to the stimulus provided through the questionnaire, and so to a fixed emotion under analysis.

Example: You are given a questionnaire with 12 questions, three for each of the variables A, B, C, D. The result will be a score (-1, 0 or 1) for each emotion class:

$$A = \frac{\sum_{i=1}^{3} A_i}{\left|\sum_{i=1}^{3} A_i\right|} \quad \text{if} \quad \sum_{i=1}^{3} Ai \neq 0. \qquad \text{If} \sum_{i=1}^{3} Ai = 0, \text{ A} = 0.$$

$$B = \frac{\sum_{i=1}^{3} B_i}{\left|\sum_{i=1}^{3} B_i\right|} \quad \text{if} \quad \sum_{i=1}^{3} Bi \neq 0. \qquad \text{If} \sum_{i=1}^{3} Bi = 0, \text{ B} = 0.$$

$$C = \frac{\sum_{i=1}^{3} C_i}{\left|\sum_{i=1}^{3} C_i\right|} \quad \text{if} \quad \sum_{i=1}^{3} Ci \neq 0. \qquad \text{If} \sum_{i=1}^{3} Ci = 0, \text{ C} = 0.$$

$$D = \frac{\sum_{i=1}^{3} D_i}{\left|\sum_{i=1}^{3} D_i\right|} \quad \text{if} \quad \sum_{i=1}^{3} Di \neq 0. \qquad \text{If} \sum_{i=1}^{3} Di = 0, \; D = 0.$$

Let us consider as an example that S = (1, -1, -1, 0). This would indicate that the learner is anxious (for A = 1), will be affected (because B = -1), is excited (because C = -1) and has no sense of self esteem or frustration because D = 0.

4.1.2 Step Level 2: Output Response - Quantity

The parameters which the user has given a negative or indifferent answer to are not discussed further: the case of the parameter D in the previous example.

The other parameters will be quantified in a scale of 1 to 10 (or in %) through 10 targeted and specific questions in detail in a later time.

Referring to the previous example, the system will present a second questionnaire containing 30 questions (or 5 for each emotion that is 15 – this will be a result of the assessment in field to find a balancing between a good evaluation of the learner emotional status and a not boring experience), which specifically are:

- 10 questions to measure the degree of anxiety (A);
- 10 questions to measure the degree of interest (B);
- 10 questions to measure the degree of excitement (C);

Then we compute:

$$\frac{\qquad}{\qquad}$$

$$\frac{\qquad}{\qquad}$$

$$\frac{\qquad}{\qquad}$$

$$\frac{\qquad}{\qquad}$$

(The multiplication with 100 allows us to put the results in correspondence with a probability distribution).

We are aware that a user´s potential flow experience or interest while being engaged with the ALICE-environment would be occupied when (s)he has to respond to a questionnaire consisting of 30 items.

In general it is advisable to follow a method-pluralistic approach for the assessment of underlying constructs. In the next phase of the project, we will follow a methodology whereby the emotional states comprise 3 components: i) a subjective experience (which could be assessed by questionnaires as described here), ii) a behavioral / expressive aspect and finally, iii) physiological expressions (e.g. EDA, EMG, etc.).

An example which would be part of the set of question related to anxiety::

Going to the roller coaster amusement park makes you:

1. a lot of anxiety;
2. little anxiety;
3. no anxiety;

4.1.3 Step Level 3: Estimation of Dominance

This is the stage where the different parameters (elementary emotive status) of the tuple are generalized in relation to the 2nd output of the approach and in relation to the weight given to each of the parameters of the learner. In other words, at this stage the dominant emotional state is considered and it is numerically quantified.

Example:

The variables $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$ more value is near to 100 more the subject will be sensitive to the parameter indicated. Therefore, referring to the example with this multi-parametric analysis we will be able to tell which is the percentage level of anxiety, of interest and excitement. We will also be able to assess the dominance hierarchy of parameters. For example, if A = 70, B = 90 and C = 100 that means C > B > A

This means that the learner is primarily excited, interested secondarily, and only partially anxious; then we can conclude that you are having fun. The learner dominates the excitement, followed by the interest, followed by the anxiety.

4.1.4 Step Level 4: Evaluation of the emotions

Now we introduce one or more parameters to obtain a representative variable of the emotive status. Consequently, we introduce:

1) ε(s) = absolute current emotion = ———— ≤ 100

2) ξ(s) = subjective emotion = —— x 100

where is the maximum observed activity of the individual; if ε > then

—— = 1 e becomes the new ε .

Moreover (s) is the cumulative mean value of emotionality in different actions (different questionnaires which are given at different times); in other words (s) has the memory of the emotive state of the learner.

3) ζ(s) = emotive distance of the learner with respect to his mean value = ε(s) - ε (s)

4) ρ(s) = emotive distance of the learner with respect to the mean value of a group = - where S_G is the relative state to a group

5) σ(s) = emotive derivative of a learner with respect to his group = ————

4.1.5 Step Level 4 Bis: Characterization of Emotivity

We said that the status of an individual is characterized by the tuple S = (A, B, C, D) in V^4; in order to determine the status and assess the overall emotion of a learner, consider the following characteristic parameters:

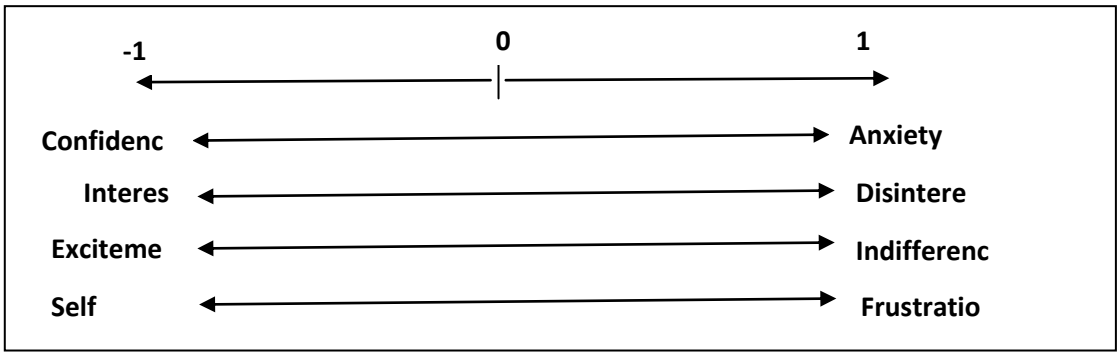

Figure 4-3: Class of emotion for Emotivity

We observe that the sequence of four parameters (A, B, C, D) each of which can take three values (-1,0,1), is a provision with repetitions $D_{n,k}$ = nk, in fact we have three choices for the first element, three for the second and so on. In our case it is the provisions of length 4 with repetition of elements {-1,0,1} and found to be 3^4 = 81.

The presentation of all possible cases is presented in "'Appendix A".

4.2 Affectivity

4.2.1 Step Level 1: Stimulus-Response

For the Affectivity we proceed the same way as for Emotivity. Even if the steps are similar, for the sake of clarity, we present the following steps to represent the affectivity. The status of an individual is characterized by the tuple T = (A, B, C, D) $\in V^4$. In this case the pre-quantification of the affective state is obtained through a questionnaire with 12 questions, three for each of the variables A, B, C, D. The output will indicate if the student responds positively, negatively or indifferently to the questionnaire.

The set of emotions for Affectivity is the following:

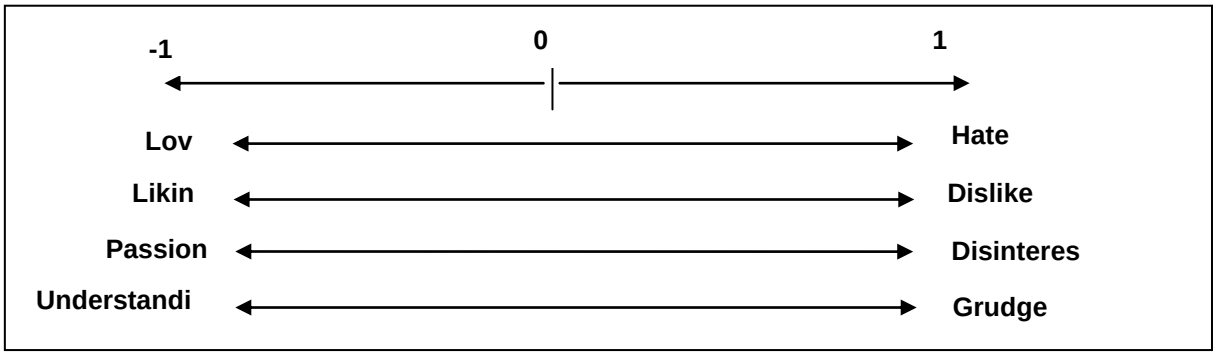

Figure 4-4: Class of emotion for Affectivity

The resulting trivalent value will be calculated by:

$$A = \frac{\sum_{i=1}^{3} A_i}{\left|\sum_{i=1}^{3} A_i\right|} \text{ if } \sum_{i=1}^{3} Ai \neq 0. \qquad \text{If } \sum_{i=1}^{3} Ai = 0, \text{ A} = 0.$$

$$B = \frac{\sum_{i=1}^{3} B_i}{\left|\sum_{i=1}^{3} B_i\right|} \text{ if } \sum_{i=1}^{3} Bi \neq 0. \qquad \text{If } \sum_{i=1}^{3} Bi = 0, \text{ B} = 0.$$

$$C = \frac{\sum_{i=1}^{3} C_i}{\left|\sum_{i=1}^{3} C_i\right|} \text{ if } \sum_{i=1}^{3} Ci \neq 0. \qquad \text{If } \sum_{i=1}^{3} Ci = 0, \text{ C} = 0.$$

$$D = \frac{\sum_{i=1}^{3} D_i}{\left|\sum_{i=1}^{3} D_i\right|} \text{ if } \sum_{i=1}^{3} Di \neq 0. \qquad \text{If } \sum_{i=1}^{3} Di = 0, \text{ D} = 0.$$

Then T will be for example = (1, 1, -1,0), then this will mean that the learner will feel Hate (for A = 1), will feel Disinterest (because B = 1), will feel Passion (because C = -1) and has no Understanding of Grudge because D = 0.

4.2.2 Step Level 2: Output Response - Quantity

The parameters which the user has given a positive answer to (i.e. not indifferent: -1 or 1), they will be quantified in a scale of 1 to 10 through 10 targeted and specific questions in detail in a later time.

Referring to the previous example, the system will present to the learner a second questionnaire containing 30 questions, which specifically are:

- 10 to measure the degree of Hate;
- 10 to measure the degree of Disinterest;
- 10 to measure the degree of Passion;

_____ , _____ , _____ , _____ *

* (the x 100 allows us to put the results in correspondence with a probability distribution.)

Where $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$ they are one of ten questions that the learner will give a response (-1,0,1).

4.2.3 Step Level 3: Estimation of Dominance

As in the case of Emotivity, the tuple parameters are generalized in relation to the output of the 2 ° approach and in relation to the weight given to each of the parameters of the learner.

4.2.4 Step Level 4: Evaluation of the Affectivity

In the case of the Affectivity we introduce the following parameters:

1. λ(t) = absolute current Affectivity = _____ ≤ 100

2. θ (t) = Affectivity on subjective = _____ x 100

where is the maximum observed activity of the individual; if λ > then

——— = 1 and becomes the new .

Moreover (t) is the cumulative mean value of affectivity in different actions (different questionnaires which are given at different times); in other words (t) has the memory of the emotive state of the learner.

3. θ (s) = affective distance of the learner with respect to his mean value = -

4. δ (s) = affective distance of the learner with respect to the mean value of a group = - where is where S_G is the relative state to a group;

5. α (s) = affective derivative of a learner with respect to his group =

———————

4.2.5 Step Level 4 Bis: Characterization of Affectivity

We said that the status of an individual is characterized by the tuple T = (A, B, C, D) in V^4; in order to determine the status and assess the overall emotion of a learner, consider the following characteristic parameters:

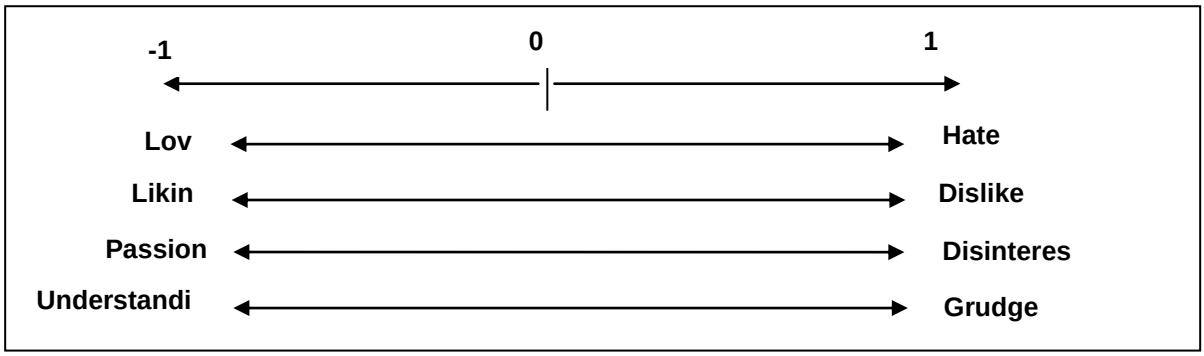

Figure 4-5: Characterization of Affectivity

As in the case of Emotivity, we observe that the sequence of four parameters (A, B, C, D) each of which can take three values (-1,0,1), is a provision with repetitions $D_{n,k} = n^k$, in fact we have three choices for the first element, three for the second and so on. In our case it is the provisions of length 4 with repetition of elements {-1,0,1} and found to be $3^4 = 81$.

The presentation of all possible cases is presented in "'Appendix A".

5 Existing Standardized Questionnaires

Measuring all 48 discrete emotions that fall around the Plutchik´s circumplex [58] in a reliable and valid way is complicated by the comparatively small number of questionnaires on emotions, which suffice the quality criteria of measurement theory. Due to the scientific convention to draw on existing instruments based on empirical validation studies and not to create ad hoc- instruments, we follow an approach that will be outlined in the following.

5.1 Combined Application of State and Trait Scales for an Assessment of Emotions

Our approach is based on the dichotomy of emotional states and emotional traits. While states denote current events of short duration, traits refer to individual dispositions to easily, frequently and intensively experience particular types of emotions [69]. Within the field of differential psychology, particular scales of questionnaires (sets of items) have been developed to measure either state- or trait aspects of emotions, such as anxiety- states and traits. An eLearning environment sensitive to a learner's affective state should apply both types of scales in a particular chronology. The measurement of a learner's traits has to proceed at the very beginning of her interactions with the environment in order to elicit her general tendency to experience states with positive or negative valence of high or low activation. On the other hand, state-scales can depict emotional fluctuations of a person and are therefore, appropriate for an ongoing assessment procedure to become aware of affective changes within a short time-period, e.g. a learning episode.

After the results of an initial assessment have been compared to population norms (for a corresponding age and gender) the learner's trait can be judged on a continuum varying from low over average to high. The outcome of this judgement process should then be taken into account for the presentation-frequency of the corresponding state-scales. For instance, a learner with a high anxiety-trait should be observed frequently with respect to her or his current anxiety-state, in order to avoid the presentation of difficult learning objects during a state of negative valence and high activation (= anxiety). To the contrary, the evaluation of an anxiety state can take place less frequently in case of a phlegmatic learner with a low tendency to experience anxiety.

From this it follows that the initial assessment must be grounded on the usage of reliable questionnaires that must be selected carefully with respect to quality criteria. Consequently, we focus on discrete emotions of the circumplex model that are operationalized by questionnaires with high psychometric quality. We also strive to select short forms of questionnaires, since several scales of different questionnaires must be combined to operationalize the dimensions of the ALICE constructs of emotivity and affectivity. Individuals tend to respond negatively to long questionnaires [70] and hence, the resulting set of items to be administered has to be as short as possible.

5.2 Standardized Questionnaires to measure Dimensions of Emotivity: Confidence (vs. Anxiety), Excitement (vs. Indifference) and Self-Esteem (vs. Frustration)

We start the discussion of potential questionnaires by mentioning that the distinction between the two dimensions of activation and valence is an alternative interpretation of the circumplex model to the distinction between negative affect (NA) and positive affect (PA), conceptualized by [71]. The dimension *negative affect* (NA) is in turn strongly related to the psychological research on a particular

kind of emotion, namely anxiety. With respect to the circumplex, anxiety falls into the quadrant of *unpleasant state with high activation*. Since anxiety is a central emotional construct with respect to learning achievement and academic performance - e.g. [72] - and spans a wide field of empirical studies, we firstly elaborate on questionnaires developed to operationalize trait and state aspects of anxiety.

One of the most prominent self-report measure of state- and trait aspects of anxiety is the *State-Trait-Anxiety-Inventory* (*STAI*; [73], [74]) that consists of two scales: the Anxiety-Trait-Scale (A-Trait) and the Anxiety-State-Scale (A-state), each encompassing 20 items to be answered on a four-point Likert-scale (1 = “not at all”; 4 = “very much”). The A-State items elicit how a person feels at “this very moment” (e.g. “I feel calm”); the A-Trait items elicit how she “generally” feels (e.g. “I worry too much over something that really doesn't matter“). Both scales have good reliability estimates: For the A-Trait scale the authors have obtained retest correlations between r=0.76 and r=0.77; for the A-State scale they gathered consistency coefficients between α=0.83 and α=0.92. With respect to validity, the study of [75] impressively demonstrated the independence and dependence of the A-Trait and A-State scale, respectively, on situations arousing more or less anxiety. Additionally, [76] have developed STAI-6, a short form of A-state only consisting of six items. In the light of further empirical studies, both scales appear to be suited for an application in the learning context and to capture dimensions of the ALICE’ construct emotivity. According to [69], the A-trait scale is suited to predict a person’s tendency to experience anxiety in situations, which put a persons’s self-esteem at risk and where people are likely to loose confidence in their own abilities. Therefore, the A-Trait and A-State scales should be suited to assess a learner’s general tendency and current state, respectively, with regards to the ALICE’ dimensions of *confidence vs. anxiety* as well *self-esteem vs. frustration*. Because of arguments, mentioned in the introduction, STAI-6 should be used to gather values for these two dimensions.

Another standardized questionnaire that could be administered to gather values for the confidence/anxiety dimension is a subscale of the Computer Attitude Scale CAS [77]. It consits of 10 five-point Likert-type items (α=0.91) and there exists evidence for valid use with adolescents (e.g. [77]).

In this sense, also the *S-R-Inventory of Anxiousness* [78] seems to be suited to measure trait anxiety aspects related to dimensions suggested in this deliverable. This inventory consists of 14 items to be answered on 5-point rating scales. The inventory takes into account the interaction between the tendency to experience anxiety and three different categories of situations: social situations, situations of physical danger and situations of uncertainty and therefore, this inventory allows for a differentiation of the A-Trait. Referring to [79], the amount of uncertainty evoked by learning material is crucial for a learner’s willingness to both contribute and make use of content provided by social media. Hence, the scale of the S-R-Inventory for situations of uncertainty could be used to measure trait aspects, which allow inferences about a learner’s disposition to be in a state of confidence or anxiety during the interaction with the eLearning environment of ALICE.

It is well known that emotional reactions proceed at three different levels of the so-called emotional trias: (1) the neurophysiological, (2) the subjective-psychological and (3) the motor-behavioural level. Low correlations between indicators of the different levels demonstrate that these three levels are associated with different aspects of an emotion [80]. Interestingly, the relationship is mediated by the intensity of emotions: the higher the intensity, the stronger the correlations between the three levels [69]. The emotional trias is also reflected by a factor-analysis of the S-R-Inventory. [78] could assign the inventory’s items to the following three categories: (1) vegetative reactions (headache, sweat, palpitation, and dry mouth), (2) muscle tone (shaking, backache), and (3) feelings of anxiety (worried, depressed, uncertain). In continuation of this result-pattern, [81], [82] and [83] developed the *Endler Multidimensional Anxiety Scales* (EMAS) for a self-report measure of state anxiety (EMAS-S), different

dimensions of trait anxiety (EMAS-T) and the perception of anxiety (EMAS-P). All items of these scales are rated on 5-point Lickert scales, ranging from 1 (not at all) to 5 (very much). Similar to the state scale of STAI, EMAS-S has 20 items for an autonomic emotional (AE) and a cognitive worry (CW) component of state anxiety. Separating AE from CW is owed to the "Two-Component-Theory" [84] [85], which assumes that anxiety is constituted by physiological excitement and cognitive worry. Correlational studies have revealed that the two components differentially influence academic performance, since physiological excitement (measured by AE) is conducive and cognitive worry (captured by CW) detrimental to learning achievement (e.g. [86] [72]). Thus, two dimensions of the (ALICE-) construct emotivity could be operationalized by EMAS-S: the dimension "excitement vs. indifference" by the subscale AE and the dimension "self-esteem vs. frustration" by the subscale CW, given that cognitive worry about personal abilities is inversely related to self-esteem.

The scale EMAS-T encompasses four subscales, each consisting of 15 Likert-type-items, for trait anxiety in social situations, situations of physical danger, new or strange situations and daily routines, respectively. As argued above, the subscale for social situations appears to be relevant for the ALICE-project.

Finally, the eLearning environment of ALICE could also make use of the favoured Test-Anxiety-Inventory (TAI) of [73] which has been developed to differentiate between self-esteem-related cognitions and perception of vegetative excitement in the context of academic achievement. Thus, it is based on the definition of trait anxiety as a "combination of exaggerated cognitive and physiological responses" [70]. The original TAI, consisting of 20 items and having a high level of reliability (α=0.95), has been pared to a short form with five items (TAI-5; [87] [70]), which still measures emotionality and worry components of test anxiety. TAI-5 has the following Likert-type response scale: 1 = almost never, 2 = sometimes, 3 = often, and 4 = almost always. The five items are: (1) "During tests, I feel very tense", (2) "I wish examinations did not bother me so much", (3) "I seem to defeat myself while working on important tests", (4) "I feel very panicky when I take an important test", and (5) "During examinations I get so nervous that I forget facts I really know". Reliability is α=0.86; the convergent validity is r=.64 and the divergent validity is α=0.31 (i.e., a desired less-than-strong correlation).

Table 4 gives a short summary of this section by displaying the constructs, described so far, and the selected questionnaires to measure state- and trait aspects.

Questionnaire	Trait	State	Conf./Anxiety	Self-Est./Frust.	Excit./Indif.
STAI-6		x	x	x	
CAS	x		x		
S-R-I	x				
EMAS-S		x		x	x
EMAS-T	x			x	
TAI-5	x		x		

Table 4. Potential questionnaires to measure trait- and state-aspects of emotivity

5.3 Standardized Questionnaire to measure Interest vs. Disinterest

A subscale of the *Questionnaire on Current Motivation* (QCM; [88]) can be applied to measure the fourth dimension of emotivity, namely interest. The QCM has been developed to capture different

factors of *current achievement motivation* (*CAM*), which is assumed "to directly influence task-related behaviour in a specific situation" [89]. In particular, CAM consists of (1) anxiety (fear of failure), (2) challenge, (3) interest and (4) probability of success. The factor interest stands for the positive affect elicited by the task itself and is thus, related to Csikszentmihalyi's construct of *flow* [90]. The original QCM is constituted by 18 items to be answered on a 7-point rating scale ranging from disagree to agree, and is appropriate to predict performance in cognitive tasks. The short form of the QCM contains 12 items (three items/factor) and therefore, provides an efficient instrument for an unobtrusive and ongoing measurement of a learner's state of interest. The internal consistencies for the short form, measured by Cronbach's *α*, are .81, .71, .78 and .85 for the factors anxiety, challenge, interest and probability of success, respectively. For the present purpose, only the factors anxiety and interest are relevant. The items for anxiety are (1) "I feel under pressure to do this task well", (2) "I am afraid I will make a fool out of myself", and (3) "It would be embarrassing to fail at this task". The items for interest are (1) "After having read the instruction, the task seems to be very interesting to me", (2) "For tasks like this I do not need a reward, they are lots of fun anyhow", and (3) "I would work on this task even in my free time".

As argued above, regarding interest as an internal state associated with positive feelings aroused by the task itself and not by external incentives, establishes a theoretical relationship with the construct of flow. Flow denotes a mental state of effortless production; it is experienced during tasks people are highly interested in and is accompanied by a reduced perception of time and space: all attention is focused on the task while the context and environment is – to some extent – blinded out. Therefore, an instrument to measure flow should allow for inferences about a learner's interest in a particular task. In line with our approach of separating state and trait aspects of emotions and motivations, [91] have developed the Flow State Scale-2 (FSS-2) and the Dispositional-Flow -Scale-2 (DFS-2). The FSS-2 consists of 36 5-point Likert-type items with α=.91 and captures the "experience of flow during the task" [70]. The DFS-2 assesses the person's general tendency to experience flow and has – similar to FSS-2 – 36 items. Due to our aim to create a compilation of items as short as possible, we will follow the same approach as [70] and will drop items with low face validity for the current context, i.e. eLearning environment.

5.4 Economic Procedure to Capture Discrete Emotions within Plutchik's Circumplex

In order to develop an emotion-aware system, [66] have applied a technique of [92] that could be adopted by the eLearning environment of ALICE as well. To analyze emotional states for use in digital systems, [66] conflated two main approaches to represent and structure emotions: a discrete approach (e.g. [58]) distinguishing basic and universal emotions (e.g. fear, anger, happiness, etc.) and a dimensional approach, which characterises all emotions by the two dimensions of arousal and valence (e.g. [93]). Firstly, learners performing computer tasks rate their emotional experience by a non-verbal, language-independent method, such as *SAM* (*Self-Assessment Manikin*; [94]). The SAM consists of pictures of manikins for the dimensions of valence and arousal, where each manikin represents one of five states (see Figure 2-5). The current emotional state is rated either by marking on a manikin or on a space between two manikins. Afterwards, the learners' ratings can be mapped on the coordinate system with respect to arousal and valence, and the resulting point with an x- and a y-coordinate can then be labelled by a corresponding emotional term.

5.5 Examples

5.5.1 PANAS [95]

Table 5. Adjectives to be used to elicit positive and negative affectivity

	not at all	a little	moderately	quite a bit	extremely
interested					
distressed					
excited					
upset					
strong					
guilty					
scared					
hostile					
enthusiastic					
proud					
irritable					
alert					
ashamed					
inspired					
nervous					
determined					
attentive					
jittery					
active					
afraid					

Instruction:

This scale consists of number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the according. Indicate to what extend [INSERT APPROPRIATE TIME INSTRUCTIONS HERE].

Possible time instructions:

- Moment (you feel this way right now, that is, at the present moment)

- Today (you have felt this way today)

- Past few days (you have felt this way during the past few days)

- Week (you have felt this way during the past week)

- Past few weeks (you have felt this way during the past few week)

- Year (you have felt this way during the past year)

- General (you generally feel this way, that is, how you feel on the average)

Evaluation of the questionnaire / Calculation of Sum Scores

- not at all: value = 1

- a little: value = 2

- moderately: value = 3

- quite a bit: value = 4

- extremely: value = 5

Scales: *Positive Affect* and *Negative Affect*

Scale-value for *Positive Affect* = Sum of values for interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, active

Scale-value for *Negative Affect* = Sum of values for distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, afraid

5.5.2 *STAI* [74]

No cost-free version available in the internet

http://www.mindgarden.com/products/staisad.htm#ms

http://www.hogrefe.co.uk/state-trait-anxiety-inventory-stai.html

Costs for STAI Complete Kit (Manual with Scoring Key and 25 Test Booklets): £118.00

5.5.3 *STAI-6* [76]

No specific items available (just item numbers). If STAI is available, then STAI-6 is available too.

5.5.4 *CAS* [77]

One subscale of the Computer Attitude Scale (CAS), the confidence/anxiety dimension, consists of 10 five-point Likert-type items (α=0.91) and there exists evidence for valid use with adolescents. The following lists the items that could be applied for ALICE:

I would rather achieve my goals without using the computer.

I am afraid to use a computer.

I would enjoy the challenge of using a computer.

I don't feel sure of myself when it comes to teaming to use a computer.

I think it would be fun to work on computer.

I think that I can be more productive if I team to use a computer.

I am afraid that I can't team to use a computer.

A computer could help me to accomplish some important personal goals.

I think I would enjoy playing games on a computer.

I think I would feel powerful if I could use a computer well.

5.5.5 *SRI* [78]

No cost-free version available in the internet

Can be downloaded at: http://psycnet.apa.org/journals/mon/76/17/1/

Costs: $11.95

5.5.6 *SAM* [94]

The SAM consists of pictures of manikins for the dimensions of valence and arousal, where each manikin represents one of five states. The current emotional state is rated either by marking on a manikin or on a space between two manikins (see Figure 5-1.). Afterwards, the learners' ratings can be mapped on the coordinate system with respect to arousal and valence, and the resulting point with an x- and a y-coordinate can then be labelled by a corresponding emotional term. The usual scales are 9-Point but 5- and 7-Point Scales also exist.

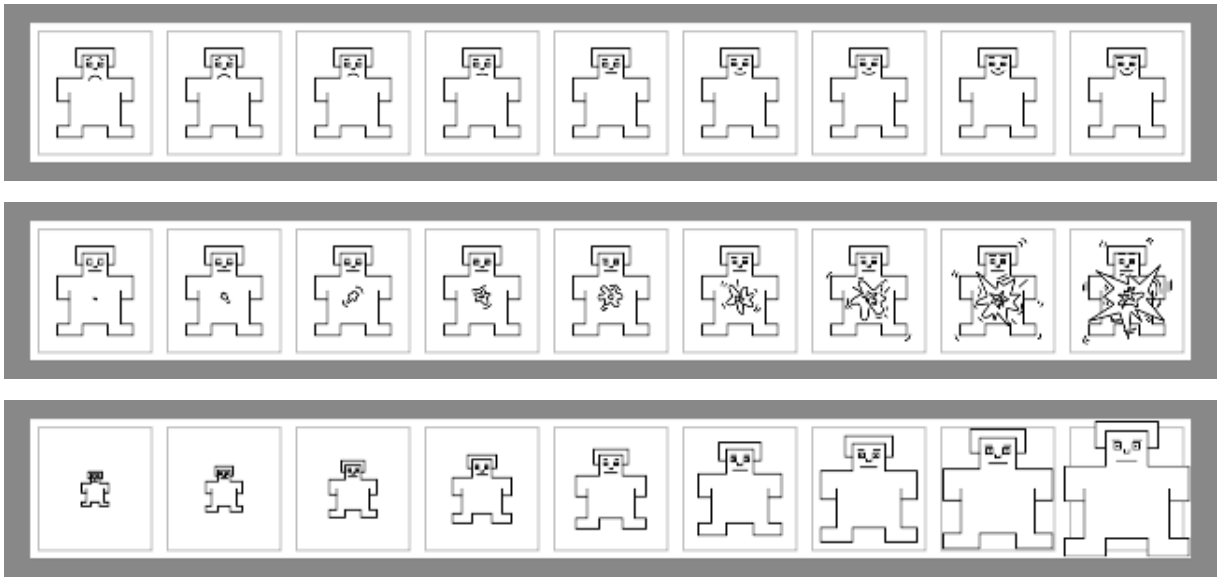

Figure 5-1: SAM 9-Point scales for Valence, Arousal and Dominance
(copied February 8, 2012 from http://irtel.uni-mannheim.de/pxlab/demos/index_SAM.html)

5.5.7 *EMAS-S and EMAS-T*

No cost-free version available in the internet

http://portal.wpspublish.com/portal/page?_pageid=53,102679&_dad=portal&_schema=PORTAL

Costs for EMAS Complete Kit (Manual with Scoring Key and 25 Test Booklets): £115.00

5.5.8 *TAI-5* [87]

Table 6: Items of TAI-5

During tests, I feel very tense.	B
I wish examinations did not bother me so much.	A
I seem to defeat myself while working on important tests.	A
I feel very panicky when I take an important test.	B
During examinations I get so nervous that I forget facts I really know.	A

Note. A = Item on (cognitive) worry component, B = Item on (physiological) emotionality

The original TAI, consisting of 20 items and having a high level of reliability (α=0.95), has been pared to a short form with five items (TAI-5 Table 6; [87], [70]), which still measures emotionality and worry components of test anxiety. TAI-5 has the following Likert-type response scale: 1 = almost never, 2 = sometimes, 3 = often, and 4 = almost always. Reliability is α=0.86; the convergent validity is r=.64 and the divergent validity is α=0.31 (i.e., a desired less-than-strong correlation).

5.5.9 *QCM Short Form* [89]

Table 7: Items of the QCM short form

I think I am up to the difficulty of this task	Probability of success
I probably won´t manage to do this task	Probability of success (-)
I feel under pressure to do this task well	Anxiety
After having read the instruction, the task seems to be very interesting to me	Interest
I am eager to see how I will perform in the task	Challenge
I am afraid I will make a fool out of myself	Anxiety
I am really going to try as hard as I can on this task	Challenge
For tasks like this I do not need a reward, they are lots of fun anyhow	Interest
It would be embarrassing to fail at this task	Anxiety
I think everyone could do well on this task	Probability of success
If I can do this task, I feel proud of myself	Challenge
I would work on this task even in my free time	Interest

The short form of the QCM contains 12 items (three items/factor) and therefore, provides an efficient instrument for an unobtrusive and on-going measurement of a learner's state of interest. The internal consistencies for the short form, measured by Cronbach's *α*, are .81, .71, .78 and .85 for the factors anxiety, challenge, interest and probability of success, respectively. For the present purpose, only the factors anxiety and interest are relevant (grey fields in Table 7).

5.5.10 FSS-2 [91]

1	skills met challenge	Challenge-Skill Balance (CHAL)
2	knew what I wanted to do	Clear Goals (GOAL)
3	clearly doing well	Unambiguous Feedback (FDBK)
4	attention focused	Concentration on Task (CONC)
5	in total control	Paradox of Control (CONT)
6	not concerned with others	Loss of Self-Consciousness (LOSS)
7	altered time	Transformation of Time (TRAN)
8	enjoyed experience	Autotelic Experience (ENJY)
9	abilities matched challenge	Challenge-Skill Balance (CHAL)
10	correct movements without thinking	Action-Awareness Merging (ACT)
11	kept my mind on what was happening	Concentration on Task (CONC)
12	I could control what I was doing	Paradox of Control (CONT)
13	not worried about performance	Loss of Self-Consciousness (LOSS)
14	different rime from normal	Transformation of Time (TRAN)
15	wanted to recapture the feeling	Autotelic Experience (ENJY)
16	competent to meet demands	Challenge-Skill Balance (CHAL)
17	total concentration	Concentration on Task (CONC)
18	experience left me feeling great	Autotelic Experience (ENJY)
19	challenge and skills equally high	Challenge-Skill Balance (CHAL)

20	thinks happened automatically	Action-Awareness Merging (ACT)
21	strong sense of what I wanted to do	Clear Goals (GOAL)
22	aware of how well I was performing	Unambiguous Feedback (FDBK)
23	completely focused on task	Concentration on Task (CONC)
24	in total control of body	Paradox of Control (CONT)
25	not concerned with presentation	Loss of Self-Consciousness (LOSS)
26	time stopped	Transformation of Time (TRAN)
27	performed automatically	Action-Awareness Merging (ACT)
28	knew what I wanted to achieve	Clear Goals (GOAL)
29	knew how well I was doing while performing	Unambiguous Feedback (FDBK)
30	feeling of total control	Paradox of Control (CONT)
31	spontaneous and automatic	Action-Awareness Merging (ACT)
32	clearly defined goals	Clear Goals (GOAL)
33	knew how well I was doing by the way I was performing	Unambiguous Feedback (FDBK)
34	not worried about others	Loss of Self-Consciousness (LOSS)
35	slow motion	Transformation of Time (TRAN)
36	experience was extremely rewarding	Autotelic Experience (ENJY)

5.5.11 PrEmo

It was first introduced from the scientific research at the Technical University of Delft by Dr. Pieter Desmet (2003) and further developed by SusaGroup and TUDelft, resulting in a new and improved interface and character (Figure 5-2). It is a non-verbal instrument that provides respondents with expressive cartoon animations to report their emotions. It measures a set of 12 emotions, 6 pleasant (i.e. desire, pleasant surprise, amusement, admiration, satisfaction, fascination), and 6 unpleasant (i.e. indignation, contempt, disgust, surprise, dissatisfaction, disappointment, and boredom). In the instrument, each of the 12 measured emotions is portrayed by an animation of dynamic facial, bodily, and vocal expressions. Once the animation is selected, the respondent can use the scales on the right side of the character to report to what degree the feeling expressed by the character matches his/her own feeling.

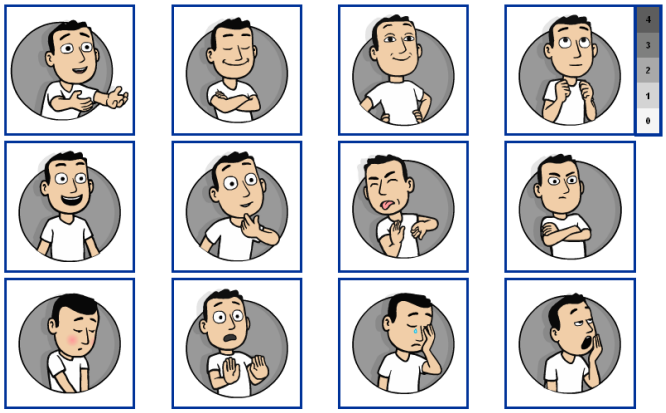

Figure 5-2: PrEMO characters (copied February 8, 2012 from http://www.premo-online.com/)

PrEMO is a commercial product available in a considerable cost (begins from 500€). Moreover, it has been designed for commercial use, not suitable to education settings. For example, the respondent is asked to report on each of the 12 characters by using the right side scales (0 to 5). This leads to a 12-times assessment per page and thus frustrating students..

5.5.12 The Geneva Emotion Wheel (GEW)

It was developed by Klaus Scherer (2005), in the Geneva Emotion Research Group (Figure 5-3). It has 20 different emotion families (10 positive emotions and 10 negative) arranged in a circular fashion on a response sheet. The two words or labels that represent each family can stand for a whole range of similar emotions. The respondent is first asked to choose the emotion family that seems to best correspond to the kind of feeling that he/she experienced when an event took place. Then they determine with which intensity they experienced the respective emotion by checking one of the circles in the "spike" corresponding to this emotion family -- the bigger the circle and the closer it is to the rim of the wheel, the stronger would have been their emotional experience.

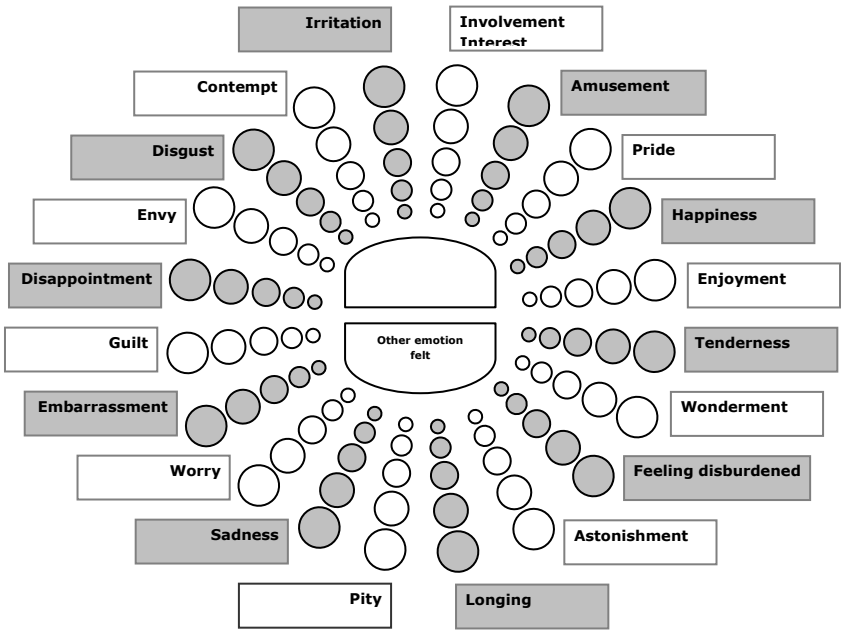

Figure 5-3 – The Geneva Emotion Wheel (copied February 8, 2012, from Scherer, 2005)

6 Questionnaire Example

In the previous section we saw particular scales of questionnaires (sets of items) that have been developed to measure state- or trait aspects of emotions. The various sections of our questionnaire has been defined according to this scale. In particular have been taken into account particular versions of already existing questionnaires to measure state-aspects of emotivity. STAI-6, a short form of Test-Anxiety-Inventory (TAI) useful to measure the anxiety (Marteau, 1992) suited for an application in the learning context has been chosen to assess a learner's current state, respectively, with regards to the dimensions of confidence vs. anxiety as well self-esteem vs. frustration, during the interaction with the specific learning assignment. A subscale of the Questionnaire on Current Motivation (QCM) (Rheinberg, 2001) called *Flow State Scale-2 (FSS-2)* has applied to measure the fourth dimension of emotivity, namely interest *vs* interest, and subscale of EMAS (EMAS-P) to measure excitement *vs* indifference.

The short form of these scale (see below) revisited in easy form for students, provides an efficient instrument for an unobtrusive and on-going measurement of a learner's state of interest.

6.1 Sample Questionnaire for Emotivity

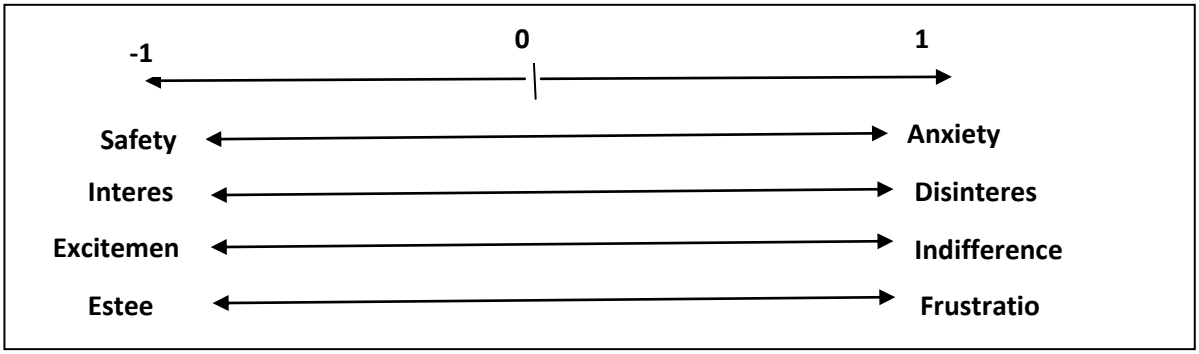

Figure 6-1: *Class of emotion for Emotivity*

6.1.1 Step Level 1: Stimulus-Response

You are given a questionnaire with 12 questions, three for each of the axes. the output will tell if the student responds positively, negatively or indifferently to the stimulus provided through the questionnaire.

Requests for pre-quantification **Safety←→ Anxiety**

1. Whenever you are assigned a new task, the first impression that assails you is:
    a. Anxiety, I'm not sure about can do it (-1).
    b. Confidence in my ability (1).
    c. None in particular (0).
2. If you perform a task when there are difficulties as the first thing you tend to:
    a. Get help from other (-1).

b. I stop, I reason and I find solutions (1).
c. I resign the task (0).

3. It happens that I cannot finish the task in the best way possible, I try:
   a. I cannot think of it and shot me down thinking about not being able to do well at all (-1).
   b. It happens to everyone even the best will do next time (1).
   c. I will not dwell too much (0).

Requests for pre-quantification **Interest←→ Disinterest**

1. You come across a group of students discussing individual theories and concepts learned in class. You:
   a. You approach shown interest in contributing (1);
   b. You approach but limits you to listen (0);
   c. Do not you care about them (-1).
2. An environment rich in resources and stimulating alternative what triggers you?
   a. I am ready to explore them all very carefully (1).
   b. I try to show them with appropriate caution at a time (-1).
   c. If they are alternatives I do not look (0).
3. Knowing when and how you can deal with an experience or a job is for you:
   a. Highly relevant. It's the first thing I look (1).
   b. It is a basic information to work well (0).
   c. Does not affect the way I work (-1).

Requests for pre-quantification **Excitement←→ Indifference**

1. How do you feel when, during the learning experience, you understand the usefulness of things learned and their importance in everyday life?
   a. I enthusiastically emotional myself because I understand the usefulness of things (1).
   b. In general it is not that excite me that much (0).
   c. Never happens, or at least I did not realize (-1).
2. How do you feel when during any teaching experience you are allowed to enter the scene through an avatar?
   a. Fantastic, I have a new "Ego" with which to experience (1).
   b. I do not know (0).
   c. An alternative experience of the many (-1).
3. How do you feel when you're in the position of having to choose at a crossroads?
   a. Enthusiasm and I'm driven to act because I feel I can determine the events.
   b. I do not act all that much even if it seems to me to be part of the scene (0).
   c. Indifference (-1).

Requests for pre-quantification **Esteem←→ Frustration**

1. What do you think is the view that your friends have you?
   a. They have a low opinion and I think that does not help (-1).
   b. Respect me and I always try (1).
   c. I can not answer (0).
2. What do you think of yourself as a student?
   a. I think not to be "SMART": they are very creative and I do not get fast solutions (-1).
   b. I can do great things (1).

c. I cannot judge me (0).

3. Think you have a strong identity?
   a. No, even if I could change my appearance to be more secure (-1).
   b. You are a guide and I have the energy to force myself (1).
   c. I do not know (0).

6.1.2 Step Level 2: Output Response - Quantity

The parameters which the user has given a negative or indifferent answer to, will be quantified in a scale of 1 to 100 through 10 targeted and specific questions (see paragraph 3.2.2). Sample Questionnaire:

Questionnaire Safety/Anxiety

Question 1:

You are a person constantly in tension, also worried for no apparent reason?

- Yes (1);
- No (-1);
- I do not know (0);

Question 2

In general, when you finish to complete a task immediately start thinking of all the other things you need to do?

- Yes (1);
- No (-1);
- I do not know (0);

Question 3

You always have confidence in your abilities, and this allows you to remain calm and deal with situations well.

- Yes (1);
- No (-1);
- I do not know (0);

Question 4

You are a quiet person can accomplish with lucidity all the activities.

- Yes (1);
- No (-1);
- I do not know (0);

Question 5

Tend to think that it is always necessary to seek help from others to deal with security experience.

- Yes (1);
- No (-1);
- I do not know (0);

Question 6

You worry too much about things that really understand that not matter?

- Yes (1);
- No (-1);
- I do not know (0);

Question 7

Are you a person who does not accept living with disappointment because with such participation cannot take them off of your head?

- Yes (1);
- No (-1);
- I do not know (0);

Question 8

Are you an organized person and this allows you to always reach the best results?

- Yes (1);
- No (-1);
- I do not know (0);

Question 9

Try not to worry too much about things ever, despite everything you never to address peacefully the activities that you are assigned.

- Yes (1);
- No (-1);
- I do not know (0);

Question 10

Lacks confidence in yourself?

- Yes (1);
- No (-1);
- I do not know (0);

Questionnaire Interest/Disinterest

Question 1

How significant that the activities' educational practices are highly contextualized and concrete situations?

- Yes (1);
- No (-1);
- I do not know (0);

Question 2

Considers the experience activating and motivating?

- Yes (1);
- No (-1);
- I do not know (0);

Question 3

Different views from different resources can afford to reach maturity on the overall management of the problems?

- Yes (1);
- No (-1);
- I do not know (0);

Question 4

How would you rate your level of attention than the content of learning resources fruite?

- Yes (1);
- No (-1);
- I do not know (0);

Question 5

It 'important to assess the time spent in the environment for learning?

- Yes (1);
- No (-1);
- I do not know (0);

Question 6

The experience is relevant to the objective enjoyed teaching you had code?

- Yes (1);
- No (-1);
- I do not know (0);

Question 7

The ongoing tests are a useful time to reflect and re-orientation of the route?

- Yes (1);
- No (-1);
- I do not know (0);

Question 8

You better check your cognitive state in the knowledge expected from the experience in the course?

- Yes (1);
- No (-1);
- I do not know (0);

Question 9

Check the resources suggested by the system to fit your interest and if the knowledge that characterize your profile.

- Yes (1);
- No (-1);
- I do not know (0);

Question 10

You are usually compared with the discussions generated in the social space or read the collective spaces of microblogging?

- Yes (1);
- No (-1);
- I do not know (0);

Questionnaire Excitement/Indifference

Question 1

The inclusion of elements that characterize the experience to your next experience really makes you feel more engaged and involved?

- Yes (1);
- No (-1);
- I do not know (0);

Question 2

The expression of emotion in case of danger evokes in you a greater sense of belonging to the scene?

- Yes (1);
- No (-1);
- I do not know (0);

Question 3

Being able to live an experience to take the form of an avatar can affect your involvement and participation?

- Yes (1);
- No (-1);
- I do not know (0);

Question 4

As the presence of a visual guide to human functional communication proxemics (gestures) and fatigue (expressions) is important for your involvement?

- Yes (1);
- No (-1);
- I do not know (0);

Question 5

What is motivating you to the thought that the whole experience that you are following will take you to a puzzle that can help you identify future situations of practical application?

- Yes (1);
- No (-1);
- I do not know (0);

Question 6

Normally when you face a task you feel able to move towards resolving the problems?

- Yes (1);
- No (-1);
- I do not know (0);

Question 7

The experience stirs in you a sense of drive to act?

- Yes (1);
- No (-1);
- I do not know (0);

Question 8

Your involvement as it affects the ability to maneuver and dynamic educational situations?

- Yes (1);
- No (-1);
- I do not know (0);

Question 9

The thought of having to be assessed puts you in turmoil?

- Yes (1);
- No (-1);
- I do not know (0);

Question 10

The multimedia scenes manage to slip into the context of the study?

- Yes (1);
- No (-1);
- I do not know (0);

Questionnaire Esteem/Frustration

Question 1

How do you rate your ability to affect others and be a reference point for them?

- Yes (1);
- No (-1);
- I do not know (0);

Question 2.

How do you rate your ability to expose your thinking without losing the peace and safety of what you say?

- Yes (1);
- No (-1);
- I do not know (0);

Question 3.

Do you often disappoint yourself?

- Yes (1);
- No (-1);
- I do not know (0);

Question 4.

Listen not to be a creative person that can share good ideas?

- Yes (1);
- No (-1);
- I do not know (0);

Question 5

Often in comparison with others you seem to not maintain the pace, not to think so quickly to compete with them?

Question 6

How do you value the trust that others have of you?

- Yes (1);
- No (-1);
- I do not know (0);

Question 7

Do you ever 'often thought of not having the energy to do great things?

- Yes (1);
- No (-1);
- I do not know (0);

Question 8

Do you ever feel ashamed enough to want to be somebody else?

- Yes (1);
- No (-1);
- I do not know (0);

Question 9

How do you rate your ability to express your ideas with conviction being able to communicate what you believe?

- Yes (1);
- No (-1);
- I do not know (0);

Question 10

Think you're a certain person in a position to carry out activities without fear?

- Yes (1);
- No (-1);
- I do not know (0);

References

[1]. Goldin, P., Hutcherson, C., Ochsner, K., Glover, G., Gabrieli, J., and Grossa, J. (2005). The neural bases of amusement and sadness: A comparison of block contrast and subject-specific emotion intensity regression approaches. NeuroImage 27, p.26– 36.

[2]. Marsella, S. & Gratch, J. (2009). EMA: A Model of Emotional Dynamics. Journal of Cognitive Systems Research, 10(1), 70-90.

[3]. R.J. Davidson, K.R. Scherer, and H.H. Goldsmith, Handbook of Affective Sciences. Oxford Univ. Press, 2003.

[4]. P. Ekman, “An Argument for Basic Emotions,” Cognition and Emotion, vol. 6, pp. 169-200, 1992.

[5]. P. Ekman, “Expression and the Nature of Emotion,” Approaches to Emotion, K. Scherer and P. Ekman, eds., pp. 319-344, Erlbaum, 1984.

[6]. P. Ekman and W. Friesen, Facial Action Coding System: A Technique for the Measurement of Facial Movement: Investigator’s Guide 2 Parts. Consulting Psychologists Press, 1978.

[7]. Z. Zeng, M. Pantic, G.I. Roisman, and T.S. Huang, “A Survey of Affect Recognition Methods: Audio, Visual, and Spontaneous Expressions,” IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 31, no. 1, pp. 39-58, Jan. 2009.

[8]. J.A. Russell, J.A. Bachorowski, and J.M. Fernandez-Dols, “Facial and Vocal Expressions of Emotion,” Ann. Rev. of Psychology, vol. 54, pp. 329-349, 2003.

[9]. T. Johnstone and K. Scherer, “Vocal Communication of Emotion,” Handbook of Emotions, pp. 220-235, Guilford Press, 2000.

[10]. P. Bull, Posture and Gesture. Pergamon Press, 1987.

[11]. M. Demeijer, “The Contribution of General Features of Body Movement to the Attribution of Emotions,” J. Nonverbal Behavior, vol. 13, pp. 247-268, 1989.

[12]. A. Mehrabian, Nonverbal Communication. Aldine-Atherton, 1972.

[13]. N. Bernstein, The Co-Ordination and Regulation of Movement. Pergamon Press, 1967.

[14]. S. Mota and R. Picard, “Automated Posture Analysis for Detecting Learner’s Interest Level,” Proc. Computer Vision and Pattern Recognition Workshop, vol. 5, p. 49, 2003.

[15]. N. Bianchi-Berthouze and C. Lisetti, “Modeling Multimodal Expression of User’s Affective Subjective Experience,” User Modeling and User-Adapted Interaction, vol. 12, pp. 49-84, Feb. 2002.

[16]. G. Castellano, M. Mortillaro, A. Camurri, G. Volpe, and K. Scherer, “Automated Analysis of Body Movement in Emotionally Expressive Piano Performances,” Music Perception, vol. 26, pp. 103-119, Dec. 2008.

[17]. C.E. Osgood, W.H. May, and M.S. Miron, Cross-Cultural Universals of Affective Meaning. Univ. of Illinois Press, 1975.

[18]. C.E. Osgood, Language, Meaning, and Culture: The Selected Papers of C.E. Osgood. Praeger Publishers, 1990.

[19]. J.A. Russell, “Core Affect and the Psychological Construction of Emotion,” Psychological Rev., vol. 110, pp. 145-172, 2003.

[20]. L. Barrett, “Are Emotions Natural Kinds?” Perspectives on Psychological Science, vol. 1, pp. 28-58, 2006.

[21]. A.V. Samsonovich and G.A. Ascoli, “Cognitive Map Dimensions of the Human Value System Extracted from Natural Language,” Proc. AGI Workshop Advances in Artificial General Intelligence: Concepts, Architectures and Algorithms, pp. 111-124, 2006.

[22]. M.A. Cohn, M.R. Mehl, and J.W. Pennebaker, “Linguistic Markers of Psychological Change Surrounding September 11, 2001,” Psychological Science, vol. 15, pp. 687-693, Oct. 2004.

[23]. J. Pennebaker, M. Mehl, and K. Niederhoffer, “Psychological Aspects of Natural Language Use: Our Words, Our Selves,” Ann. Rev. Psychology, vol. 54, pp. 547-577, 2003.

[24]. J. Kahn, R. Tobin, A. Massey, and J. Anderson, “Measuring Emotional Expression with the Linguistic Inquiry and Word Count,” Am. J. Psychology, vol. 120, pp. 263-286, Summer 2007.

[25]. C.G. Shields, R.M. Epstein, P. Franks, K. Fiscella, P. Duberstein, S.H. McDaniel, and S. Meldrum, “Emotion Language in Primary Care Encounters: Reliability and Validity of an Emotion Word Count Coding System,” Patient Education and Counseling, vol. 57, pp. 232-238, May 2005.

[26]. Y. Bestgen, “Can Emotional Valence in Stories Be Determined from Words,” Cognition and Emotion, vol. 8, pp. 21-36, Jan. 1994.

[27]. J. Hancock, C. Landrigan, and C. Silver, “Expressing Emotion in Text-Based Communication,” Proc. SIGCHI, 2007.

[28]. C. Chung and J. Pennebaker, “The Psychological Functions of Function Words,” Social Comm., K. Fielder, ed., pp. 343-359, Psychology Press, 2007.

[29]. J. Pennebaker, M. Francis, and R. Booth, Linguistic Inquiry and Word Count (LIWC): A Computerized Text Analysis Program. Erlbaum Publishers, 2001.

[30]. W. Weintraub, Verbal Behavior in Everyday Life. Springer, 1989.

[31]. J.P. Pinel, Biopsychology. Allyn and Bacon, 2004.

[32]. M. Pantic and L. Rothkrantz, “Toward an Affect-Sensitive Multimodal Human-Computer Interaction,” Proc. IEEE, vol. 91, no. 9, pp. 1370-1390, Sept. 2003.

[33]. R. Sharma, V.I. Pavlovic, and T.S. Huang, “Toward Multimodal Human-Computer Interface,” Proc. IEEE, vol. 86, no. 5, pp. 853- 869, May. 1998.

[34]. Rafael A. Calvo - Sidney K. D'Mello. New Perspectives on Affect and Learning Technologies. Springer-Verlag New York Inc. ISBN: 1441996249.

[35]. Picard, R. (1997). Affective Computing. MIT Press: Cambridge, MA.

[36]. Woolf, B., Burelson, W., and Arroyo, I. (2007). Emotional Intelligence for Computer Tutors. Supplementary Proceedings of the 13th International Conference on Artificial In- telligence in Education (AIED 2007)

[37]. D'Mello, S., et al. (2008). AutoTutor Detects and Responds to Learners Affective and Cognitive States. Workshop on Emotional and Cognitive Issues at the International Conference of Intelligent Tutoring Systems, Montreal, Canada.

[38]. Forbes-Riley, K. & Litman, D. (2009). Designing and evaluating a wizarded uncertainty-adaptive spoken dialogue tutoring system. Computer Speech and Language, 25(1):105–126.

[39]. Robison, J., McQuiggan, S. and Lester, J. (2009). Evaluating the consequences of affective feedback in intelligent tutoring systems. In Proceedings of the International Conference on Affective Computing & Intelligent Interaction, September 10-12, 2009, Amsterdam, The Netherlands. Workshop on Empirical Methods for Tutorial Dialogue Systems.

[40]. Ashford, S. J., Blatt, R., & VandeWalle, D. (2003). Reflections on the looking glass: A review of research on feedback-seeking behavior in organizations. Journal of Management, 29, 773-799.

[41]. Hascher, T. (2010). Learning and Emotion: perspectives for theory and research. European Educational Research Journal, 9, p. 13-28.

[42]. Goleman, D. (1995). Emotional Intelligence. New York:Bantam Books.

[43]. Kort, B., Reilly, R., (2002). Analytical Models of Emotions, Learning and Relationships: Towards an Affect-sensitive Cognitive Machine. M.I.T. Media Laboratory.

[44]. Pekrun, R. (1992). The impact of emotions on learning and achievement: Towards a theory of cognitive/motivational mediators. Applied Psychology: An International Review, Vol 41(4), Oct 1992

[45]. Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. Educational Psychology Review, 18, 315–341.

[46]. Collaborative for Academic, Social, and Emotional Learning (CASEL), http://www.casel.org/.

[47]. Shute, V. J. (2006). Focus on formative feedback. ETS Research Report, Princeton, NJ.

[48]. Aist, G. Kort, B., Reilly, R., Mostow, J., Picard R. (2002). Experimentally augmenting an intelligent tutoring system with human-supplied capabilities: adding Human-Provided Emotional Scaffolding to an Automated Reading Tutor that Listens. In: Proceedings of Intelligent Tutoring Systems Conference

[49]. Liu, K., Picard, R.W. (2005). Embedded empathy in continuous, interactive health assessment. In: CHI Workshop on HCI Challenges in Health Assessment.

[50]. Kleine, M., Goetz, T., Pekrun, R. H., & Hall, N. C. (2005). The structure of students' emotions experienced during a mathematical achievement test. International Reviews on Mathematics Education, 37, 221-225.

[51]. Wang, N., Johnson, W., Mayer, R.E., Rizzo, P., Shaw, E., Collins, H. (2008). The politeness effect: pedagogical agents and learning outcomes. International Journal of Human–Computer Studies 66 (2), 98–112.

[52]. Chaffar, S. & Frasson, C. (2004). Using an emotional intelligent agent to improve the learner's performance. In Proceedings of the Workshop on Social and Emotional Intelligence in Learning Environments in conjunction with Intelligent Tutoring Systems, Maceio, Brazil.

[53]. Bersak, D., McDarby, G., Augenblick, N., McDarby, P., McDonnell, D., McDonal, B., Karkun, R. (2001). Biofeedback using an Immersive Competitive Environment. Online Proceedings for the Designing Ubiquitous Computing Games Workshop, Ubicomp 2001.

[54]. Sharry, J., Condron, J., Burke, R. & Mcdarby, G. (2003). Affective Feedback: Learning skills in the virtual world for use in the real world, M.I.T. Media Lab, Europe, Dublin, Ireland.

[55]. I.Arroyo, K.Muldner, W.Burleson, B.Woolf, and D.Cooper, Designing Affective Support to Foster Learning, Motivation and Attribution, Proceeding of AIED workshop 2009.

[56]. Lang, P. J. (1980). Behavioral treatment and bio-behavioral assessment: computer applications. In J. B. Sidowski, J. H. Johnson, & T. A. Williams (Eds.), Technology in mental health care delivery systems (pp. 119-l37). Norwood, NJ: Ablex.

[57]. Suk, Hyeon-Jeong (2006). Color and Emotion - a study on the affective judgment across media and in relation to visual stimuli. University of Mannheim: Dissertation.

[58]. Plutchik, R. (1980). A general psychoevolutionary theory of emotion. In R. Plutchik & H. Kellerman (Eds.), Emotion: Theory, research, and experience: Vol. 1. Theories of emotion (pp. 3-33). New York: Academic.

[59]. T. Kanade, J. F. Cohn and Y. Tian, Comprehensive database for facial expression analysis, Proc. of FG00, pages 46-53, 2000.

[60]. M. Bedek, P. Seitlinger, S. Kopeinik, and D Albert “Multivariate Assessment of Motivation and Emotion in Digital Educational Games.” In: Proceedings of the 5th European Conference on Game Based Learning. S. 18 - 25, Oct. 2011.

[61]. M. Bedek, B. Cowley, P. Seitlinger, M. Fantato, S. Kopeinik, D. Albert, N. Ravaja “Assessment of the Emotional State by Psycho-physiological and Implicit Measurements.” In: 13th International Conference on Multimodal Interaction. Nov. 2011.

[62]. S. Kopeinik, M. Bedek, P. Seitlinger, D. Albert “The Artificial Mentor: An assessment based approach to adaptively enhance learning processes in virtual learning environments.” In: Proceedings of the 19th International Conference on Computers in Education. Dec. 2011.

[63]. R. J. Larsen and E. Diener “Promises and problems with the circumplex model of emotion.” In M. Clark (Ed.), Review of personality and social psychology (Vol. 13, pp. 25-59). Newbury Park, CA: Sage. 1992.

[64]. L. F. Barrett “Discrete emotions or dimensions? The role of valence focus and arousal focus.” Cognition and Emotion, 12, 579–599. 1998.

[65]. A.H. Harcourt and P. J. Lang ”The emotion probe. Studies of motivation and attention.” American Psychologist, 50, 372-385. 1995.

[66]. H. Cai, H. and Lin, Y. “Modeling of operators’ emotion and task performance in a virtual driving environment.” International Journal of Human-Computer Studies, 69, 571-586. 2011.

[67]. P. Pirolli, and S. K. Card. “Information Foraging.” Psychological Review, 106, 643-675. 1999.

[68]. http://boccignone.dsi.unimi.it/IUM2_files/0_AffectReview.pdf)

[69]. Stemmler, G., Hagemann, D., Amelang, M., & Bartussek, D. (2011). Differentielle Psychologie und Persönlichkeitsforschung. Stuttgart: Kohlhammer.

[70]. Marszalek, J. M. (2009). Validation of a TAI short form with an adolescent sample. The Journal of General Psychology, 136, 333-349.

[71]. Watson, D., Clark, L. A. & Carey, G. (1988). Positive and negative affectivity and their relation to anxiety and depressive disorders. Journal of Abnormal Psychology, 97, 346-353.

[72]. Seipp, B. & Schwarzer, C. (1991). Angst und Leistung: Eine Metaanalyse empirischer Befunde. Zeitschrift für Pädagogische Psychologie, 5, 85-97.

[73]. Spielberger, C. D. (1980). Test anxiety inventory (“Test attitude inventory”). Palo Alto, CA: Psychologists Press.

[74]. Spielberger, C. D. (1983). Manual for the State Trait Anxiety Inventory (Form V). Palo Alto, CA: Psychologists Press.

[75]. Lamb, D. H. (1973). The effects of two stressors on state anxiety for students who differ in trait anxiety. Journal of Research in Personality, 7, 116-126.

[76]. Marteau, T. M. & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). British Journal of Social & Clinical Psychology, 31, 301-306.

[77]. Gressard, C. P. & Loyd, B. H. (1986). Validation studies of a new computer attitude scale. Association for Educational Data Systems Journal, 18, 295–301.

[78]. Endler, N. S., Hunt, J. M. & Rosenstein, A. J (1962). An S-R inventory of anxiousness. Psychological Monographs, 76.

[79]. Adomßent, M. (2001). Realisierungspotenziale kooperativen Lernens mit Hilfe virtueller Kommunikation. Gruppendynamik und Organisationsberatung, 32, 161-175.

[80]. Fahrenberg, J. (1992). Psychophysiology of neuroticism and anxiety. In A. Gale & M. W. Eysenck (Eds.) Handbook of individual differences (pp. 179-226). New York: Wiley.

[81]. Endler, N. S., Edwards, J. M. & Vitelli, R. (1991). Endler Multidimensional Anxiety Scales (EMAS): Manual. Los Angeles, CA: Werten Psychological Services.

[82]. Endler, N. S. & Flett, G. L. (2002). Separation, self-disclosure, and social evaluation anxiety as facets of trait social anxiety. European Journal of Personality, 16, 239-269.

[83]. Miclea, S., Ciuka, A. & Albu, M. (2009). Validation of the Endler Multidimensional Anxiety Scales and EMAS Social Anxiety Scales (EMAS and EMAS-SAS) on the Romanian population. Cognition, Brain, Behavior: An Interdisciplinary Journal, 13, 147-164.

[84]. Liebert, R. M. & Morris, L. W. (1967). Cognitive and emotional components of anxiety testing: A distinction and some initial data. Psychological Reports, 20, 975-978.

[85]. Morris, L. W., Davis, M. A. & Hutchings, C. H. (1981). Cognitive and emotional components of anxiety: Literature review and a revised worry-emotionality-scale. Journal of Educational Psychology, 73, 541-555.

[86]. Hodapp, V. (1982). From nonexperimental research on anxiety and educational achievment. In H. W. Krohne & L. Laux (Eds.), Achievment, stress, and anxiety (pp. 355-372). Washington, DC: Hemisphere.

[87]. Taylor, J. & Deane, F. P. (2002). Development of a short form of the test anxiety inventory (TAI). The Journal of General Psychology, 129, 127–136.

[88]. Rheinberg, F., Vollmeyer, R. & Burns, B. D. (2001), FAM: Ein Fragebogen zur Erfassung aktueller Motivation in Lern- und Leistungssituationen. Diagnostica, 47, 57-66.

[89]. Freund, P.A., Kuhn, J.-T., & Holling, H. (2011). Measuring current achievement motivation with the QCM: Short form development and investigation of measurement invariance. Personality and Individual Differences, 51, 629-634..

[90]. Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience. New York: Harper & Row.

[91]. Jackson, S. A. & Ecklund, R. C. (2002). Assessing flow in physical activity: The Flow State Scale-2 and Dispositional Flow Scale-2. Journal of Sport & Exercise Psychology, 24, 133–150.

[92]. Peter, C. & Herbon, A. (2006). Emotion representation and physiology assignments in digital systems. Interacting with Computers, 18, 139-170.

[93]. Russell, J. A. (1983). Pancultural aspects of the human conceptual organization of emotions. Journal of Personality and Social Psychology, 45, 1281- 1288.

[94]. Bradley, M. & Lang, P. (1994). Measuring emotion: self-assessment Manikin and the semantic differential. Journal of Behavior Therapy and Experimental Psychiatry, 25, 49-59.

[95]. Watson, D., & Clark, L. A. (1988). Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales. Journal of Personality and Social Psychology, 54(6), 1063-1070.

[96]. Boekaerts, M. (1993). Being concerned with well-being and with learning, *Educational Psychologist, (28), pp.149-167.*

[97]. Calvo, R. (2009). Incorporating affect into educational design patterns and technologies. *Proceedings of the 9th IEEE international conference on advanced learning technologies. July 14-18, Riga, Latvia*, http://sydney.edu.au/engineering/latte/docs/Calvo09-Icalt.pdf

[98]. Dave, K., Lawrence, S., & Pennock, D. M. (2003). Mining the peanut gallery: Opinion extraction and semantic classification of product reviews. *In Proc. of the 12th Int.WWW Conf.*

[99]. Desmet, P. M. A. (2003). *Measuring emotions: Development and application of an instrument to measure emotional responses to products,* In M.A. Blythe, A.F. Monk, K. Overbeeke, and P.C. Wright (Eds.), Funology: From Usability to Enjoyment. Dordrecht: Kluwer Academic Publishers

[100]. Feidakis, M., & Daradoumis, T., & Caballé, S. (2011b). *Emotion Measurement in Intelligent Tutoring Systems-What, When and How to Measure*. Proceedings of the 3rd International Conference on Networking and Collaborative Systems (INCOS), Fukuoka, Japan November 30 - December 2, 2011

[101]. Lang, P.J. (1980). *Behavioral treatment and bio-behavioral assessment: computer applications.* In: Sidowski, J.B., Johnson, J.H., Williams, T.A. (Eds.). Technology in mental health care delivery systems, 119-l37. Ablex, Norwood, NJ

[102]. Liu, H., Lieberman, H., Selker, T. (2003). *A Model of Textual Affect Sensing using Real-World Knowledge*, Proceedings of the Seventh International Conference on Intelligent User Interfaces (IUI 2003),pp. 125-132. Miami, Florida

[103]. Pekrun, R., Goetz, T., Frenzel, A., C. & Perry, R., P. (2011). *Measuring emotions in students' learning and performance: the Achievement Emotions Questionnaire (AEQ).* Contemporary Educational Psychology, Elsevier, 36(1!, Pages: 36-48, ISSN: 0361476X

[104]. Scherer, K. R. (2005). *What are emotions? And how can they be measured?* In Social Science Information, 44(4), 693-727

[105]. Valitutti, A., Strapparava, C., and Stock, O. (2004) *Developing Affective Lexical Resources*". In *PsychNology Journal, 2(1)*

[106]. Yi, J., Nasukawa, T. , Bunescu, R. and Niblack. W. (2003). *Sentiment analyzer: Extracting sentiments about a given topic using natural language processing techniques*. *In IEEE ICDM-2003.*

[107]. Wilson, T., Wiebe, J., and Hoffmann, P. (2005). Recognizing Contextual Polarity in Phrase-Level Sentiment Analysis. *Joint Human Language Technology Conference and the Conference on Empirical Methods in Natural Language Processing (HLT-EMNLP-2005).*

[108]. Wong, M. (2006). *Emotion assessment in evaluation of affective interfaces*. Master thesis, University of Waterloo, Ontario, Canada. Retrieved March 13, 2011 from http://www.cgl.uwaterloo.ca/~wmcowan/research/essays/maria.pdf

[109]. Zimmermann, P., G. (2008). *Beyond usability-Measuring aspects of user experience*. (Doctoral. dissertation, Swiss Federal Institute of Technology, Zurich). Retrieved July 13th, 2011 from http://e-collection.library.ethz.ch/eserv/eth:41599/eth-41599-02.pdf

Appendix A

As seen in Section 3.1.5, during the emotional prequantification possible combinations of the sequence of parameters that we take into account is 34 = 81. Consider the class of pure states, i.e. those after the first phase have only one nonzero value:

1) (0,0,0,0) Neutro (parameter has no value other than zero);
2) (-1,0,0,0) Confident;
3) (1,0,0,0) Anxious;
4) (0,-1,0,0) Interest;
5) (0,1,0,0) Disinterested;
6) (0,0,-1,0) Excited;
7) (0,0,1,0) Indifferent;
8) (0,0,0,-1) Self-Esteem
9) (0,0,0,1) Frustated;

In the first case, the emotional state appears to be neutral because no parameter has nonzero value.

In other cases, after making the step to the second level responsive/quality, you will have a quantification of the parameters of interest that will tell us what the learner will be Interested, Anxious, concerned and so forth. In case 2), for example, whereas the status of an individual is characterized by the tuple:

S = (A,B,C,D) we have that B, C, D = 0, while the parameter A = -1 indicates that the Confidence is detected, so we will have a value of A ∈ [0, 100], which provides a response quantitative of Confidence, we recall

---

Similarly, if in case 3, we have that the only non-zero value is A = 1 indicating the anxiety which can be given by the value $\overset{\approx}{A}$ ∈ [0, 100].

The case 4) tells us that the only variable to consider is B = -1, which indicates the presence of interest which will be quantified by a certain $\overset{\approx}{B}$ value. Address the same applies to all cases 5,6,7,8 and 9.

In the remaining 72 cases, several variables that characterize the tuple S, are simultaneously non-zero value. In these cases, the individual shows, at the same time the presence of different emotional states, quantified by measuring different values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

Let us now examine the cases where we have only 2 variables other than zero, such cases can be quantified in 24 and are as follows from 10) to 33):

10) (0, 0, -1, 1) in this case Excitement and Frustration are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Excitement and then secondarily Frustration. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Frustration and secondarily Excitement and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Excitement and Frustration.

11) (0, 0, -1, -1) in this case Excitement and Self-esteem are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Excitement and then secondarily Self-esteem. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Self-esteem and secondarily Excitement and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Excitement and Self-esteem.

12) (0, 0, 1, -1) in this case Indifference and Self-esteem are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Indifference and then secondarily Self-esteem. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Self-esteem and secondarily Indifference and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Indifference and Self-esteem.

13) (0, 0, 1, 1) in this case Indifference and Frustration are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Indifference and then secondarily Frustration. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Frustration and secondarily Indifference and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Indifference and Frustration.

14) (0, -1, 0, -1) in this case Interest and Self Esteem are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Interest and then secondarily Self Esteem. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Self Esteem and secondarily Interest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Interest and Self Esteem.

15) (0, -1, 0, 1) in this case Interest and Frustration are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Interest and then secondarily Frustration. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Frustration and secondarily Interest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Interest and Frustration.

16) (0, -1, -1, 0) in this case Interest and Excitement are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Interest and then secondarily Excitement. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Excitement and secondarily Interest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Interest and Excitement.

17) (0, -1, 1, 0) in this case Interest and Indifference are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Interest and then secondarily Indifference. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Indifference and secondarily Interest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Interest and Indifference.

18) (0,1, 0, -1) in this case Disinterest and Self Esteem are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Disinterest and then secondarily Self Esteem. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Self Esteem and secondarily Disinterest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Disinterest and Self Esteem.

19) (0,1, 0, 1) in this case Disinterest and Frustration are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Disinterest and then secondarily Frustration. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Frustration and secondarily Disinterest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Disinterest and Frustration.

20) (0,1, -1, 0) in this case Disinterest and Excitement are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Disinterest and then secondarily Excitement. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Excitement and secondarily Disinterest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Disinterest and Excitement.

21) (0, 1, 1, 0) in this case Disinterest and Indifference are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Disinterest and then secondarily Indifference. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Indifference and secondarily Disinterest and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Disinterest and Indifference.

22) (-1, 0, 0, -1) in this case Confidence and Self Esteem are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will feel mostly Confidence and then secondarily Self Esteem. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will experience primarily Self Esteem and secondarily Confidence and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Confidence and Self Esteem.

23) (-1.0, 0, 1) in this case Confidence and Frustration are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will feel mostly Confidence and then secondarily Frustration. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will experience primarily Frustration and secondarily Confidence and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Confidence and Frustration.

24) (-1, 0, -1, 0) in this case Confidence and Excitement are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will experience mostly Confidence and then secondarily Excitement. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will feel primarily Excitement and secondarily Confidence, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Confidence and Excitement.

25) (-1, 0, 1, 0) in this case Confidence and Indifference are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will experience mostly Confidence and then secondarily Indifference. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will feel primarily Indifference and secondarily Confidence, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Confidence and Indifference.

26) (-1, -1, 0, 0) in this case Confidence and Interest are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will experience mostly Confidence and then secondarily Interest. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will feel primarily Interest and secondarily Confidence, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Confidence and Interest.

27) (-1.1, 0, 0) in this case Confidence and Disinterest are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will experience mostly Confidence and then secondarily Disinterest. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will feel primarily Disinterest and secondarily Confidence, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Confidence and Disinterest.

28) (1, 0, 0, -1) in this case Anxiety and Self Esteem are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will experience mostly Anxiety and then secondarily Self Esteem. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will feel primarily Esteem and secondarily Anxiety, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Anxiety and Esteem.

29) (1, 0, 0, 1) in this case Anxiety and Indifference are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will feel mostly Anxiety and then secondarily Indifference. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will experience primarily Indifference and secondarily Anxiety and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Anxiety and Indifference.

30) (1, 0,-1, 0) in this case Anxiety and Excitement are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will feel mostly Anxiety and then secondarily Excitement. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will experience primarily Excitement and secondarily Anxiety and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Anxiety and Excitement.

31) (1, 0, 1, 0) in this case Anxiety and Indifference are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will feel mostly Anxiety and then secondarily Indifference. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will experience primarily Indifference and secondarily Anxiety and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Anxiety and Indifference.

32) (1, -1, 0, 0) in this case Anxiety and Interest are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will feel mostly Anxiety and then secondarily Interest. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will experience primarily Interest and secondarily Anxiety and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Anxiety and Interest.

33) (1, 1, 0, 0) in this case Anxiety and Disinterest are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will feel mostly Anxiety and then secondarily Disinterest. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will experience primarily Disinterest and secondarily Anxiety and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Anxiety and Disinterest.

Let us now examine some cases containing 3 variables different from zero, such cases can be quantified in 32 cases, as described below from 34) to 65):

34) (0, -1, -1, 1) we have B = -1, C = -1 and D = 1 simultaneously states Interest, Excitement and Frustration whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Excitement and finally Frustration to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest and secondly Excitement and Frustration to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Frustration and finally Excitement to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Interest and Excitement to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Interest and Excitement to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Interest, Excitement and Frustration to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Excitement and finally Interest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Excitement to the same extent, and Interest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Frustration and finally Interest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Interest and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Interest and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Interest and Frustration to the same extent.

35) (0, -1, -1,-1) we have B = -1, C = -1 and D = -1 simultaneously states Interest, Excitement and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Excitement and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest and secondly Excitement and Self Esteem to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Self Esteem and finally Excitement to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Interest and Excitement to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Interest and Excitement to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Interest, Excitement and Self Esteem to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Excitement and finally Interest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Excitement to the same extent, and Interest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Self Esteem and finally Interest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Interest and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Interest and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Interest and Self Esteem to the same extent.

36) (0, -1, 1,-1) we have B = -1, C = 1 and D = -1 simultaneously states Interest, Indifference and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Indifference and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest and secondly Indifference and Self Esteem to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Self Esteem and finally Indifference to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Interest and Indifference to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Interest and Indifference to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Interest, Indifference and Self Esteem to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Indifference and finally Interest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Indifference to the same extent, and Interest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Self Esteem and finally Interest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Interest and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Interest and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Interest and Self Esteem to the same extent.

37) (0, -1, 1, 1) we have B = -1, C = 1 and D = 1 simultaneously states Interest, Indifference and Frustration whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Indifference and finally Frustration to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest and secondly Indifference and Frustration to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Frustration and finally Indifference to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Interest and Indifference to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Interest and Indifference to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Interest, Indifference and Frustration to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Indifference and finally Interest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Indifference to the same extent, and Interest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Frustration and finally Interest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Interest and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Interest and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Interest and Frustration to the same extent.

38) (0, 1, -1, 1) we have B = 1, C = -1 and D = 1 simultaneously states Disinterest, Excitement and Frustration whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Excitement and finally Frustration to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Excitement and Frustration to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Frustration and finally Excitement to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Disinterest and Excitement to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Disinterest and Excitement to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Disinterest, Excitement and Frustration to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Excitement and finally Disinterest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Excitement to the same extent, and Disinterest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Frustration and finally Disinterest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Disinterest and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Disinterest and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Disinterest and Frustration to the same extent.

39) (0, 1, -1, -1) we have B = 1, C = -1 and D = -1 simultaneously states Disinterest, Excitement and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Excitement and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Excitement and Self Esteem to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Self Esteem and finally Excitement to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Disinterest and Excitement to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Disinterest and Excitement to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Disinterest, Excitement and Self Esteem to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Excitement and finally Disinterest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Excitement to the same extent, and Disinterest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Self Esteem and finally Disinterest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Disinterest and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Disinterest and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Disinterest and Self Esteem to the same extent.

40) (0, 1, 1, -1) we have B = 1, C = 1 and D = -1 simultaneously states Disinterest, Indifference and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Indifference and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Indifference and Self Esteem to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Self Esteem and finally Indifference to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Disinterest and Indifference to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Disinterest and Indifference to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Disinterest, Indifference and Self Esteem to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Indifference and finally Disinterest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Indifference to the same extent, and Disinterest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Self Esteem and finally Disinterest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Disinterest and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Disinterest and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Disinterest and Self Esteem to the same extent.

41) (0, 1, 1, 1) we have B = 1, C = 1 and D = 1 simultaneously states Disinterest, Indifference and Frustration whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Indifference and finally Frustration to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Indifference and Frustration to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Frustration and finally Indifference to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Disinterest and Indifference to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Disinterest and Indifference to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Disinterest, Indifference and Frustration to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Indifference and finally Disinterest to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Indifference to the same extent, and Disinterest to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Frustration and finally Disinterest to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Disinterest and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Disinterest and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Disinterest and Frustration to the same extent.

42) (-1, 0, -1, 1) we have A = -1, C = -1 and D = 1 simultaneously states Confidence, Excitement and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

The following nine cases may occur:

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Excitement and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Excitement and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Frustration and finally Excitement to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Excitement to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Confidence and Excitement to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Excitement and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Excitement and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Excitement to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Frustration and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Confidence and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Confidence and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Confidence and Frustration to the same extent.

43) (-1, 0, -1, -1) we have A = -1, C = -1 and D = -1 simultaneously states Confidence, Excitement and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}$, $\tilde{\tilde{C}}$, $\tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Excitement and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Excitement and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Self Esteem and finally Excitement to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Excitement to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Confidence and Excitement to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Excitement and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Excitement and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Excitement to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Self Esteem and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Confidence and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Confidence and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Confidence and Self Esteem to the same extent.

44) (-1, 0, 1, -1) we have A = -1, C = 1 and D = -1 simultaneously states Confidence, Indifference and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Indifference and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Indifference and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Self Esteem and finally Indifference to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Indifference to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Confidence and Indifference to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Indifference and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Indifference and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Indifference to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Self Esteem and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Confidence and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Confidence and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Confidence and Self Esteem to the same extent.

45) (-1, 0, 1, 1) we have A = -1, C = 1 and D = 1 simultaneously states Confidence, Indifference and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Indifference and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Indifference and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Frustration and finally Indifference to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Indifference to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Confidence and Indifference to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Indifference and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Indifference and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Indifference to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Frustration and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Confidence and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Confidence and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Confidence and Frustration to the same extent.

46) (1, 0, -1, 1) we have A = 1, C = -1 and D = 1 simultaneously states Anxiety, Excitement and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Excitement and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Excitement and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Frustration and finally Excitement to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Excitement to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Anxiety and Excitement to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Excitement and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Excitement and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Excitement to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Frustration and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Anxiety and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Anxiety and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Anxiety and Frustration to the same extent.

47) (1, 0, -1, -1) we have A = 1, C = -1 and D = -1 simultaneously states Anxiety, Excitement and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Excitement and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Excitement and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Self Esteem and finally Excitement to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Excitement to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Anxiety and Excitement to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Excitement and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Excitement and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Excitement to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Self Esteem and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Anxiety and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Anxiety and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Anxiety and Self Esteem to the same extent.

48) (1, 0, 1, -1) we have A = 1, C = 1 and D = -1 simultaneously states Anxiety, Indifference and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Indifference and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Indifference and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Self Esteem and finally Indifference to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Indifference to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Anxiety and Indifference to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Indifference and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Indifference and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Indifference to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Self Esteem and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Anxiety and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Anxiety and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Anxiety and Self Esteem to the same extent.

49) (1, 0, 1, 1) we have A = 1, C = 1 and D = 1 simultaneously states Anxiety, Indifference and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Indifference and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Indifference and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Frustration and finally Indifference to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Indifference to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Anxiety and Indifference to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Indifference and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Indifference and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Indifference to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Frustration and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Anxiety and finally Indifference to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference, secondly Anxiety and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Indifference and secondly Anxiety and Frustration to the same extent.

50) (-1, 0, -1, -1) we have A = -1, C = -1 and D = -1 simultaneously states Confidence, Excitement and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Excitement and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Excitement and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Self Esteem and finally Excitement to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Excitement to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Confidence and Excitement to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Excitement and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Excitement and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Excitement to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Self Esteem and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Esteem, secondly Confidence and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Confidence and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Confidence and Self Esteem to the same extent.

51) (-1, 0, -1, 1) we have A = -1, C = -1 and D = 1 simultaneously states Confidence, Excitement and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Excitement and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Excitement and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Frustration and finally Excitement to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Excitement to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Confidence and Excitement to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Excitement and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Excitement and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Excitement to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Frustration and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Confidence and finally Excitement to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Confidence and finally Frustration to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement and secondly Confidence and Frustration to the same extent.

52) (-1, 1, 0, 1) we have A = -1, B = 1 and D = 1 simultaneously states Confidence, Disinterest and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Disinterest and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Disinterest and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Frustration and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Disinterest to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Confidence and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Disinterest and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Disinterest and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Disinterest to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Frustration and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Frustration, secondly Confidence and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Confidence and finally Frustration to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Confidence and Frustration to the same extent.

53) (-1,1, 0, -1) we have A = -1, B = 1 and D = -1 simultaneously states Confidence, Disinterest and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Disinterest and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and secondly Disinterest and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Self Esteem and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Disinterest to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Confidence and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence, Disinterest and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Disinterest and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Disinterest to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Self Esteem and finally Confidence to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Self Esteem, secondly Confidence and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Confidence and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Confidence and Self Esteem to the same extent.

54) (1, -1, 0,-1) we have A = 1, B = -1 and D = -1 simultaneously states Anxiety, Interest and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Interest and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Interest and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Self Esteem and finally Interest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Interest to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Anxiety and Interest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Interest and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Interest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Interest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Self Esteem and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Self Esteem, secondly Anxiety and finally Interest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Anxiety and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest and secondly Anxiety and Self Esteem to the same extent.

55) (1, -1, 0, 1) we have A = 1, B = -1 and D = 1 simultaneously states Anxiety, Interest and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Interest and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Interest and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Frustration and finally Interest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Interest to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Anxiety and Interest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Interest and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Interest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Interest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Frustration and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Frustration, secondly Anxiety and finally Interest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Anxiety and finally Frustration to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest and secondly Anxiety and Frustration to the same extent.

56) (1,1, 0, -1) we have A = 1, B = 1 and D = -1 simultaneously states Anxiety, Disinterest and Self Esteem whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Disinterest and finally Self Esteem to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Disinterest and Self Esteem to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Self Esteem and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Disinterest to the same extent, and Self Esteem to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem to a greater extent, and Anxiety and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Disinterest and Self Esteem to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Esteem, secondly Disinterest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Self Esteem and Disinterest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Self Esteem and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Self Esteem, secondly Anxiety and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Anxiety and finally Self Esteem to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Anxiety and Self Esteem to the same extent.

57) (1,1, 0, 1) we have A = 1, B = 1 and D = 1 simultaneously states Anxiety, Disinterest and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety, secondly Disinterest and finally Frustration to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Anxiety and secondly Disinterest and Frustration to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Frustration and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Anxiety and Disinterest to the same extent, and Frustration to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Frustration to a greater extent, and Anxiety and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Anxiety, Disinterest and Frustration to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Disinterest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Frustration and Disinterest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Frustration and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Frustration, secondly Anxiety and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Anxiety and finally Frustration to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Anxiety and Frustration to the same extent.

58) (-1, -1, -1, 0) we have A = -1, B = -1 and C = -1 simultaneously states Confidence, Interest and Excitement whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Interest and finally Excitement to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence and secondly Interest and Excitement to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Excitement and finally Interest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Confidence and Interest to the same extent, and Excitement to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Excitement to a greater extent, and Confidence and Interest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Confidence, Interest and Excitement to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Interest and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Excitement and Interest to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Excitement and finally Confidence to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Excitement, secondly Confidence and finally Interest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Confidence and finally Excitement to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest and secondly Confidence and Excitement to the same extent.

59) (-1, -1, 1, 0) we have A = -1, B = -1 and C = 1 simultaneously states Confidence, Interest and Indifference whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Interest and finally Indifference to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence and secondly Interest and Indifference to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Indifference and finally Interest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Confidence and Interest to the same extent, and Indifference to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Indifference to a greater extent, and Confidence and Interest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Confidence, Interest and Indifference to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Interest and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Indifference and Interest to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Interest and finally Confidence to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Indifference, secondly Confidence and finally Interest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Confidence and finally Indifference to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest and secondly Confidence and Indifference to the same extent.

60) (-1, 1, -1, 0) we have A = -1, B = 1 and C = -1 simultaneously states Confidence, Disinterest and Excitement whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Disinterest and finally Excitement to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence and secondly Disinterest and Excitement to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Excitement and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Confidence and Disinterest to the same extent, and Excitement to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Excitement to a greater extent, and Confidence and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Confidence, Disinterest and Excitement to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Disinterest and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Excitement and Disinterest to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Disinterest and finally Confidence to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Excitement, secondly Confidence and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Confidence and finally Excitement to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest and secondly Confidence and Excitement to the same extent.

61) (-1,1, 1, 0) we have A = -1, B = 1 and C = 1 simultaneously states Confidence, Disinterest and Indifference whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Disinterest and finally Indifference to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence and secondly Disinterest and Indifference to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Indifference and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Confidence and Disinterest to the same extent, and Indifference to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Indifference to a greater extent, and Confidence and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Confidence, Disinterest and Indifference to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Disinterest and finally Confidence to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Indifference and Disinterest to the same extent, and Confidence to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Disinterest and finally Confidence to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Indifference, secondly Confidence and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Confidence and finally Indifference to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest and secondly Confidence and Indifference to the same extent.

62) (1, -1, -1, 0) we have A = 1, B = -1 and C = -1 simultaneously states Anxiety, Interest and Excitement whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Interest and finally Excitement to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety and secondly Interest and Excitement to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Excitement and finally Interest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Anxiety and Interest to the same extent, and Excitement to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Excitement to a greater extent, and Anxiety and Interest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Anxiety, Interest and Excitement to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Interest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Excitement and Interest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Interest and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Excitement, secondly Anxiety and finally Interest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Anxiety and finally Excitement to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest and secondly Anxiety and Excitement to the same extent.

63) (1, -1, 1, 0) we have A = 1, B = -1 and C = -1 simultaneously states Anxiety, Interest and Indifference whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Interest and finally Indifference to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety and secondly Interest and Indifference to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Indifference and finally Interest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Anxiety and Interest to the same extent, and Indifference to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Indifference to a greater extent, and Anxiety and Interest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Anxiety, Interest and Indifference to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Interest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Indifference and Interest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Interest and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Indifference, secondly Anxiety and finally Interest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Anxiety and finally Indifference to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest and secondly Anxiety and Indifference to the same extent.

64) (1, 1, -1, 0) we have A = 1, B = 1 and C = -1 simultaneously states Anxiety, Disinterest and Excitement whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Disinterest and finally Excitement to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety and secondly Disinterest and Excitement to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Excitement and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Anxiety and Disinterest to the same extent, and Excitement to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Excitement to a greater extent, and Anxiety and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Anxiety, Disinterest and Excitement to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Disinterest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Excitement and Disinterest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Disinterest and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Excitement, secondly Anxiety and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Anxiety and finally Excitement to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest and secondly Anxiety and Excitement to the same extent.

65) (1,1, 1, 0) we have A = 1, B = 1 and C = -1 simultaneously states Anxiety, Disinterest and Indifference whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety, secondly Disinterest and finally Indifference to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Anxiety and secondly Disinterest and Indifference to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Anxiety, secondly Indifference and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Anxiety and Disinterest to the same extent, and Indifference to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Indifference to a greater extent, and Anxiety and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Anxiety, Disinterest and Indifference to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Disinterest and finally Anxiety to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Indifference and Disinterest to the same extent, and Anxiety to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Indifference, secondly Disinterest and finally Anxiety to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Indifference, secondly Anxiety and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Anxiety and finally Indifference to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest and secondly Anxiety and Indifference to the same extent.

Finally, we examine the cases containing 4 variables different from zero, such cases can be quantified in 16 cases, as described below from 66) to 81):

66) (-1, -1, -1, 1) we have A = -1, B = -1, C = -1 and D = 1 simultaneously states Confidence, Interest, Excitement and Frustration whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$, such cases can be quantified in 69 and are as follows:

1. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Interest, then Excitement to a lesser extent and finally Frustration.
2. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence to a greater extent, secondly Interest, and then Excitement and Frustration to the same extent.
3. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Interest, then Frustration to a lesser extent and finally Excitement.
4. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Frustration, then Interest to a lesser extent and finally Excitement.
5. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Confidence, then Interest to a lesser extent and finally Excitement.
6. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence, secondly Frustration and Interest to the same extent, finally Excitement to a lesser extent.
7. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and Interest to the same extent, secondly Excitement, and finally Frustration to a lesser extent.
8. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Excitement and Interest to the same extent, finally Frustration to a lesser extent.
9. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, and secondly Interest, Excitement and Frustration to the same extent.
10. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Confidence to a greater extent, secondly Frustration , and then Excitement and Interest to the same extent.

11. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration to a greater extent, secondly Confidence, and then Excitement and Interest to the same extent.
12. $\tilde{\tilde{A}} = \tilde{\tilde{D}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Confidence and Frustration to the same extent and Interest and Excitement to a lesser extent and the same intensity.
13. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, secondly Excitement, then Interest to a lesser extent and finally Frustration.
14. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Excitement, then Interest to a lesser extent and finally Frustration.
15. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence to a greater extent, secondly Excitement, and then Interest and Frustration to the same extent.
16. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Confidence, then Interest to a lesser extent and finally Frustration.
17. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Excitement, secondly Confidence, then Frustration to a lesser extent and finally Interest.
18. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement to a greater extent, secondly Confidence, and then Interest and Frustration to the same extent.
19. $\tilde{\tilde{C}} > \tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Excitement, secondly Confidence, then Frustration to a lesser extent and finally Interest.
20. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence and Excitement to the same extent, secondly Interest, and finally Frustration to a lesser extent.
21. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence and Excitement to the same extent, secondly Frustration, and finally Interest to a lesser extent.
22. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Excitement to the same extent and Interest and Frustration to a lesser extent and the same intensity.
23. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Frustration and Excitement to the same extent, finally Interest to a lesser extent.
24. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Frustration and Excitement to the same extent, finally Interest to a lesser extent.
25. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Confidence, secondly Frustration, then Interest to a lesser extent and finally Excitement.

26. $\tilde{D} > \tilde{A} > \tilde{C} > \tilde{B}$ denotes that the individual firstly feels Frustration, secondly Confidence, then Excitement to a lesser extent and finally Interest.

27. $\tilde{D} > \tilde{C} > \tilde{A} > \tilde{B}$ denotes that the individual firstly feels Frustration, secondly Excitement, then Confidence to a lesser extent and finally Interest.

28. $\tilde{A} = \tilde{C} > \tilde{B} > \tilde{D}$ denotes that the individual firstly feels Confidence and Excitement to the same extent, secondly Interest, and finally Frustration to a lesser extent.

29. $\tilde{D} > \tilde{A} = \tilde{C} > \tilde{B}$ denotes that the individual firstly feels Frustration, secondly Confidence and Excitement to the same extent, finally Interest to a lesser extent.

30. $\tilde{D} = \tilde{C} = \tilde{A} > \tilde{B}$ denotes that the individual feels Frustration, Excitement and Trust to the same extent, and Interest to a lesser extent.

31. $\tilde{A} = \tilde{B} > \tilde{C} > \tilde{D}$ denotes that the individual firstly feels Confidence and Interest to the same extent, secondly Excitement, and finally Frustration to a lesser extent.

32. $\tilde{A} = \tilde{B} > \tilde{C} = \tilde{D}$ denotes that the individual feels Confidence and Interest to the same extent and Excitement and Frustration to a lesser extent and the same intensity.

33. $\tilde{A} = \tilde{B} = \tilde{D} > \tilde{C}$ denotes that the individual feels Confidence, Interest and Frustration to the same extent, and Excitement to a lesser extent.

34. $\tilde{A} = \tilde{B} > \tilde{D} > \tilde{C}$ denotes that the individual firstly feels Confidence and Interest to the same extent, secondly Frustration, and finally Excitement to a lesser extent.

35. $\tilde{D} > \tilde{A} = \tilde{B} > \tilde{C}$ denotes that the individual firstly feels Frustration, secondly Confidence and Interest to the same extent, finally Excitement to a lesser extent.

36. $\tilde{A} = \tilde{B} = \tilde{C} > \tilde{D}$ denotes that the individual feels Confidence, Interest and Excitement to the same extent, and Frustration to a lesser extent.

37. $\tilde{A} = \tilde{B} = \tilde{C} = \tilde{D}$ denotes that the individual firstly feels Frustration, and secondly Interest, Excitement and Confidence to the same extent.

38. $\tilde{A} = \tilde{B} = \tilde{C} < \tilde{D}$ denotes that the individual firstly feels Frustration, and secondly Interest, Excitement and Confidence to the same extent.

39. $\tilde{A} = \tilde{B} = \tilde{D} < \tilde{C}$ denotes that the individual firstly feels Excitement, and secondly Frustration, Interest and Confidence to the same extent.

40. $\tilde{C} > \tilde{A} > \tilde{B} = \tilde{D}$ denotes that the individual firstly feels Excitement to a greater extent, secondly Confidence, and then Interest and Frustration to the same extent.

41. $\tilde{\tilde{D}} < \tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Excitement, secondly Confidence and Interest to the same extent, finally Frustration to a lesser extent.

42. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Excitement and Frustration to the same extent and Confidence and Interest to a lesser extent and the same intensity.

43. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration to a greater extent, secondly Excitement, and then Interest and Confidence to the same extent.

44. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Confidence, then Excitement to a lesser extent and finally Frustration.

45. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Interest, secondly Excitement, then Frustration to a lesser extent and finally Confidence.

46. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Excitement, then Confidence to a lesser extent and finally Frustration.

47. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, secondly Excitement and Confidence to the same extent, finally Frustration to a lesser extent.

48. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest to a greater extent, secondly Excitement, and then Confidence and Frustration to the same extent.

49. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest to a greater extent, secondly Confidence, and then Excitement and Frustration to the same extent.

50. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Interest, secondly Excitement and Frustration to the same extent, finally Confidence to a lesser extent.

51. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest, and secondly Confidence, Excitement and Frustration to the same extent.

52. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Confidence, then Frustration to a lesser extent and finally Excitement.

53. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Interest, secondly Frustration, then Confidence to a lesser extent and finally Excitement.

54. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Interest, secondly Frustration, then Excitement to a lesser extent and finally Confidence.

55. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration, secondly Interest, then Confidence to a lesser extent and finally Excitement.

56. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Frustration to a greater extent, secondly Interest, and then Confidence and Excitement to the same extent.

57. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Frustration, secondly Interest, then Excitement to a lesser extent and finally Confidence.

58. $\tilde{\tilde{B}} = \tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Confidence and Interest to the same extent and Excitement and Frustration to a lesser extent and the same intensity.

59. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Interest and Excitement to the same extent, secondly Frustration, and finally Confidence to a lesser extent.

60. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Interest and Excitement to the same extent, secondly Confidence, and finally Frustration to a lesser extent.

61. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Confidence, and secondly Interest, Excitement and Frustration to the same extent.

62. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Excitement and Interest to the same extent, finally Confidence to a lesser extent.

63. $\tilde{\tilde{C}} > \tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{A}} >$ denotes that the individual firstly feels Excitement, secondly Frustration, then Interest to a lesser extent and finally Confidence.

64. $\tilde{\tilde{C}} > \tilde{\tilde{D}} = \tilde{\tilde{B}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Excitement, secondly Frustration and Interest to the same extent, finally Confidence to a lesser extent.

65. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement to a greater extent, secondly Interest, and then Confidence and Frustration to the same extent.

66. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Excitement, secondly Interest, then Confidence to a lesser extent and finally Frustration Confidence.

67. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Excitement, secondly Frustration and Interest to the same extent, finally Confidence to a lesser extent.

68. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration and Excitement to the same extent, secondly Interest, and finally Confidence to a lesser extent.

69. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Frustration, secondly Excitement, then Interest to a lesser extent and finally Confidence.

For the following 15 cases, in which all variables are different from zero, for each of them we have 69 combinations as seen above, and the result type to be analyzed in the same way.

67) (-1, -1, -1,-1)

68) (-1, -1, 1,-1)

69) (-1, -1, 1, 1)

70) (-1,1, -1, 1)

71) (-1,1, -1, -1)

72) (-1,1, 1, -1)

73) (-1,1, 1, 1)

74) (1, -1, -1, 1)

75) (1, -1, -1,-1)

76) (1, -1, 1,-1)

77) (1, -1, 1, 1)

78) (1,1, -1, 1)

79) (1,1, -1, -1)

80) (1,1, 1, -1)

81) (1,1, 1, 1)

Appendix B

As seen in Section 3.2.5, during the affective prequantification possible combinations of the sequence of parameters that we take into account is 34 = 81. Consider the class of pure states, i.e. those after the first phase have only one nonzero value::

1) (0,0,0,0) Neutro (tivial case);
2) (-1,0,0,0) Love;
3) (1,0,0,0) Hate;
4) (0,-1,0,0) Liking;
5) (0,1,0,0) Dislike;
6) (0,0,-1,0) Passion;
7) (0,0,1,0) Disintereste;
8) (0,0,0,-1) Undertanding;
9) (0,0,0,1) Grudge;

In the first case, the affective state appears to be neutral because no parameter has nonzero value. In other cases, after making the step to the second level responsive/quality, you will have a quantification of the parameters of interest that will tell us what the learner will feel Love, Hate, Liking and so forth.
In case 2), for example, whereas the status of an individual is characterized by the tuple:
T = (A,B,C,D) we have that B, C, D = 0, while the parameter A = -1 indicates that the Love is detected, so we will have a value of $\tilde{\tilde{A}} \in [0, 100]$, which provides a response quantitative of Love, we recall

---

In case 3) the address is the same that we have the only non-zero value is A = 1 indicating the Hate which can be given by the value $\tilde{\tilde{A}} \in [0, 100]$.
The case 4) tells us that the only variable to consider is B = -1, which indicates the presence of Liking which will be quantified by a certain $\tilde{\tilde{B}}$ value. Address the same applies to all cases 5,6,7,8 and 9.

In the remaining 72 cases, several variables that characterize the tuple T, are simultaneously non-zero value. In these cases we show that the individual at the same time the presence of different emotional states is also quantified in different measurement values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
Let us now examine the cases where we have only 2 variables other than zero, such cases can be quantified in 24 and are as follows from 10) to 33):

10) (0, 0, -1, 1) in this case Passion and Grudge are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Passion and then secondarily Grudge. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Grudge

and secondarily Passion and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Passion and Grudge.

11) (0, 0, -1, -1) in this case Passion and Self-Understanding are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Passion and then secondarily Self-Understanding. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Self-Understanding and secondarily Passion and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Passion and Self-Understanding.

12) (0, 0, 1, -1) in this case Disinterest and Self-Understanding are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Disinterest and then secondarily Self-Understanding. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Self-Understanding and secondarily Disinterest and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Disinterest and Self-Understanding.

13) (0, 0, 1, 1) in this case Disinterest and Grudge are shown. If $\tilde{\tilde{C}} > \tilde{\tilde{D}}$ then the individual will feel mostly Disinterest and then secondarily Grudge. If $\tilde{\tilde{C}} < \tilde{\tilde{D}}$ he will experience primarily Grudge and secondarily Disinterest and finally, if $\tilde{\tilde{C}} = \tilde{\tilde{D}}$ he will have the same level of Disinterest and Grudge.

14) (0, -1, 0, -1) in this case Liking and Understanding are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Liking and then secondarily Self Understanding. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Understanding and secondarily Liking and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Liking and Self Understanding.

15) (0, -1, 0, 1) in this case Liking and Grudge are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Liking and then secondarily Grudge. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Grudge and secondarily Liking and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Liking and Grudge.

16) (0, -1, -1, 0) in this case Liking and Passion are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Liking and then secondarily Passion. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Passion and secondarily Liking and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Liking and Passion.

17) (0, -1, 1, 0) in this case Liking and Disinterest are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Liking and then secondarily Disinterest. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Disinterest and secondarily Liking and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Liking and Disinterest.

18) (0,1, 0, -1) in this case Dislike and Understanding are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Dislike and then secondarily Self Understanding. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Understanding and secondarily Dislike and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Dislike and Self Understanding.

19) (0,1, 0, 1) in this case Dislike and Grudge are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{D}}$ then the individual will feel mostly Dislike and then secondarily Grudge. If $\tilde{\tilde{B}} < \tilde{\tilde{D}}$ he will experience primarily Grudge and secondarily Dislike and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{D}}$ he will have the same level of Dislike and Grudge.

20) (0,1, -1, 0) in this case Dislike and Passion are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Dislike and then secondarily Passion. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Passion and secondarily Dislike and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Dislike and Passion.

21) (0, 1, 1, 0) in this case Dislike and Disinterest are shown. If $\tilde{\tilde{B}} > \tilde{\tilde{C}}$ then the individual will feel mostly Dislike and then secondarily Disinterest. If $\tilde{\tilde{B}} < \tilde{\tilde{C}}$ he will experience primarily Disinterest and secondarily Dislike and finally, if $\tilde{\tilde{B}} = \tilde{\tilde{C}}$ he will have the same level of Dislike and Disinterest.

22) (-1, 0, 0, -1) in this case Love and Understanding are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will feel mostly Love and then secondarily Self Understanding. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will experience primarily Understanding and secondarily Love and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Love and Self Understanding.

23) (-1.0, 0, 1) in this case Love and Grudge are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will feel mostly Love and then secondarily Grudge. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will experience primarily Grudge and secondarily Love and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Love and Grudge.

24) (-1, 0, -1, 0) in this case Love and Passion are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will experience mostly Love and then secondarily Passion. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will feel primarily Passion and secondarily Love, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Love and Passion.

25) (-1, 0, 1, 0) in this case Love and Disinterest are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will experience mostly Love and then secondarily Disinterest. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will feel primarily Disinterest and secondarily Love, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Love and Disinterest.

26) (-1, -1, 0, 0) in this case Love and Liking are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will experience mostly Love and then secondarily Liking. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will feel primarily Liking and secondarily Love, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Love and Liking.

27) (-1.1, 0, 0) in this case Love and Dislike are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will experience mostly Love and then secondarily Dislike. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will feel primarily Dislike and secondarily Love, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Love and Dislike.

28) (1, 0, 0, -1) in this case Hate and Understanding are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will experience mostly Hate and then secondarily Self Understanding. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will feel primarily Understanding and secondarily Hate, and finally if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Hate and Understanding.

29) (1, 0, 0, 1) in this case Hate and Disinterest are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{D}}$ then the individual will feel mostly Hate and then secondarily Disinterest. If $\tilde{\tilde{A}} < \tilde{\tilde{D}}$ he will experience primarily Disinterest and secondarily Hate and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{D}}$ he will have the same level of Hate and Disinterest.

30) (1, 0,-1, 0) in this case Hate and Passion are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will feel mostly Hate and then secondarily Passion. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will experience primarily Passion and secondarily Hate and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Hate and Passion.

31) (1, 0, 1, 0) in this case Hate and Disinterest are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{C}}$ then the individual will feel mostly Hate and then secondarily Disinterest. If $\tilde{\tilde{A}} < \tilde{\tilde{C}}$ he will experience primarily Disinterest and secondarily Hate and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{C}}$ he will have the same level of Hate and Disinterest.

32) (1, -1, 0, 0) in this case Hate and Liking are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will feel mostly Hate and then secondarily Liking. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will experience primarily Liking and secondarily Hate and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Hate and Liking.

33) (1, 1, 0, 0) in this case Hate and Dislike are shown. If $\tilde{\tilde{A}} > \tilde{\tilde{B}}$ then the individual will feel mostly Hate and then secondarily Dislike. If $\tilde{\tilde{A}} < \tilde{\tilde{B}}$ he will experience primarily Dislike and secondarily Hate and finally, if $\tilde{\tilde{A}} = \tilde{\tilde{B}}$ he will have the same level of Hate and Dislike.

Let us now examine some cases containing 3 variables different from zero, such cases can be quantified in 32 cases, as described below from 34) to 65):

34) (0, -1, -1, 1) we have B = -1, C = -1 and D = 1 simultaneously states Liking, Passion and Grudge whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Passion and finally Grudge to a lesser extent.
b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking and secondly Passion and Grudge to the same extent.
c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking, secondly Grudge and finally Passion to a lesser extent.
d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Liking and Passion to the same extent, and Grudge to a lesser extent.
e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Liking and Passion to the same extent.
f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Liking, Passion and Grudge to the same extent.
g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Passion and finally Liking to a lesser extent.
h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Passion to the same extent, and Liking to a lesser extent.
i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Grudge and finally Liking to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Liking and finally Passion to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Liking and finally Grudge to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Liking and Grudge to the same extent.

35) (0, -1, -1,-1) we have B = -1, C = -1 and D = -1 simultaneously states Liking, Passion and Understanding whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Passion and finally Understanding to a lesser extent.
b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking and secondly Passion and Understanding to the same extent.
c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking, secondly Understanding and finally Passion to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Liking and Passion to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Liking and Passion to the same extent.
f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Liking, Passion and Understanding to the same extent.
g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Passion and finally Liking to a lesser extent.
h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Passion to the same extent, and Liking to a lesser extent.
i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Understanding and finally Liking to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Liking and finally Passion to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Liking and finally Understanding to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Liking and Understanding to the same extent.

36) (0, -1, 1,-1) we have B = -1, C = 1 and D = -1 simultaneously states Liking, Disinterest and Understanding whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Disinterest and finally Understanding to a lesser extent.
b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking and secondly Disinterest and Understanding to the same extent.
c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking, secondly Understanding and finally Disinterest to a lesser extent.
d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Liking and Disinterest to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Liking and Disinterest to the same extent.
f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Liking, Disinterest and Understanding to the same extent.
g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Disinterest and finally Liking to a lesser extent.
h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Disinterest to the same extent, and Liking to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Understanding and finally Liking to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Liking and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Liking and finally Understanding to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Liking and Understanding to the same extent.

37) (0, -1, 1, 1) we have B = -1, C = 1 and D = 1 simultaneously states Liking, Disinterest and Grudge whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Disinterest and finally Grudge to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking and secondly Disinterest and Grudge to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking, secondly Grudge and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Liking and Disinterest to the same extent, and Grudge to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Liking and Disinterest to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Liking, Disinterest and Grudge to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Disinterest and finally Liking to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Disinterest to the same extent, and Liking to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Grudge and finally Liking to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Liking and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Liking and finally Grudge to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Liking and Grudge to the same extent.

38) (0, 1, -1, 1) we have B = 1, C = -1 and D = 1 simultaneously states Dislike, Passion and Grudge whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Passion and finally Grudge to a lesser extent.
b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Passion and Grudge to the same extent.
c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Grudge and finally Passion to a lesser extent.
d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Dislike and Passion to the same extent, and Grudge to a lesser extent.
e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Dislike and Passion to the same extent.
f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Dislike, Passion and Grudge to the same extent.
g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Passion and finally Dislike to a lesser extent.
h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Passion to the same extent, and Dislike to a lesser extent.
i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Grudge and finally Dislike to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Dislike and finally Passion to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Dislike and finally Grudge to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Dislike and Grudge to the same extent.

39) (0, 1, -1, -1) we have B = 1, C = -1 and D = -1 simultaneously states Dislike, Passion and Understanding whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Passion and finally Understanding to a lesser extent.
b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Passion and Understanding to the same extent.
c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Understanding and finally Passion to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Dislike and Passion to the same extent, and Understanding to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Dislike and Passion to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Dislike, Passion and Understanding to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Passion and finally Dislike to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Passion to the same extent, and Dislike to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Understanding and finally Dislike to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Dislike and finally Passion to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Dislike and finally Understanding to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Dislike and Understanding to the same extent.

40) (0, 1, 1, -1) we have B = 1, C = 1 and D = -1 simultaneously states Dislike, Disinterest and Understanding whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Disinterest and finally Understanding to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Disinterest and Understanding to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Understanding and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Dislike and Disinterest to the same extent, and Understanding to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Dislike and Disinterest to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Dislike, Disinterest and Understanding to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Disinterest and finally Dislike to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Disinterest to the same extent, and Dislike to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Understanding and finally Dislike to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Dislike and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Dislike and finally Understanding to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Dislike and Understanding to the same extent.

41) (0, 1, 1, 1) we have B = 1, C = 1 and D = 1 simultaneously states Dislike, Disinterest and Grudge whose response will be given by the quantitative values $\tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Disinterest and finally Grudge to a lesser extent.

b. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Disinterest and Grudge to the same extent.

c. $\tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Grudge and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Dislike and Disinterest to the same extent, and Grudge to a lesser extent.

e. $\tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Dislike and Disinterest to the same extent.

f. $\tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Dislike, Disinterest and Grudge to the same extent.

g. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Disinterest and finally Dislike to a lesser extent.

h. $\tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Disinterest to the same extent, and Dislike to a lesser extent.

i. $\tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Grudge and finally Dislike to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Dislike and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Dislike and finally Grudge to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Dislike and Grudge to the same extent.

42) (-1, 0, -1, 1) we have A = -1, C = -1 and D = 1 simultaneously states Love, Passion and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.
The following nine cases may occur:

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Passion and finally Grudge to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Passion and Grudge to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Grudge and finally Passion to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Passion to the same extent, and Grudge to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Love and Passion to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Passion and Grudge to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Passion and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Passion to the same extent, and Love to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Grudge and finally Love to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Love and finally Passion to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Love and finally Grudge to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Love and Grudge to the same extent.

43) (-1, 0, -1, -1) we have A = -1, C = -1 and D = -1 simultaneously states Love, Passion and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Passion and finally Understanding to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Passion and Understanding to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Understanding and finally Passion to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Passion to the same extent, and Understanding to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Love and Passion to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Passion and Understanding to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Passion and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Passion to the same extent, and Love to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Understanding and finally Love to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Love and finally Passion to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Love and finally Understanding to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Love and Understanding to the same extent.

44) (-1, 0, 1, -1) we have A = -1, C = 1 and D = -1 simultaneously states Love, Disinterest and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Disinterest and finally Understanding to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Disinterest and Understanding to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Understanding and finally Disinterest to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Disinterest to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Love and Disinterest to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Disinterest and Understanding to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Disinterest and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Disinterest to the same extent, and Love to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Understanding and finally Love to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Love and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Love and finally Understanding to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Love and Understanding to the same extent.

45) (-1, 0, 1, 1) we have A = -1, C = 1 and D = 1 simultaneously states Love, Disinterest and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Disinterest and finally Grudge to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Disinterest and Grudge to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Grudge and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Disinterest to the same extent, and Grudge to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Love and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Disinterest and Grudge to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Disinterest and finally Love to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Disinterest to the same extent, and Love to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Grudge and finally Love to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Love and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Love and finally Grudge to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Love and Grudge to the same extent.

46) (1, 0, -1, 1) we have A = 1, C = -1 and D = 1 simultaneously states Hate, Passion and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Passion and finally Grudge to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Passion and Grudge to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Grudge and finally Passion to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Passion to the same extent, and Grudge to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Hate and Passion to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Passion and Grudge to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Passion and finally Hate to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Passion to the same extent, and Hate to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Grudge and finally Hate to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Hate and finally Passion to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Hate and finally Grudge to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Hate and Grudge to the same extent.

47) (1, 0, -1, -1) we have A = 1, C = -1 and D = -1 simultaneously states Hate, Passion and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Passion and finally Understanding to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Passion and Understanding to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Understanding and finally Passion to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Passion to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Hate and Passion to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Passion and Understanding to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Passion and finally Hate to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Passion to the same extent, and Hate to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Understanding and finally Hate to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Hate and finally Passion to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Hate and finally Understanding to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Hate and Understanding to the same extent.

48) (1, 0, 1, -1) we have A = 1, C = 1 and D = -1 simultaneously states Hate, Disinterest and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Disinterest and finally Understanding to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Disinterest and Understanding to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Understanding and finally Disinterest to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Disinterest to the same extent, and Understanding to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Hate and Disinterest to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Disinterest and Understanding to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Disinterest and finally Hate to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Disinterest to the same extent, and Hate to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Understanding and finally Hate to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Hate and finally Disinterest to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Hate and finally Understanding to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Hate and Understanding to the same extent.

49) (1, 0, 1, 1) we have A = 1, C = 1 and D = 1 simultaneously states Hate, Disinterest and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Disinterest and finally Grudge to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Disinterest and Grudge to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Grudge and finally Disinterest to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Disinterest to the same extent, and Grudge to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Hate and Disinterest to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Disinterest and Grudge to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Disinterest and finally Hate to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Disinterest to the same extent, and Hate to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Grudge and finally Hate to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Hate and finally Disinterest to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest, secondly Hate and finally Grudge to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Disinterest and secondly Hate and Grudge to the same extent.

50) (-1, 0, -1, -1) we have A = -1, C = -1 and D = -1 simultaneously states Love, Passion and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Passion and finally Understanding to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Passion and Understanding to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Understanding and finally Passion to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Passion to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Love and Passion to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Passion and Understanding to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Passion and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Passion to the same extent, and Love to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Understanding and finally Love to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Self Understanding, secondly Love and finally Passion to a lesser extent.
k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Love and finally Understanding to a lesser extent.
l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Love and Understanding to the same extent.

51) (-1, 0, -1, 1) we have A = -1, C = -1 and D = 1 simultaneously states Love, Passion and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Passion and finally Grudge to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Passion and Grudge to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Grudge and finally Passion to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Passion to the same extent, and Grudge to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Love and Passion to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Passion and Grudge to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Passion and finally Love to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Passion to the same extent, and Love to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Grudge and finally Love to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Love and finally Passion to a lesser extent.

k. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion, secondly Love and finally Grudge to a lesser extent.

l. $\tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion and secondly Love and Grudge to the same extent.

52) (-1, 1, 0, 1) we have A = -1, B = 1 and D = 1 simultaneously states Love, Dislike and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Dislike and finally Grudge to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Dislike and Grudge to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Love, secondly Grudge and finally Dislike to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Dislike to the same extent, and Grudge to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Love and Dislike to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Dislike and Grudge to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Dislike and finally Love to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Dislike to the same extent, and Love to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Grudge and finally Love to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Grudge, secondly Love and finally Dislike to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Love and finally Grudge to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Love and Grudge to the same extent.

53) (-1,1, 0, -1) we have A = -1, B = 1 and D = -1 simultaneously states Love, Dislike and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Dislike and finally Understanding to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and secondly Dislike and Understanding to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Love, secondly Understanding and finally Dislike to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Love and Dislike to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Love and Dislike to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Love, Dislike and Understanding to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Dislike and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Dislike to the same extent, and Love to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Understanding and finally Love to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Self Understanding, secondly Love and finally Dislike to a lesser extent.
k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Love and finally Understanding to a lesser extent.
l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Love and Understanding to the same extent.

54) (1, -1, 0,-1) we have A = 1, B = -1 and D = -1 simultaneously states Hate, Liking and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Liking and finally Understanding to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Liking and Understanding to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Understanding and finally Liking to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Liking to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Hate and Liking to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Liking and Understanding to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Liking and finally Hate to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Liking to the same extent, and Hate to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Understanding and finally Hate to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Self Understanding, secondly Hate and finally Liking to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Hate and finally Understanding to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking and secondly Hate and Understanding to the same extent.

55) (1, -1, 0, 1) we have A = 1, B = -1 and D = 1 simultaneously states Hate, Liking and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Liking and finally Grudge to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Liking and Grudge to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Grudge and finally Liking to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Liking to the same extent, and Grudge to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Hate and Liking to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Liking and Grudge to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Liking and finally Hate to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Liking to the same extent, and Hate to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Grudge and finally Hate to a lesser extent.

j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Grudge, secondly Hate and finally Liking to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Hate and finally Grudge to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking and secondly Hate and Grudge to the same extent.

56) (1,1, 0, -1) we have A = 1, B = 1 and D = -1 simultaneously states Hate, Dislike and Understanding whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Dislike and finally Understanding to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Dislike and Understanding to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Understanding and finally Dislike to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Dislike to the same extent, and Understanding to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Understanding to a greater extent, and Hate and Dislike to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Dislike and Understanding to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Self Understanding, secondly Dislike and finally Hate to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Understanding and Dislike to the same extent, and Hate to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Understanding and finally Hate to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Self Understanding, secondly Hate and finally Dislike to a lesser extent.
k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Hate and finally Understanding to a lesser extent.
l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Hate and Understanding to the same extent.

57) (1,1, 0, 1) we have A = 1, B = 1 and D = 1 simultaneously states Hate, Dislike and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{D}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate, secondly Dislike and finally Grudge to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Hate and secondly Dislike and Grudge to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Grudge and finally Dislike to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}}$ denotes that the individual feels Hate and Dislike to the same extent, and Grudge to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual feels Grudge to a greater extent, and Hate and Dislike to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Hate, Dislike and Grudge to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Dislike and finally Hate to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual feels Grudge and Dislike to the same extent, and Hate to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Grudge and finally Hate to a lesser extent.
j. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Grudge, secondly Hate and finally Dislike to a lesser extent.
k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike, secondly Hate and finally Grudge to a lesser extent.
l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Dislike and secondly Hate and Grudge to the same extent.

58) (-1, -1, -1, 0) we have A = -1, B = -1 and C = -1 simultaneously states Love, Liking and Passion whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Liking and finally Passion to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Love and secondly Liking and Passion to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Love, secondly Passion and finally Liking to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Love and Liking to the same extent, and Passion to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Passion to a greater extent, and Love and Liking to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Love, Liking and Passion to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Liking and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Passion and Liking to the same extent, and Love to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Passion and finally Love to a lesser extent.
j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Passion, secondly Love and finally Liking to a lesser extent.
k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Love and finally Passion to a lesser extent.
l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking and secondly Love and Passion to the same extent.

59) (-1, -1, 1, 0) we have A = -1, B = -1 and C = 1 simultaneously states Love, Liking and Disinterest whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Liking and finally Disinterest to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Love and secondly Liking and Disinterest to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Love, secondly Disinterest and finally Liking to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Love and Liking to the same extent, and Disinterest to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Disinterest to a greater extent, and Love and Liking to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Love, Liking and Disinterest to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Liking and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Disinterest and Liking to the same extent, and Love to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Liking and finally Love to a lesser extent.
j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Disinterest, secondly Love and finally Liking to a lesser extent.
k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking, secondly Love and finally Disinterest to a lesser extent.
l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking and secondly Love and Disinterest to the same extent.

60) (-1, 1, -1, 0) we have A = -1, B = 1 and C = -1 simultaneously states Love, Dislike and Passion whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Dislike and finally Passion to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Love and secondly Dislike and Passion to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Love, secondly Passion and finally Dislike to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Love and Dislike to the same extent, and Passion to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Passion to a greater extent, and Love and Dislike to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Love, Dislike and Passion to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Dislike and finally Love to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Passion and Dislike to the same extent, and Love to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Dislike and finally Love to a lesser extent.
j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Passion, secondly Love and finally Dislike to a lesser extent.
k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Love and finally Passion to a lesser extent.
l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike and secondly Love and Passion to the same extent.

61) (-1,1, 1, 0) we have A = -1, B = 1 and C = 1 simultaneously states Love, Dislike and Disinterest whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Dislike and finally Disinterest to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Love and secondly Dislike and Disinterest to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Love, secondly Disinterest and finally Dislike to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Love and Dislike to the same extent, and Disinterest to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Disinterest to a greater extent, and Love and Dislike to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Love, Dislike and Disinterest to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Dislike and finally Love to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Disinterest and Dislike to the same extent, and Love to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Dislike and finally Love to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Disinterest, secondly Love and finally Dislike to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Love and finally Disinterest to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike and secondly Love and Disinterest to the same extent.

62) (1, -1, -1, 0) we have A = 1, B = -1 and C = -1 simultaneously states Hate, Liking and Passion whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Liking and finally Passion to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate and secondly Liking and Passion to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Passion and finally Liking to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Hate and Liking to the same extent, and Passion to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Passion to a greater extent, and Hate and Liking to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Hate, Liking and Passion to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Liking and finally Hate to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Passion and Liking to the same extent, and Hate to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Liking and finally Hate to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Passion, secondly Hate and finally Liking to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking, secondly Hate and finally Passion to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking and secondly Hate and Passion to the same extent.

63) (1, -1, 1, 0) we have A = 1, B = -1 and C = -1 simultaneously states Hate, Liking and Disinterest whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Liking and finally Disinterest to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate and secondly Liking and Disinterest to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Disinterest and finally Liking to a lesser extent.

d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Hate and Liking to the same extent, and Disinterest to a lesser extent.

e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Disinterest to a greater extent, and Hate and Liking to the same extent.

f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Hate, Liking and Disinterest to the same extent.

g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Liking and finally Hate to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Disinterest and Liking to the same extent, and Hate to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Liking and finally Hate to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Disinterest, secondly Hate and finally Liking to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking, secondly Hate and finally Disinterest to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Liking and secondly Hate and Disinterest to the same extent.

64) (1, 1, -1, 0) we have A = 1, B = 1 and C = -1 simultaneously states Hate, Dislike and Passion whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Dislike and finally Passion to a lesser extent.

b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate and secondly Dislike and Passion to the same extent.

c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Passion and finally Dislike to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Hate and Dislike to the same extent, and Passion to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Passion to a greater extent, and Hate and Dislike to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Hate, Dislike and Passion to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Dislike and finally Hate to a lesser extent.
h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Passion and Dislike to the same extent, and Hate to a lesser extent.
i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Dislike and finally Hate to a lesser extent.
j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Passion, secondly Hate and finally Dislike to a lesser extent.
k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Hate and finally Passion to a lesser extent.
l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike and secondly Hate and Passion to the same extent.

65) (1,1, 1, 0) we have A = 1, B = 1 and C = -1 simultaneously states Hate, Dislike and Disinterest whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}$.

a. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate, secondly Dislike and finally Disinterest to a lesser extent.
b. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Hate and secondly Dislike and Disinterest to the same extent.
c. $\tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Hate, secondly Disinterest and finally Dislike to a lesser extent.
d. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual feels Hate and Dislike to the same extent, and Disinterest to a lesser extent.
e. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual feels Disinterest to a greater extent, and Hate and Dislike to the same extent.
f. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Hate, Dislike and Disinterest to the same extent.
g. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Dislike and finally Hate to a lesser extent.

h. $\tilde{\tilde{A}} < \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual feels Disinterest and Dislike to the same extent, and Hate to a lesser extent.

i. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Disinterest, secondly Dislike and finally Hate to a lesser extent.

j. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual firstly feels Disinterest, secondly Hate and finally Dislike to a lesser extent.

k. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike, secondly Hate and finally Disinterest to a lesser extent.

l. $\tilde{\tilde{B}} > \tilde{\tilde{A}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Dislike and secondly Hate and Disinterest to the same extent.

Finally, we examine the cases containing 4 variables different from zero, such cases can be quantified in 16 cases, as described below from 66) to 81):

66) (-1, -1, -1, 1) we have A = -1, B = -1, C = -1 and D = 1 simultaneously states Love, Liking, Passion and Grudge whose response will be given by the quantitative values $\tilde{\tilde{A}}, \tilde{\tilde{B}}, \tilde{\tilde{C}}, \tilde{\tilde{D}}$, such cases can be quantified in 69 and are as follows:

1. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Liking, then Passion to a lesser extent and finally Grudge.
2. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love to a greater extent, secondly Liking, and then Passion and Grudge to the same extent.
3. $\tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Liking, then Grudge to a lesser extent and finally Passion.
4. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Grudge, then Liking to a lesser extent and finally Passion.
5. $\tilde{\tilde{D}} > \tilde{\tilde{A}} > \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Love, then Liking to a lesser extent and finally Passion.
6. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love, secondly Grudge and Liking to the same extent, finally Passion to a lesser extent.
7. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and Liking to the same extent, secondly Passion, and finally Grudge to a lesser extent.
8. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, secondly Passion and Liking to the same extent, finally Grudge to a lesser extent.
9. $\tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Love, and secondly Liking, Passion and Grudge to the same extent.
10. $\tilde{\tilde{A}} > \tilde{\tilde{D}} > \tilde{\tilde{B}} = \tilde{\tilde{C}}$ denotes that the individual firstly feels Love to a greater extent, secondly Grudge , and then Passion and Liking to the same extent.

11. $\tilde{D} > \tilde{A} > \tilde{B} = \tilde{C}$ denotes that the individual firstly feels Grudge to a greater extent, secondly Love, and then Passion and Liking to the same extent.
12. $\tilde{A} = \tilde{D} > \tilde{B} = \tilde{C}$ denotes that the individual feels Love and Grudge to the same extent and Liking and Passion to a lesser extent and the same intensity.
13. $\tilde{A} > \tilde{C} > \tilde{B} > \tilde{D}$ denotes that the individual firstly feels Love, secondly Passion, then Liking to a lesser extent and finally Grudge.
14. $\tilde{A} > \tilde{C} > \tilde{D} > \tilde{B}$ denotes that the individual firstly feels Love, secondly Passion, then Liking to a lesser extent and finally Grudge.
15. $\tilde{A} > \tilde{C} > \tilde{B} = \tilde{D}$ denotes that the individual firstly feels Love to a greater extent, secondly Passion, and then Liking and Grudge to the same extent.
16. $\tilde{C} > \tilde{A} > \tilde{B} > \tilde{D}$ denotes that the individual firstly feels Passion, secondly Love, then Liking to a lesser extent and finally Grudge.
17. $\tilde{C} > \tilde{A} > \tilde{D} > \tilde{B}$ denotes that the individual firstly feels Passion, secondly Love, then Grudge to a lesser extent and finally Liking.
18. $\tilde{C} > \tilde{A} > \tilde{B} = \tilde{D}$ denotes that the individual firstly feels Passion to a greater extent, secondly Love, and then Liking and Grudge to the same extent.
19. $\tilde{C} > \tilde{D} > \tilde{A} > \tilde{B}$ denotes that the individual firstly feels Passion, secondly Love, then Grudge to a lesser extent and finally Liking.
20. $\tilde{A} = \tilde{C} > \tilde{B} > \tilde{D}$ denotes that the individual firstly feels Love and Passion to the same extent, secondly Liking, and finally Grudge to a lesser extent.
21. $\tilde{A} = \tilde{C} > \tilde{D} > \tilde{B}$ denotes that the individual firstly feels Love and Passion to the same extent, secondly Grudge, and finally Liking to a lesser extent.
22. $\tilde{A} = \tilde{C} > \tilde{B} = \tilde{D}$ denotes that the individual feels Love and Passion to the same extent and Liking and Grudge to a lesser extent and the same intensity.
23. $\tilde{A} > \tilde{C} = \tilde{D} > \tilde{B}$ denotes that the individual firstly feels Love, secondly Grudge and Passion to the same extent, finally Liking to a lesser extent.
24. $\tilde{A} > \tilde{C} = \tilde{D} > \tilde{B}$ denotes that the individual firstly feels Love, secondly Grudge and Passion to the same extent, finally Liking to a lesser extent.
25. $\tilde{A} > \tilde{D} > \tilde{C} > \tilde{B}$ denotes that the individual firstly feels Love, secondly Grudge, then Liking to a lesser extent and finally Passion.
26. $\tilde{D} > \tilde{A} > \tilde{C} > \tilde{B}$ denotes that the individual firstly feels Grudge, secondly Love, then Passion to a lesser extent and finally Liking.
27. $\tilde{D} > \tilde{C} > \tilde{A} > \tilde{B}$ denotes that the individual firstly feels Grudge, secondly Passion, then Love to a lesser extent and finally Liking.
28. $\tilde{A} = \tilde{C} > \tilde{B} > \tilde{D}$ denotes that the individual firstly feels Love and Passion to the same extent, secondly Liking, and finally Grudge to a lesser extent.
29. $\tilde{D} > \tilde{A} = \tilde{C} > \tilde{B}$ denotes that the individual firstly feels Grudge, secondly Love and Passion to the same extent, finally Liking to a lesser extent.

30. $\tilde{\tilde{D}} = \tilde{\tilde{C}} = \tilde{\tilde{A}} > \tilde{\tilde{B}}$ denotes that the individual feels Grudge, Passion and Trust to the same extent, and Liking to a lesser extent.
31. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Love and Liking to the same extent, secondly Passion, and finally Grudge to a lesser extent.
32. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Love and Liking to the same extent and Passion and Grudge to a lesser extent and the same intensity.
33. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual feels Love, Liking and Grudge to the same extent, and Passion to a lesser extent.
34. $\tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{D}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Love and Liking to the same extent, secondly Grudge, and finally Passion to a lesser extent.
35. $\tilde{\tilde{D}} > \tilde{\tilde{A}} = \tilde{\tilde{B}} > \tilde{\tilde{C}}$ denotes that the individual firstly feels Grudge, secondly Love and Liking to the same extent, finally Passion to a lesser extent.
36. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual feels Love, Liking and Passion to the same extent, and Grudge to a lesser extent.
37. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, and secondly Liking, Passion and Love to the same extent.
38. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, and secondly Liking, Passion and Love to the same extent.
39. $\tilde{\tilde{A}} = \tilde{\tilde{B}} = \tilde{\tilde{D}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, and secondly Grudge, Liking and Love to the same extent.
40. $\tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{B}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Passion to a greater extent, secondly Love, and then Liking and Grudge to the same extent.
41. $\tilde{\tilde{D}} < \tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}}$ denotes that the individual firstly feels Passion, secondly Love and Liking to the same extent, finally Grudge to a lesser extent.
42. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual feels Passion and Grudge to the same extent and Love and Liking to a lesser extent and the same intensity.
43. $\tilde{\tilde{A}} = \tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge to a greater extent, secondly Passion, and then Liking and Love to the same extent.
44. $\tilde{\tilde{B}} > \tilde{\tilde{A}} > \tilde{\tilde{C}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Love, then Passion to a lesser extent and finally Grudge.
45. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{D}} > \tilde{\tilde{A}}$ denotes that the individual firstly feels Liking, secondly Passion, then Grudge to a lesser extent and finally Love.
46. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Passion, then Love to a lesser extent and finally Grudge.
47. $\tilde{\tilde{B}} > \tilde{\tilde{C}} = \tilde{\tilde{A}} > \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking, secondly Passion and Love to the same extent, finally Grudge to a lesser extent.
48. $\tilde{\tilde{B}} > \tilde{\tilde{C}} > \tilde{\tilde{A}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Liking to a greater extent, secondly Passion, and then Love and Grudge to the same extent.

49. $\tilde{B} > \tilde{A} > \tilde{C} = \tilde{D}$ denotes that the individual firstly feels Liking to a greater extent, secondly Love, and then Passion and Grudge to the same extent.
50. $\tilde{B} > \tilde{C} = \tilde{D} > \tilde{A}$ denotes that the individual firstly feels Liking, secondly Passion and Grudge to the same extent, finally Love to a lesser extent.
51. $\tilde{B} > \tilde{A} = \tilde{C} = \tilde{D}$ denotes that the individual firstly feels Liking, and secondly Love, Passion and Grudge to the same extent.
52. $\tilde{B} > \tilde{A} > \tilde{D} > \tilde{C}$ denotes that the individual firstly feels Liking, secondly Love, then Grudge to a lesser extent and finally Passion.
53. $\tilde{B} > \tilde{D} > \tilde{A} > \tilde{C}$ denotes that the individual firstly feels Liking, secondly Grudge, then Love to a lesser extent and finally Passion.
54. $\tilde{B} > \tilde{D} > \tilde{C} > \tilde{A}$ denotes that the individual firstly feels Liking, secondly Grudge, then Passion to a lesser extent and finally Love.
55. $\tilde{D} > \tilde{B} > \tilde{A} > \tilde{C}$ denotes that the individual firstly feels Grudge, secondly Liking, then Love to a lesser extent and finally Passion.
56. $\tilde{D} > \tilde{B} > \tilde{A} = \tilde{C}$ denotes that the individual firstly feels Grudge to a greater extent, secondly Liking, and then Love and Passion to the same extent.
57. $\tilde{D} > \tilde{B} > \tilde{C} > \tilde{A}$ denotes that the individual firstly feels Grudge, secondly Liking, then Passion to a lesser extent and finally Love.
58. $\tilde{B} = \tilde{A} > \tilde{C} = \tilde{D}$ denotes that the individual feels Love and Liking to the same extent and Passion and Grudge to a lesser extent and the same intensity.
59. $\tilde{B} = \tilde{C} > \tilde{D} > \tilde{A}$ denotes that the individual firstly feels Liking and Passion to the same extent, secondly Grudge, and finally Love to a lesser extent.
60. $\tilde{B} = \tilde{C} > \tilde{A} > \tilde{D}$ denotes that the individual firstly feels Liking and Passion to the same extent, secondly Love, and finally Grudge to a lesser extent.
61. $\tilde{A} > \tilde{B} = \tilde{C} = \tilde{D}$ denotes that the individual firstly feels Love, and secondly Liking, Passion and Grudge to the same extent.
62. $\tilde{A} < \tilde{B} = \tilde{C} < \tilde{D}$ denotes that the individual firstly feels Grudge, secondly Passion and Liking to the same extent, finally Love to a lesser extent.
63. $\tilde{C} > \tilde{D} > \tilde{B} > \tilde{A} >$ denotes that the individual firstly feels Passion, secondly Grudge, then Liking to a lesser extent and finally Love.
64. $\tilde{C} > \tilde{D} = \tilde{B} > \tilde{A}$ denotes that the individual firstly feels Passion, secondly Grudge and Liking to the same extent, finally Love to a lesser extent.
65. $\tilde{C} > \tilde{B} > \tilde{A} = \tilde{D}$ denotes that the individual firstly feels Passion to a greater extent, secondly Liking, and then Love and Grudge to the same extent.
66. $\tilde{C} > \tilde{B} > \tilde{A} > \tilde{D}$ denotes that the individual firstly feels Passion, secondly Liking, then Love to a lesser extent and finally Grudge Love.
67. $\tilde{C} > \tilde{B} = \tilde{D} > \tilde{A}$ denotes that the individual firstly feels Passion, secondly Grudge and Liking to the same extent, finally Love to a lesser extent.

68. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}} = \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge and Passion to the same extent, secondly Liking, and finally Love to a lesser extent.
69. $\tilde{\tilde{A}} < \tilde{\tilde{B}} < \tilde{\tilde{C}} < \tilde{\tilde{D}}$ denotes that the individual firstly feels Grudge, secondly Passion, then Liking to a lesser extent and finally Love.

For the following 15 cases, in which all variables are different from zero, for each of them we have 69 combinations as seen above, and the result type to be analyzed in the same way.

67) (-1, -1, -1,-1)
68) (-1, -1, 1,-1)
69) (-1, -1, 1, 1)
70) (-1,1, -1, 1)
71) (-1,1, -1, -1)
72) (-1,1, 1, -1)
73) (-1,1, 1, 1)
74) (1, -1, -1, 1)
75) (1, -1, -1,-1)
76) (1, -1, 1,-1)
77) (1, -1, 1, 1)
78) (1,1, -1, 1)
79) (1,1, -1, -1)
80) (1,1, 1, -1)
81) (1,1, 1, 1)