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Motives and Personality: the case of Sr. and Jr. Trader

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Abstract

Within cognitive science we are looking to figure out how the mind works. With this objective, cognitive scientists have developed an impressive variety of empirical methods that encompass studies that use observations and data correlation; experimentation with humans and animals; case studies of patients with brain damage; physiological records; and more recently, neuro-imaging techniques. We here are interested in using models that allow us to improve cognition knowledge. This work develops the design of a behavior involving a methodology that allows us to build a cognitive model that also takes into consideration the cognitive structure of emotions. The case of study is about the complex stockbrokers (traders) behavior and by extension the relation between senior and junior, including the emotions. The use of ad-hoc graphics allows us to visualize the relationship between the two behaviors belonging to the two levels of expertise, and the impact that emotions have on them. The above in order to visualize and formalize the possible next state of behavior of a trader Sr., through a behavioral pattern of emotions.

Keywords: *emotions, personality, cognitive-afecctive structure, reactive behavior, cognitive task analisys, and motives.*

1. Introduction

It should be taken into account that the stock markets are highly sensitive to the emotional impact of its participants; therefore, a Trader Junior (Jr.) is directly impacted by the events of the stock market while a Trader Senior (Sr.) is maintained with certain emotional "independence" that allows him to obtain greater profits on the knowledge of the stock markets [7, 22..25].

1.1. Work Environment and the Stock Market

The working environment of a Trader is very stressful and, to the untrained in the stock markets, very chaotic. There are two levels of traders: the Junior Traders (Jr.) and the Senior Traders (Sr.) [22… 25].

Each Trader Sr. is responsible of Traders Jr. teams ranging from three to twenty Traders Jr. Once a Trader Jr. is able to control his mental state and his activities in the stock markets are more productive, regardless of his time of experience, then, he is extracted from his Traders Jr. team and sent to job training. His Job training consists of training in neurolinguistic programming (NLP), patterns of behavior of stock markets, management, and emotional self-control [7, 25].

The following table of emotions with their respective emotional indicators; where +, means present, and - means absent; was ordered by the expert in such a way that its order coincided with a truth table of four variables [7, 22… 25]:

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Table 1. Table of emotions of the traders used by psychologists and physicians who treat them.

Emotion	EMOTIONAL INDICATORS			
	Facial Expressions	Gestures	Movements	Breathing
Euphoria	+	+	+	+
Complacency	+	+	+	-
Anxiety	+	+	-	+
Denial	+	+	-	-
Fear	+	-	+	+
Despair	+	-	+	-
Panic	+	-	-	+
Capitulation	+	-	-	-
Anger	-	+	+	+
Discouragement	-	+	+	-
Depression	-	+	-	+
Hope	-	+	-	-
Relief	-	-	+	+
Optimism	-	-	+	-
Enthusiasm	-	-	-	+
Shudder	-	-	-	-

When carrying out the previous ordering, the expert realized that subsets of emotions corresponded directly with the periods of the stock market, in this way, and by direct observation the following table was made showing the differences between the emotions of the teams of Traders Jr. and their direct supervisors, the Traders Sr., as well as their correspondence with the periods of the stock markets. As you can directly observe the emotions between a Trader Jr. and his supervisor a Trader Sr. are "inverted".

Table 2. Relationship of the periods of the stock markets with the emotions of the Traders Jr. and Sr.

TRADER Jr	TRADER Sr	Period of the Stock Market
Euphoria	Anger	Maximum Financial Risk
Complacency	Discouragement	Early Alerts
Anxiety	Depression	
Negation	Hope	
Fear	Relief	Transition Alert
Despair	Optimism	Late Alerts
Panic	Enthusiasm	
Capitulation	Shudder	
Anger	Euphoria	Maximum Financial Opportunity
Discouragement	Complacency	Recovery
Depression	Anxiety	
hope	Negation	
Relief	Fear	Indicator of Abundance
Optimism	Despair	Prosperity
Enthusiasm	Panic	
Shudder	Capitulation	

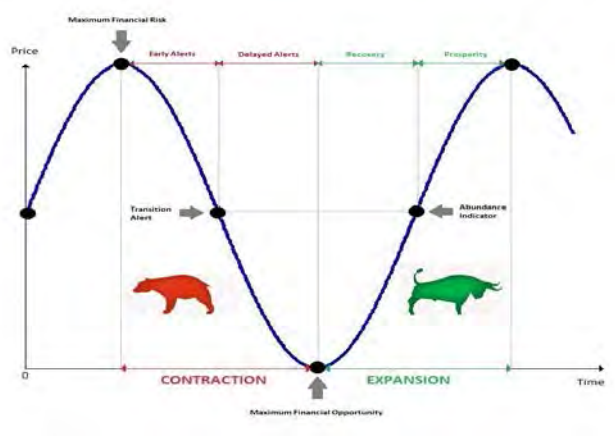

Figure 1. Diagram of the Simplified Cycle of the Stock Market. The symbol of the bull is used to indicate the expansion of the stock market and the symbol of the bear is used to indicate the contraction of the stock market.

Figure 1, shows a diagram of a simplified cycle of the stock markets showing its half cycles of contraction and expansion, as well as the periods of early and late warnings, recovery and prosperity. The inflection points are known as Maximum Financial Opportunity (MFO), Maximum Financial Risk (MFR), Transition Alert (TA) and Abundance Indicator (AI) and mark the utilitarian transitions of the stock markets.

Figure 2. Emotional Generator of the Stock Market. Turn dextrorotatory. Shows the half cycle or contraction period with their respective emotions in red boxes while showing the half cycle or period of expansion with their respective emotions in green boxes.

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By gathering all the above information, the set of emotions of the traders was modeled in a circle that the expert calls the "Emotional Stock Market Generator" whose rotation is dextrorotatory (Figure 2). The relationship between the periods of the stock markets and the emotional generator is shown in the diagrams of the Figures (3..6):

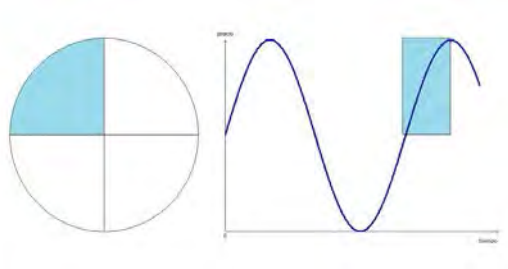

Figure 3. The regions shaded in blue correspond to the period of the stock market known as "Early Alerts" that is between the points MFR and TA.

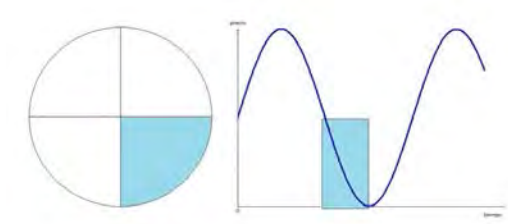

Figure 4. The regions shaded in blue correspond to the period of the stock market known as "Late Alerts" that is between points TA and MFO.

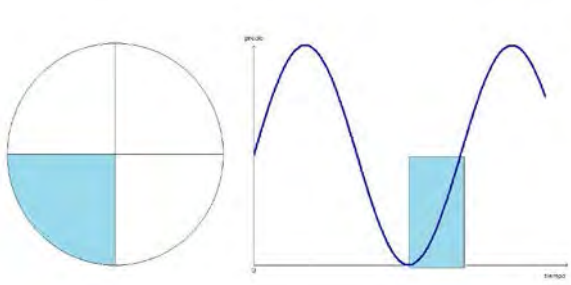

Figure 5. The regions shaded in blue correspond to the period of the stock market known as "Recovery" that is between the MFO and AI points.

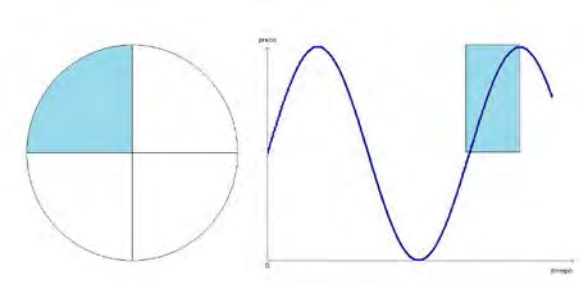

Figure 6. The regions shaded in blue correspond to the period of the stock market known as "Prosperity" which is between points AI and MFR.

Taken into account all these relationships, it is constructed a relationship between each of the emotions of the emotional generator; and the simplified cycle of the stock market was modeled to establish a mapping between both models that explains not only the speed of "movement" of the stock markets but also the emotional range that a trader experiences in: long and short times [22, 23].

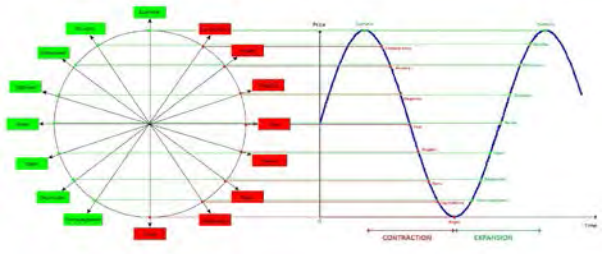

Figure 7. Periodic Emotional Model of a Cycle of a Stock Market.

1.2. Different way of visualizes information: what are Japanese Candlesticks?

Japanese candlesticks are a type of graphic representation [26] of the evolution of the price of an asset (stock or stock bond), in a certain time interval. They have their origin in the XVIII century, where they began to be used in the rice market in Japan.

When we observe this type of graph, we see a series of bars, usually green and red, or white and black, with a finer line that crosses each bar vertically. As in other graphic types, on the 'X' axis (horizontal) is plotted over time and the 'Y' axis (vertical) the asset price, Figure 8 presents an example of this type of graph, and its use in a company.

In the graph each candle represents a period of the stock market. In this example, a graph of the share price of a

company called *Aena* in one-day candles has been selected. This means that each candle shows the evolution of the price of the stock every day, since the stock market opened until it has closed. However, the investor can select any other period, making each Japanese candle represent a week, an hour, or a minute.

To explain what a Japanese candle represents, then the two parts that make it up are differentiated:

Body: this is the widest part of the candle. If the last price that the stock has had during the period represented the Japanese candle is greater than the first, the body of the Japanese candle is usually green or white and red or black if it is smaller. This tells us if the price has gone up or down in the period represented. If the bar is green or white, the lower end of the body indicates the opening price of the Japanese candle and the upper end the closing price. If the Japanese candle is red or black, the upper end of the body will mark the opening price of the period and the lower the closing price.

Shadow or wick: it is the thin line that crosses the bar vertically. The upper end of the shadow shows us the maximum price that the value has had during the period and the lower end the minimum price.

Figure 8. Stock market performance of the *Aena* company.

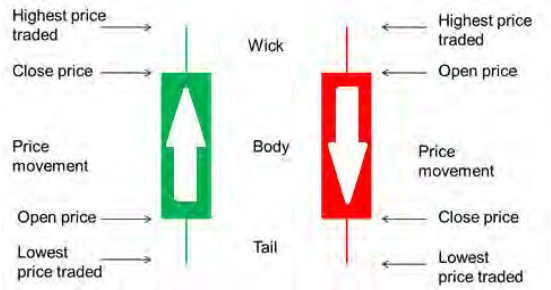

Figure 9. Japanese bullish and bearish candles with the explanation of the parts that compose them.

There may be Japanese candles without shadow or wick, or only have one at the ends. Last is because the opening and closing prices may coincide with the maximum or minimum of the period.

Compared to the classic line chart, which only gives a price per period, the candle offers us more information, since it shows four prices per period, besides adding the bullish or bearish color. Thus we can identify at a glance sessions where the value has had a strong raise or fall, temporary intervals bullish or bearish (by successions of Japanese candles of the same color) or periods of high volatility (Japanese candles higher than usual or with very long shadows). The use of Japanese candlestick charts is very widespread today among investors and traders that operate in stocks, futures, currencies or commodities, due to the large amount of information they provide. In addition, the investor or Trader can identify patterns or shapes in Japanese candlesticks, which will help him anticipate more likely succeeding market movements.

2. The environment: stock market beat or pulse metrics

When entering a working day, a Trader establishes a trading strategy [24]. This metric has been used for four years in a brokerage firm that operates in the Mexican stock market. This strategy involves multiple factors both external and internal according to the stock market of interest.

Part of the strategy, which is done intuitively today, requires a window of trading strategy per operation that involves: 1) maximum profit limit (PM), 2) maximum loss limit (pm).

The following section explains the mathematics behind the pulse of the stock market, proposed by (Guadarrama-Ponce); where the simplicity of visualization and calculation is highlighted.

Therefore, to establish seriousness in the trading strategy window is proposed a stock market indicator that the expert calls *metrics of the beat or pulse of the stock mark*et with the following considerations:

1. It is considered a circular area that shows the pulse of the stock market and whose color is

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different from that used in the charts of Japanese candles and its numerical indicator in a lower box of the same color of the circular area.

2. Once the maximum profit and loss limits are known, the initial area A_0 of the trading strategy is calculated, which by standardization is equivalent to one and with the symbol '*'

$$A_0 = \pi\left(\frac{P_{M_0} - p_{m_0}}{2}\right)^2 \equiv 1$$
$$A_0 = \frac{\pi}{4}\left(P_{M_0} - p_{m_0}\right)^2 \equiv 1$$

3. Next, if the change in the stock market cycle results in a beat or pulse with $A_1 > A_0$, then

$$A_1 = \frac{\pi}{4}\left(P_{M_1} - p_{m_1}\right)^2$$

4. The calculation of the stock beat or pulse x is

$$A_0 \rightarrow 1$$
$$A_1 \rightarrow x$$

$$x = \frac{A_1}{A_0} \; con \; x > 1$$

5. And the symbol to use is '+' and its numerical value associated with the power of the beat or pulse is x.

6. On the contrary, if the change in the stock market cycle results in a beat or pulse with $A_1 < A_0$, then

$$A_1 = \frac{\pi}{4}\left(P_{M_1} - p_{m_1}\right)^2$$

7. The calculation of the stock market beat or pulse x is

$$A_0 \rightarrow 1$$
$$A_1 \rightarrow x$$

$$x = \frac{A_1}{A_0} \; con \; 0 < x < 1$$

8. And the symbol to use is '-' and its numerical value associated with the power of the beat or pulse is x.

9. Finally, if the beat or pulse of the stock market cycle coincides with that calculated in the strategic trading window, then

$$A_0 = A_1$$
$$therefore$$
$$x = \frac{A_1}{A_0} = 1$$

10. And the symbol to use is '*' and its numerical value associated with the power of the beat or pulse is 1.

Figure 10. Example of a chart of Japanese candlesticks and examples of metrics of the beat or pulse of the stock market.

3. The cognitive model

The contribution of cognitive sciences, involves the construction of cognitive and developmental models in order to clarify complex domains [4,15], these models aim to capture the cognitive process that exactly describes or predicts the human. They can be computational models that allow through the simulation to reproduce the cognitive or conceptual process where the flow of processes is clarified. As part of the model, they include: 1) aspects of the environment, 2) knowledge operators, 3) methods operators, and 4) strategies.

The objective of this paper is to present the analysis and design of a cognitive model related to the behavior of a Trader Sr., which is related by expansion to that of a Trader Jr .; This being where the emotions will be included, as a detonating element of the actions [1,2,3,7,18].

The points that cover the development methodology are mentioned below, which will be treated in a timely manner throughout the text [10,19].

First step: you need to have a behavior of interest for the project in progress, in this case, the performance of Trader Sr. in a dynamic environment [22..25].

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Second step: in some cognitive areas it is possible to formulate competence theories, which specify: what has to be calculated, when, and why; later, based on these theories, develop an algorithm that represents it. This area of study is known as the theory of competence and is based on mental models. So we need to develop these for the study behavior; in this case the mental models of a Trader Sr. [19,20].

Third step: a cognitive analysis of tasks is developed using the steps found in mental models, in order to clarify the type of knowledge and skills needed in each of them [2,3,15].

Fourth step: a genetic graph is developed that allows to relate all the knowledge of the task. This graph allows us to hierarchize the knowledge used, and at the same time allows us to establish the different levels of competence of the Trader's expertise [2,5,19,20].

Fifth step: from the previous step, you can detect the goals that allow structuring the behavior. This is done based on a cognitive theory of emotions. This step helps us to choose the different emotions that can be perceived by the Trader (from his point of view) [2,3,14,15,20].

Sixth step: a formalization is needed that allows us to check the cognitive model, in order to take it to a computer reality. In this case, a causal matrix is developed with the representative elements that make up the behavior. This allows us to use a mathematical tool (fuzzy cognitive maps) to interpret the possible exit scenarios, within the chosen context [2,3,6,9,14,15,19,20,21].

3.1. Mental Models

A mental model is defined as a functional abstraction referring to a certain work that provides a deductive framework for solving problems; represented as a set of instructions, being able to clearly and successfully represent the restrictions and characteristics of the task; A mental model is often represented at various levels of abstraction by making explicit important principles and conceptual relationships that would otherwise be difficult to understand. The format of a mental model can be graphic, as is the case of pseudocode, structured diagrams, or Venn diagrams, among others [2,4,14,19].

The following section shows the mental models represented by pseudocodes of the conduct of a Trader Sr. (Figures 12..18); whose processes are summarized in Figure 11.In the following figures the sub behaviors that make the main behavior possible are broken down.

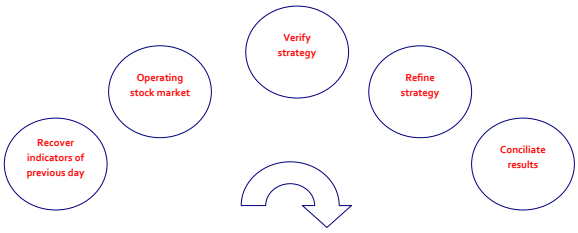

Figure 11. Steps of the Process of Interpretation of the work Environment and the Stock Market of a Trader Sr.

```
BEGIN
    Recover market indicators from the previous day STEP 0

    WHILE (there is anoperative stock market)
        IF (there is strategy)
            REPEAT
            STEP 1: Identify market period
              STEP 2: Identify emotions of Traders Jr.
              STEP 3: Set own emotion
              STEP 4: Execute stock action
            UNTIL (NOT there are resources OR inadequate strategy)
        ENDIF
        Refine strategy                    STEP 5
    ENDWHILE
    Conciliate intraday results            STEP 6
END
```

Figure 12. Principal mental model of a Trader Sr.

```
BEGIN
    Previous operation (t) ← previous operation (t-1)
    Previous slope (t) ← previous slope (t-1)
    Previous Maximum Point (t) ← previous Maximum Point (t-1)
    Previous area (t) ← previous area (t-1)
END
```

Figure 13. Recover market indicators from the previous day **(STEP 0).**

```
BEGIN
    IF (first intraday operation)
        Calculate slope                                          STEP 1.1
        Maximum point ← operation
        Calculate period (STEP 1.2)
        market ←□neutral
    ELSE
        IF (slope> 0)
            market □expansion
            IF (previous slope = 0)
                period ←□recovery
                MFR ← Previous operation
            ELSEIF (previous slope = ∞)
                period                □□ prosperity
            ELSE
                period ← prosperity indicator
            ENDIF
        ELSEIF (slope < 0)
            market ←□contraction
            IF (Previous slope = 0)
                period ← early warnings
                MFO ←□Previousoperation
            ELSEIF (Previous slope = ∞)
                period ← late warnings
            ELSE
                period □□ transitionalert
            ENDIF
        ELSE /* IF (slope = 0) */
            IF (Previous slope > 0)
                Maximum point ← MFR
            ENDIF
            IF (Previous slope < 0)
                Maximum point ← MFO
            ENDIF
        ENDIF
    ENDIF
END
```

Figure 14. Identify market period **(STEP 1).**

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```
BEGIN
        Identify facial expressions                                   STEP 2.1
        Identify gestures                                             STEP 2.2
        Identify movements                                            STEP 2.3
        Identify breathing                                            STEP 2.4

        IF (facial expressions = '+' AND gestures = '+' AND movements = '+' AND breathing = '+') THEN
                emotion (Trader Jr) ← euphoria

        ELSEIF (facial expressions = '+' AND gestures = '+' AND movements = '+' AND breathing = '-')
                emotion (Trader Jr) ← complacency

        ELSEIF (facial expressions = '+' AND gestures = '+' AND movements = '-' AND breathing = '+')
                emotion (Trader Jr) ← anxiety

        ELSEIF (facial expressions = '+' AND gestures = '+' AND movements = '-' AND breathing = '-')
                emotion (Trader Jr) ← denial

        ELSEIF (facial expressions = '+' AND gestures = '-' AND movements = '+' AND breathing = '+')
                emotion (Trader Jr) ← fear

        ELSEIF (facial expressions = '+' AND gestures = '-' AND movements = '+' AND breathing = '-')
                emotion (Trader Jr) ← desperation

        ELSEIF (facial expressions = '+' AND gestures = '-' AND movements = '-' AND breathing = '+')
                emotion (Trader Jr) ← panic

        ELSEIF (facial expressions = '+' AND gestures = '-' AND movements = '-' AND breathing = '-')
                emotion (Trader Jr) ← capitulation

        ELSEIF (facial expressions = '-' AND gestures = '+' AND movements = '+' AND breathing = '+')
                emotion (Trader Jr) ← anger

        ELSEIF (facial expressions = '-' AND gestures = '+' AND movements = '+' AND breathing = '-')
                emotion (Trader Jr) ← discouragement

        ELSEIF (facial expressions = '-' AND gestures = '+' AND movements = '-' AND breathing = '+')
                emotion (Trader Jr) ← depression

        ELSEIF (facial expressions = '-' AND gestures = '+' AND movements = '-' AND breathing = '-')
                emotion (Trader Jr) ← hope

        ELSEIF (facial expressions = '-' AND gestures = '-' AND movements = '+' AND breathing = '+')
                emotion (Trader Jr) ← relief

        ELSEIF (facial expressions = '-' AND gestures = '-' AND movements = '+' AND breathing = '-')
                emotion (Trader Jr) ← optimism

        ELSEIF (facial expressions = '-' AND gestures = '-' AND movements = '-' AND breathing = '+')
                emotion (Trader Jr) ← enthusiasm

        ELSE /* IF (facial expressions = '-' AND gestures = '-' AND movements = '-' AND breathing = '-') */
                emotion (Trader Jr) ← shudder
        ENDIF
END
```

Figure 15. Identify market period **(STEP 2).**

```
BEGIN
        IF (market = expansion)
                IF (Maximum point = MFO)
                        action ← Buy maximum allowed
                ELSE
                        IF (period = recovery)
                                action ← Buy long
                        ENDIF
                        IF (period = prosperity)
                                action ← Buy short
                        ENDIF
                ENDIF
        ELSEIF (market = contraction)
                IF (Maximum point = MFR)
                        Action ← Sell all investments
                ELSE
                        IF (period = early alerts)
                                action ← Buy long
                        ENDIF
                        IF (period = late alerts)
                                action ← Buy short
                        ENDIF
                ENDIF
        ELSE /* IF (market = neutral) */
                Refine strategy     STEP 5
        ENDIF
        IF (action > 0)
                profit ← profit+ action
        ENDIF
        IF (action < 0)
                losses ← losses + action
        ENDIF
END
```

Figure 16. Execute stock market action **(STEP 4).**

```
BEGIN
        Set maximum profit              STEP 5.1
        Set maximum loss                STEP 5.2
        radio ← (maximum profit - maximum loss) / 2
        area ← π * radio * radio
        standard ← 1
        beat ← area / previous area
        IF (beat > 0)
                pulse= positive
        ELSEIF (beat < 0)
                pulse negative
        ELSE /* IF (beat = 0) */
                pulse neutral
        ENDIF
END
```

Figure 17. Refine strategy **(STEP 5).**

```
BEGIN
        results profit - losses
        IF (results > 0)
                Declare 'Profitable Day'
        ELSEIF (results < 0)
                Declare 'Unprofitable Day'
        ELSE /* IF (results = 0) */
                Declare 'Neutral Day'
        ENDIF
END
```

Figure 18. Conciliate intraday results **(STEP 6).**

3.2. Behavioral cognitive analysis task

When analyzing a knowledge structure, it is clear that the decision-making process is not a one-step process; implying a process of successive refinements, in other words an iterative Top-Down refinement; through which restrictions are discovered based on the flow of data [16,17].

This is developed taking into account three states of analysis, agglomerated in a set of data that allow to relate [19]: knowledge, skills and mental models. Each one of the states represents the development of a successive refinement; in which the abilities in sub-skills are broken down, until reaching the basic ones.

The initial analysis is basically orientation. It is dedicated to finding a global understanding of the work and the components of expertise that make up the work.

The intermediate analysis is directed to the development of the components.

In the final state, the analysis focuses on the acquisition of skills and refinement directed to the progressive acquisition of these for the transfer from novice to expert.

In the case of study, we focus on the refinement of the initial analysis in two steps. In the tables (3..6) the initial analysis is detailed is its first iteration. In the tables (7..10),

the initial analysis is detailed in its second iteration; in order to refine the kind of skills. In this case, the following two states are not developed.

Table 3. BCAT specification for the task (initial state): session of Stock Market Intraday taking into account the necessary skills in guiding subtasks (*first iteration).*

Skills	Necessary knowledge	Conceptual representation
Pattern Recognition	Stock patterns	STEP 0, STEP 1, STEP 6
Procedural and strategic	Market periods	STEP 1, STEP 5
Procedural and tactical	Identification of Emotions	STEP 2, STEP 3
Procedural	Implementation of trading strategies	STEP 1, STEP 1, STEP 4

Table 4. BCAT specification for the task (initial state): session of Stock Market Intraday taking into account the necessary skills in guiding subtasks *(first state).*

Skills	Necessary knowledge	Conceptual representation
Procedural	Mathematical and visualization techniques	STEP 1.1
Procedural	Stock and economic cycles	STEP 1.2

Table 5. BCAT specification for the task (initial state): session of Stock Market Intraday taking into account the necessary skills in guiding subtasks *(first state).*

Skills	Necessary knowledge	Conceptual representation
Procedural and tactical	Emotional intelligence	STEP 2.1, STEP 2.2
Procedural and tactical	Neuro-Linguistic Programming	STEP 2.2, STEP 2.3
Procedural and tactical	Basic physiology	STEP 2.4

Table 6. BCAT specification for the task (initial state): session of Stock Market Intraday taking into account the necessary skills in guiding subtasks *(first state).*

Skills	Necessary Knowledge	Conceptual representation
Procedural and strategic	Risk assessment	STEP 5.1, STEP 5.2

Table 7. BCAT specification for the task: session of Stock Market Intraday taking into account the necessary skills in guiding subtasks *(second iterations). Related with Table 3.*

Skills	Necessary knowledge	Conceptual representation
-----	-----	STEP 0
Perceptual engine	Recognition of market patterns	STEP 1, STEP 3, STEP 6
Perceptual engine and tactics	Recognition of emotional states	STEP 2, STEP 3
Perceptual engine and gross engine	Stock market behavior	STEP 1, STEP 4, STEP 5

Table 8. BCAT specification for the task: session of Stock Market Intraday taking into account the necessary skills in guiding subtasks *(second iterations). Related with Table 4.*

Skills	Necessary knowledge	Conceptual representation
Perceptual engine	Statistical economics	STEP 1.1, STEP 1.2

Table 9. BCAT specification for the task: session of Stock Market Intraday taking into account the necessary skills in guiding subtasks *(second iterations). Related with Table 5*

Skills	Necessary knowledge	Conceptual representation
Perceptual engine and gross engine	Neurolinguistic programming	STEP 2.1, STEP 2.2, STEP 2.3, STEP 2.4

Table 10. BCAT specification for the task: session of Stock Market Intraday taking into account the necessary skills in guiding subtasks *(second iterations). Related with Table 6.*

Skills	Necessary knowledge	Conceptual representation
Perceptual engine and tactics	Stock limits	STEP 5.1, STEP 5.2

3.3. Genetic Graph

The genetic graph (GG) is a tool used to represent the different types of knowledge. In a general description this GG shows us the knowledge (of any kind) grouped in islands and links to relate them. These links can be of order or inclusion, as would be the case of nested hierarchies [2,19,20].

In the case of study only the properties of knowledge representation (factual, declarative, procedural, qualitative) and its type of link are developed.

The links that are used in this graph are and can be expanded according to the needs of the domain to be modeled. Below is the meaning of those used during the development of this example and shown in Figure 19:

1. **Before:** this link implies an order of precedence *before of*.
2. **After:** this link implies an order of posteriority, a knowledge that can be accessed after covering the knowledge to which it is linked.
3. **CompoundOf:** this link implies that one knowledge or skill is composed of another component.
4. **Class:** implies the existence of a conceptual or skill hierarchy.
5. **SubClass:** implies the existence of levels of granularity in the definition of conceptual abstractions or skills.
6. **ItIs:** represents the definition of a specific component according to the study domain.

The links between the islands, in addition to indicating the order of execution of the task, specify the relationships, and the data of inputs and outputs that will exist between the islands and the different levels of abstraction (may or may not exist) related to obtaining: the critical points of the general strategy and of the competence of the different levels in terms of teaching a specific context.

4. Emotions

Affective computing starts in the year 2000 [10 .. 15,18,20] and has two basic objectives: 1) elicit the emotions of a user, 2) represent synthetic emotions, through computer systems; using computer models simulate the behaviors of human beings, the emotions of the users are predicted; in order to have more accurate interactions and more located, during the interaction of these systems and at the same time understand the threads of reasoning that led to a certain action.

Computer systems that include emotions within their interaction have some of the following perceptor models: 1) a cognitive structure of emotions or 2) a set of perceivers that allow them to know the heart rate, the dilation of the pupil, the level of sweating, among others.

An emotion can not be directly observed (it is proprioceptive, like colors) by another person; but it can be guessed due to the observation and analysis of certain physiological aspects and the delimitation of a cognitive structure of emotions centered and located within a specific context *such as preparing for a swimming competition*.

In this way an emotional expression refers to everything we consciously perceive of our emotional state; related to internal and external events [7,8,15].

4.1. How can they benefit? the daily life of people artifacts that include emotional design.

Feelings provide mechanisms that make it possible to distinguish good or bad; both consciously and unconsciously; this being an important capacity. Emotions act as signals that are carriers of information and at the same time indicate to other processes how to react Picard [13].

Under the previous argument we can benefit from emotions in the following way: include a mechanism of emotions that allows us to recognize erratic behavior and protect ourselves from it [14,20].

This work focuses on the emotions that affect the Trader Sr. and, by extension, the Trader Jr. The above in order to know the pattern of behavior that can lead them to a bad

decision, as well as to predict an exacerbated emotion that leads them to cardiac arrest.

4.2. Theoretical Framework.

Approximately at the end of the year 2000, several researchers like Rosalind Picard, Donald Norman, Minsky, Ortony, Clore and Collins and Igor Aleksander [8,11,12,13], among others, founded what is known as affective computing. The latter is a sub-line of *artificial intelligence (AI)* research.

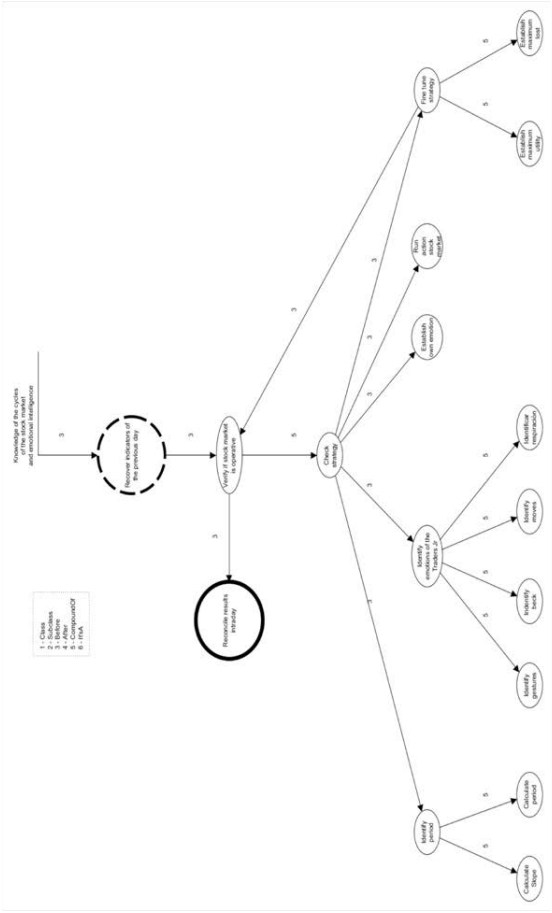

Figure 19. Gentic Graph, representing the relation among the differents types of knowledge (Trader Sr.).

The main objective of the AI is to emulate the behavior of the human being, wether cognitive or physical. With the help of cognitive psychology (CP). A more formal definition is given in the next paragraph.

AI is the simulation of human intelligence in a machine, in such a way that the machine is efficient in the process of identifying and using the correct piece of knowledge in a certain step related to the solution of a problem.

As for *affective computing*, it is the one that relates, the excitations deliberately caused to influence the user's emotions; being a field studied by psychology and its importance in the behavior of a human being. It has two aspects: a) synthetic emotions, and b) elicit human emotions

The *first current* implies the ability of an artifact to reproduce emotions according to the context of the user. For example: a videogame, or a *second life*, among others [3, 15, 20].

In the *second current* what matters is to know what the emotions experienced by a user at a certain moment may be, this implies predicting them. The above with the aim of being able to have a richer and contextualized interaction. For example, an ATM that detects the needs of the user, a pedagogical agent that detects the mood of the student, among others; emphasizing that this current is limited in cognitive emotions, leaving aside those that are produced by the physiological system [4,5,15].

In order to achieve the above, a cognitive theory of emotions is used, that allows generating a predictive model. In the following section an explanation of it will be given.

5. OCC Theory.

The OCC theory (named for its authors: Ortony, Clore and Collins [11,12]) is an effort to propose an order where there is an apparent chaos. An order that allows computer scientists to reproduce an emotion from a *general structure*, which specifies that there are three major classes of emotions [10]; each of which is based on the three highlights of the world: 1) events and their consequences, 2) agents and their actions, and 3) pure and simple objects.

The three great classes of emotions are:

1. *Emotions based on events*: elaborate consequences before desirable or undesirable events with respect to the goals.

2. *Emotions of attribution*: they attribute responsibility to the agents on their actions according to norms.

3. *Emotions of attraction*: based on attitudes with respect to objects.

With the understanding that all people have different goals they want to achieve in their lives; they take shape through an *affective-cognitive* structure; which allows us to achieve our objectives in different contexts, through those goals; one of them being the main one and the others a set of instrumental goals that allow us to achieve the main goals; then, a brief explanation is given, for more depth consult the related reference. Starting from the previous assumption, and in order to evaluate the environment, a series of variables are linked in parallel to the structure in order to measure the impact of environmental events on the internal state of the *affective-cognitive structure*. To achieve this, local and global variables are established that modify the intensity of emotions. As a result, the affections (cognitive elaboration of an emotion) linked to these emotions are presented, Figure 20 summarizes the OCC theory [10].

Figure 20. OCC Emotional structure Theory.

OCC Theory proposes a hierarchical structure composed of a higher goal (general) and sub-goals called instrumental goals (more specific). The goals have two defining characteristics (not always present): 1) type of things that can be sought and 2) the kind of things that can be achieved with a plan. The goals are of different kinds: 1) active persecution (MA); what one wants to have done, 2) of interest (MI); what one wishes to happen, and 3) filling (MR); which are cyclical, which is why even when they are met they are not abandoned. The above goals are related to the specific objectives within the behavioral context such as: achievement (achieve certain things), satisfaction (satisfy biological needs), entertainment (enjoyment), preservation (preserve states), crisis (handle crisis when the preservation ones are threatened), and instrumental (they realize other goals).

These goals are related to each other with links defined as: necessary, sufficient, facilitators or inhibitors. For more details consult the related reference.

6. Our Aproximation.

In the next section we will develop the cognitive-affective structure, based on the model developed in the previous section [19,21]. In the case of study the conduct of a Trader Sr. will be analyzed from the cognitive point of view, with emphasis on the emotions and the events that will provoke a valence, that is, events with meaning. Table 11, shows the relation among the actions of the mental model and their corresponece with the emotions.

Table 11. Relationships among the actions, mental model steps and the emotions of a Trader Sr.

Actions	Mental Model Steps	Emotions
Recover indicators from the previous day	STEP 0	Complacency (2), Anxiety (3), Optimism (14), Enthusiasm (15)
Verify operating stock market	STEP 0	Anxiety (3), Enthusiasm (15)
Verify strategy	STEP 0	Denial (4), Optimism (14)
Identify market period	STEP 1	Euphoria (1), Complacency (2), Anxiety (3), Shuddering (16)
Calculate slope	STEP 1.1	Despair (6), Optimism (14)
Calculate period	STEP 1.2	Fear (5), Relief (13)
Identify emotions of Traders Jr	STEP 2	Euphoria (1), Anger (9)
Identify facial expresions	STEP 2.1	Despair (6), Hope (12)
Identify gestures	STEP 2.2	Denial (4), Fear (5), Despair (6), Hope (12), Relief (13), Optimism (14)

Identify movements	STEP 2.3	Enthusiasm (15), Shuddering (16), Euphoria (1), Denial (4), Fear (5), Despair (6)
Identify breathing	STEP 2.4	Panic (7), Capitulation (8), Anger (9), Optimism (14), Enthusiasm (15), Shuddering (16)
Set own emotion	STEP 3	Complacency (2), Anxiety (3), Denial (4), Discouragement (10), Depression (11), Hope (12)
Execute stock action	STEP 4	Optimism (14), Enthusiasm (15), Shuddering (16), Euphoria (1)
Verify resources	STEP 4	Denial (4), Hope (12)
Refine strategy	STEP 5	Discouragement (10), Depression (11), Hope (12), Relief (13)
Set maximum profit	STEP 5.1	Enthusiasm (15), Shuddering (16), Euphoria (1)
Set maximum loss	STEP 5.2	Panic (7), Capitulation (8), Anger (9)
Conciliate intraday results	STEP 6	Anxiety (3), Denial (4), Optimism (14), Enthusiasm (15)

Through emotions we can know the state of the market. To achieve this we need a formalization of knowledge so we will use diffuse cognitive maps (MCD).

6.1. Fuzzy cognitive maps.

In the field of artificial intelligence, cognitive maps encode knowledge regarding causal events and the way in which it is activated. Modeling cognitive maps using fuzzy logic seems natural, due to the inherent uncertainty found in real-world databases and knowledge. These have been used successfully to model the behavior of expert systems on different topics [2,3,15,20,21].

The fuzzy cognitive maps (FCMs) are represented by a digraph, in which nodes are concepts describing the main features of the system, and the arrows between the nodes represent causal relationships (positive or negative) between the concepts. This graph (Figure 21) illustrates the influence that each of the concepts has over the rest [9].

The concepts in a FCM are events, whose values change over time. The concepts take values within the interval [0, 1], and the interconnection weights, pij, do so within the interval [-1,1]. As shown in the graph, the value corresponding to the edge between the concepts i and j is represented by pij. Then pij = 0 indicates the absence of a relationship between the concepts i and j, and pij> 0 indicates a positive causality, which implies that an increase in the concept i translates into an increase in the concept j and a decrease in the concept i results in a decrease in the concept j. If pij <0, there is a negative causality, which implies that an increase in the concept i generates a decrease in the concept j and a decrease in the concept i generates an increase in the concept j.

In this work we refer to the FCMs as causal representations between the events of a behavior including the emotions to represent relationships of these.

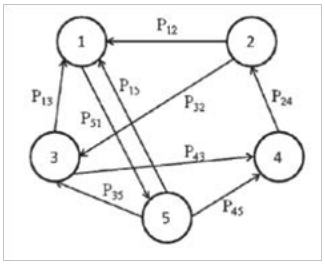

Figure 21. Fuzzy Cognitive Map

6.2. Casual Matrix.

An adjacency matrix, p, is used to represent the cause-effect relationships between the nodes. The value of each of the concepts at time t + 1 is determined by the current value of the concept and the matrix p. One of the ways most recently used to quantify the effect of each node on the rest of the elements is as follows:

$$C_i(t+1) = f\left[\sum_{k=1}^{n} p_{ki}(t_n)C_k(t_n)\right]$$

Where C_i represents the quantification of the total effect of node *i* (concept *i*) over the rest of the elements, f represents a non-linear threshold function applied individually to the components of the product of the matrix. The non-linear function allows to delimit the distribution of the output values, which gives, the FCM a self-evaluation, in the sense of knowing how well it is reasoned with respect to the design of the links of the adjacency matrix. It has to take into consideration that the inclusion of non-linearity sometimes forces the FCM to recycle itself through the states. Various functions can be used as a threshold function. The first proposal was f (x) = max {lb, min (1, x)}, where lb is the lower limit of the

values of the vertices; if the interval of values of the concepts is [0,1], it is proposed to use f (x) = 1 / (1 + ex), or else, f (x) = 1 / (1 + e-cx), where c is a positive real number other than 1.

The selection of the threshold function depends on the method used to describe the concepts, which as can be seen are two [2,15]: the first introduces two opposing concepts in the same FCM, in which the values of the concepts must be within the interval [0, 1], where 0 means the absence of the concept and 1 means the presence of the concept; and the second, where the concepts take values within the interval [-1,1], which means that if there is a concept called decision, it can take negative values to describe a wrong decision and positive values to describe a correct decision. Then f is a threshold function that is used to assign the value of the concept within a normalized interval. The appropriate selection of f is also very important, since the selection of f affects the system global behavior. Due to the nature of the emotions involved in the context of this work, the bipolar logistic function (range -1 to 1) was used in each of the scenarios analyzed.

The FCM is activated by assigning the number 1 to one or several concepts, and it is applied iteratively, multiplying the vector by the causality matrix. If the result is less than -1 or greater than 1, they are normalized to -1 or 1, respectively. A limit state is reached when: 1) a new state is equal to one already found, 2) a limit of the cycle, 3) when the last states are equal to the others previously found (a pattern of states).

7. Causal matrix of a Trader Sr.

Emotions of a Trader Sr. contemplate the whole emotional range that is experienced in a cycle of the stock market with its respective acceleration and delay influenced by external events to the stock market itself. The list of emotional elements is the following:

1. Euphoria
2. Complacency
3. Anxiety
4. Denial
5. Fear
6. Despair
7. Panic
8. Capitulation

9. Annoyed
10. Discouragement
11. Depression
12. Hope
13. Relief
14. Optimism
15. Enthusiasm
16. Shuddering

Table 12. Matrix of causalities

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	0	1	1	0	0	0	-1	-1	-1	-1	-1	0	0	0	1	1
2	1	0	1	1	0	0	0	-1	-1	-1	-1	-1	0	0	0	1
3	1	1	0	1	1	0	0	0	-1	-1	-1	-1	-1	0	0	0
4	0	1	1	0	1	1	0	0	0	-1	-1	-1	-1	-1	0	0
5	0	0	1	1	0	1	1	0	0	0	-1	-1	-1	-1	-1	0
6	0	0	0	1	1	0	1	1	0	0	0	-1	-1	-1	-1	-1
7	-1	0	0	0	1	1	0	1	1	0	0	0	-1	-1	-1	-1
8	-1	-1	0	0	0	1	1	0	1	1	0	0	0	-1	-1	-1
9	-1	-1	-1	0	0	0	1	1	0	1	1	0	0	0	-1	-1
10	-1	-1	-1	-1	0	0	0	1	1	0	1	1	0	0	0	-1
11	-1	-1	-1	-1	-1	0	0	0	1	1	0	1	1	0	0	0
12	0	-1	-1	-1	-1	-1	0	0	0	1	1	0	1	1	0	0
13	0	0	-1	-1	-1	-1	-1	0	0	0	1	1	0	1	1	0
14	0	0	0	-1	-1	-1	-1	-1	0	0	0	1	1	0	1	1
15	1	0	0	0	-1	-1	-1	-1	-1	0	0	0	1	1	0	1
16	1	1	0	0	0	-1	-1	-1	-1	-1	0	0	0	1	1	0

In the following section, four entry scenarios are tested; and the outputs are interpreted.

7.1. Description of possible stock market scenarios for a Trader Sr.

First scenario – Stock Market period of early warnings Senior

This scenario describes the beginning of the decline of the stock market, manifests the emotions of the confidence of a boom period and prosperity mixed with the emotions that indicate the beginning of the arrival of negative news that cause the contraction of the market.

Input vector: complacency (2), anxiety (3), denial (4), fear (5), **NO** discouragement (10), **NO** depression (11), **NO** hope (12), **NO** relief (13).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	+	+	+	+	0	0	0	0	-	-	-	-	0	0	0

Output vector:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+

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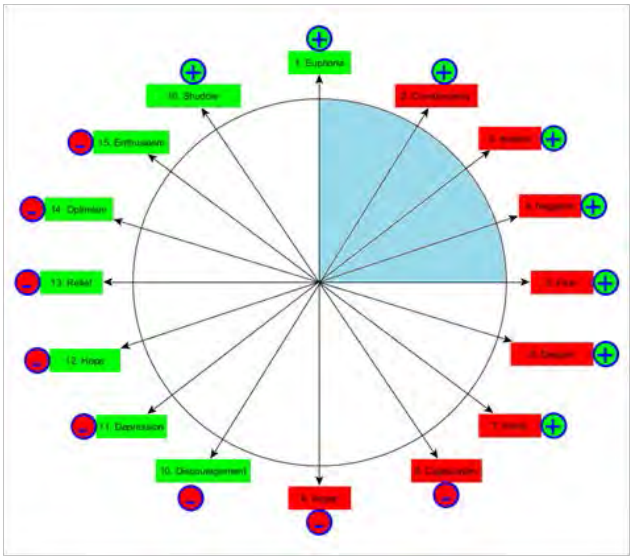

Figure 22. Emotional activation of a Trader Sr in the period of the stock market known as "Early Warnings". The blue circles with symbol '+' indicate the activation of the corresponding emotion while those with the symbol '-' indicate the inhibition of the corresponding emotion.

Interpretation:
Indicates that the emotions expressed with emphasis are complacency (2), anxiety (3), denial (4) and fear (5) with the historical security framework of the previous period with euphoria (1) and shuddering (16).) that are gradually abandoned and combined with the predictive security framework to the next cycle of the stock market with desperation (6) and panic (7) that start their activation; Figure 22, is a graphic representation.

Second scenario - Market period of late warnings Senior

This scenario describes the core of the decline of the stock market, manifests the emotions of the distrust of a period of stock market contraction mixed with the emotions that indicate the beginning of the arrival of positive news that cause the market expansion.

This scenario describes the core of the decline of the stock market, manifests the emotions of the distrust of a period of stock market contraction mixed with the emotions that indicate the beginning of the arrival of positive news that cause the market expansion.

Input vector: despair (6), panic (7), capitulation (8), anger (9), NO optimism (14), **NO** enthusiasm (15), **NO** shuddering (16), **NO** euphoria (1).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
-	0	0	0	0	+	+	+	+	0	0	0	0	-	-	-

Output vector:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-

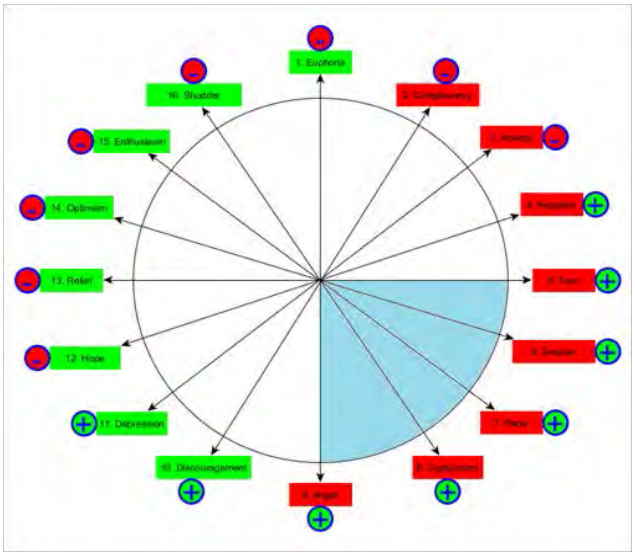

Figure 23. Emotional activation of a Trader Sr in the period of the stock market known as "Delayed Warnings". The blue circles with symbol '+' indicate the activation of the corresponding emotion while those with the symbol '-' indicate the inhibition of the corresponding emotion.

Interpretation:
The emotions expressed with emphasis are desperation (6), panic (7), capitulation (8) and anger (9) with the historical security framework of the previous period with denial (4) and fear (5)) that are gradually abandoned and combined with the predictive security framework for the next cycle of the stock market with capitulation (8) and anger (9) that initiate their activation; Figure 23, is a graphic representation.

Third scenario - Market period in recovery Senior

This scenario describes the beginning of the expansion of the stock market, manifests the emotions of the distrust of a period of contraction of the stock market mixed with the emotions that indicate the beginning of the arrival of positive news that cause the expansion of the market.

Input vector: discouragement (10), depression (11), hope (12), relief (13), **NO** complacency (2), **NO** anxiety (3), **NO** denial (4), **NO** fear (5).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	-	-	-	-	0	0	0	0	+	+	+	+	0	0	0

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Output vector:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-

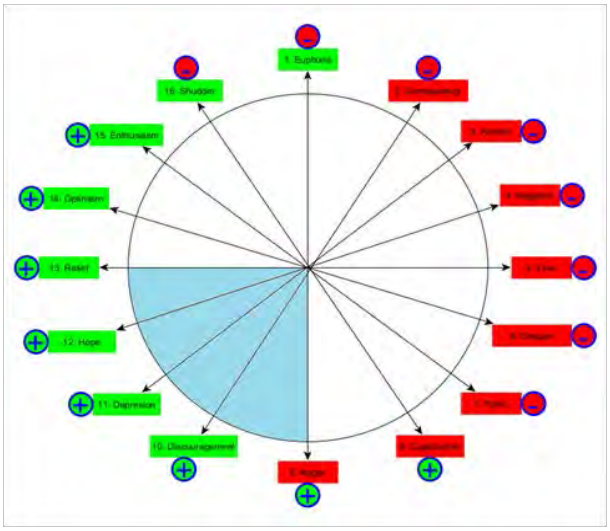

Figure 24. Emotional activation of a Trader Sr in the period of the stock market known as "Prosperity". The blue circles with symbol '+' indicate the activation of the corresponding emotion while those with the symbol '-' indicate the inhibition of the corresponding emotion.

Interpretation:
The emotions expressed with emphasis are discouragement (10), depression (11), hope (12) and relief (13) with the historical security framework of the previous period with capitulation (8) and anger (9) that are gradually abandoned and combined with the predictive security framework for the next cycle of the stock market with optimism (14) and enthusiasm (15) that initiate their activation; Figure 24, is a graphic representation.

Fourth scenario - Prosperity market period Senior

This scenario describes the core of the expansion of the stock market with boom period and prosperity, the emotions characteristic of the confidence of a period of stock market expansion mixed with the emotions that indicate the beginning of the arrival of negative news that cause the contraction of the market are manifested.

Input vector: optimism (14), enthusiasm (15), shuddering (16), euphoria (1), **NO** despair (6), **NO** panic (7), **NO** capitulation (8), **NO** anger (9).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+	0	0	0	0	-	-	-	-	0	0	0	0	+	+	+

Output vector:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+

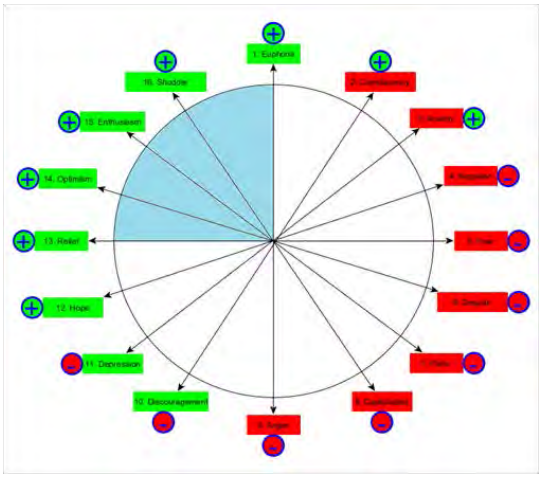

Figure 25. Emotional activation of a Trader Sr in the period of the stock market known as "Prosperity". The blue circles with symbol '+' indicate the activation of the corresponding emotion while those with the symbol '-' indicate the inhibition of the corresponding emotion.

Interpretation:
The emotions expressed with emphasis are optimism (14), enthusiasm (15), shuddering (16) and euphoria (1) with the historical security framework of the previous period with hope (12) and relief (13).) that are gradually abandoned and combined with the predictive security framework to the next cycle of the stock market with complacency (2) and anxiety (3) that begin their activation; Figure 25, is a graphic representation.

8. Conclusions

The rules are not enough to understand and predict the behavior of human beings; Recent scientific discoveries offer evidence about the importance that emotions have in: rational decision making, perception, learning, among other cognitive functions. The study of emotions makes us more aware of the way humans behave. This allows us to test emotional theories, helping to establish affective patterns that allow doctors to understand the role of emotion in preventive medicine.

Emotional intelligence is the ability to understand the feelings and emotions of oneself and others; being able to discriminate them and use the information that underlies them as a guide for their own behavior. Emotional intelligence involves factors such as: motivation, empathy,

impulse control, self-knowledge, perseverance and social skills.

The work of a Trader Sr., is considered a high-risk job due to the time periods in which the emotions occur in cycles of + TO -, and having as frequency all the working hours that involve between six and eight hours of work. The above entails a high stress.

The stress to which they are subjected during the workday creates an emotional tension, which has a reflection in the physical tension, as they can be: gastric problems, severe migraines and muscular pains, are common affections of these financial intermediaries; coming to have continuous physical wear which implies a quick retirement.

The behavioral analysis that is developed in this work allows us to make a prediction of behaviors through emotions, by locating them in the times of the stock market. This study in a parallel way offers a showcase of the possible negative emotions that together with an exacerbated behavior can predict a crisis in the Traders.

The behavioral analysis carried out in this work can be used: 1) as the seed of a recognition software for facial and body expressions; in coordination with physiological meters. The design of software should serve doctors and psychologists to prevent a possible crisis that can result in a heart attack or a nervous breakdown. Another aplication could be 2) a tutorial that allows to assemble a learning process of skills and knowledge necessary to reach the expertise of the Trader Sr.
In this study we can observe the ability of an expert Sr. Trader who, once given a moment, is up or down; will be preparing the next state, the above is observed in the scenarios studied. sIt is emphasized that when a Trader Jr. begins to show a behavior similar to a Sr., at that time it is considered that they are prepared to take the leap to the next level.

The creation of a cognitive model of a Trader Sr. has allowed to identify the relations between the emotions of the Traders Sr. and the periods of the stock markets to obtain greater profits from them.

It was found that there are emotions in which a Trader Sr. focuses his attention and in contrary vision to a Trader Jr., reacts differently, these work situations cause Traders Jr. to have as catchword the following sentence; *my boss always takes me the opposite*.

Also, a Trader Sr. activates characteristics of the neighboring emotions in which he has focused his attention as a way of preparing or "predicting" the following events of a stock market.

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