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When Do We Act under Non-Coercive Circumstances

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ABSTRACT

This study proposes two models that predict when an individual will take action after he focuses on achieving a goal. Models designed for an environment that does not force the decision maker to act at a given moment, and divided this environment into two subsets that 'do not allow' or 'allow' analytical reasoning. Study I simulated the former situation and identified the following factors to predict the moment of action: The value assigned by the decision maker to the target (V), the individual's introversion or extraversion level (IE) and the individual's neuroticism level (N). Three classes (time-interval) were defined for both studies that sequentially diverge from the moment when the focus began, with the help of a reference group. Decision Tree I utilized the Random Committee Algorithm and achieved to assign **37,2%** of the 424 subjects correctly to one of these classes, while the natural success rate is 33%. Study II simulated the latter situation. Decision Tree II utilized the Random Forest Algorithm and achieved to assign **44,5%** of the 430 subjects correctly, with the help of the factors; (V), heuristic versus analytic decision-making disposition (HRA), decision-making extensity (E), general intelligence level (IQ), and self-confidence level (SC). Finally, an independent chapter discussed the optimum moment of action in Study II type situations with a Charnovian approach. The study has also illuminated how analytical capacity affects dwell time. Study I may contribute to crime prediction algorithms and Decision Tree II can be used in a range from financial investments to internet applications.

1. Introduction

When public transport arrives, you take a step forward to get on. When someone punches, you quickly back away. When your alarm clock rings, you turn it off, or while on a hunt with a sniper rifle you pull the trigger when the moment is right, neither before nor after. These examples represent varying degrees of coercive situations. There is no clear line between these situations and non-coercive situations, you might think that they have accumulated at two opposite ends of the spectrum. You have some money, and you want to invest in a stock in the stock market, do you buy the paper immediately or decide after you get some information? When do you put an end to your investigation? This question can be answered as follows:

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"When I feel that I have learned enough." It refers to a heuristic process and draws attention to a point that optimizes the utility of knowledge and the cost of acquiring it. You have some capital, and you will open your dream restaurant, how much preparation you would do for the venture? When would you leave the Wikipedia page? You have participated in an experiment, and you were asked to put your finger on a surface and lift it when you feel like it. Lifting your finger is now your 'goal'. Do you achieve that goal immediately or do you wait for a while? You have participated in another experiment, and you are presented with a cartoonish visual: A woman lies on the floor in a room with a gun in one hand and a cigarette in the other. You think she is dead because of the bloodstain on the wall and the overturned stool. There are many objects in the room that hold clues, from an unfinished letter to a full trash bin. You are given unlimited time and asked if the woman committed suicide or was murdered. How long does it take for you to come to a decision?

These are non-coercive situations. If you know the action moments of the individuals towards a specific non-coercive target and if the correct factors regarding the said individuals have been measured, and also if you know the values of a later member for the mentioned factors and the deviations of these values from the community mean; it can be determined with a reasonable error in which direction and with how much deviation from the average time the later member will take action.

Accordingly, this study aims to predict as accurately as possible when an individual who is focused on the goal **a)** without interruption and **b)** without giving up, will act **c)** in a non-coercive circumstance. To achieve this aim, the sole theory that deals with the moment of action was highlighted under the title of 'Benefit, Cost and Action' and discussed why this theory (MVT) which is based on the feeding behavior of animals, can't be used in its pure form when it comes to human. Under the title 'Interpreting the Continuum Leading the Action', the non-coercive cases were split into two parts, in terms of whether they allow analytical reasoning or not; and the 'factors' that might be useful in making predictions for each sub-case, were discussed theoretically. The expected effects of these factors on the moment of action were discussed under Study I and Study II titles and two different experiments conducted to understand how these factors relate to the moment of action. The data obtained from the experiments were analyzed with 'Random Committee' and 'Random Forest' Algorithms to predict the test-set's moment of action. To get an idea about the optimum moment of action, a final chapter was prepared under the title of 'Story, Time and Action' and a Charnovian framework constructed for Study II, which individuals balance the "cost of diminishing returns" with the "complicating factors".

Predictive models are generally depending on the agent's background and the specific circumstances of that history. For example, Song et al.'s work (2010) successfully predicts where the individual will be in London the next day at a given moment, but when we move the individual to Paris, it needs to be followed for a while to predict where he will be the next day because the forecast is a specific product of the individual's interaction with the city concerned. However, the methods used in the present study does not require the action history of the individual, instead, the history of a group of people on the relevant subject was taken as basis and the personal characteristics of the mentioned group were compared with the characteristics of the person who was the subject of the prediction. Except for the value that the individual assign to the target, these factors are relatively independent of the target, are relatively resistant to change over time, and once obtained, they can be used to make predictions in different situations.

2. Benefit, Cost and Action

In non-coercive situations, people go through a preparation process to act. 'Preparation' is done to increase the success of the action because if a goal cannot be achieved, its true value is zero regardless of market value or authentic value. The action or initiative is expected to succeed because the target is more or less valuable to the individual. Since things of high value are rare[1], you would expect the 'Preparative Interval'[2] (*T*) to increase as the market value or intrinsic value of the target increases, because as *T* increases so do the information, financial and physical resources to be used on behalf of the venture. However, the gap between the accumulated cost of the acquired knowledge or resources and their utility closes overtime after a point because **a)** under the law of diminishing returns, the added value of each unit of knowledge or resource gradually decreases, and **b)** after a certain point, the best moment to act is likely to be over (Christian & Griffiths, 2017, 21)[3]. Imagine a cat sneaking up on its prey; the first meters of crawling contribute to the success of the final jump towards the prey, but this contribution gradually decreases, on the other hand, as the cat approaches its prey, the probability of being noticed before the jump increases and thus returning empty-handed. If it does not undergo a radical change during the *T* time, the target's return is relatively constant. The accumulated resources often increase the probability of getting this fixed income, they do not change it. While the set-up cost increases, the return tends to remain constant, as adaptation theorists (Gregory, 2009; Nelson et. al., 2007) points out the environment (may) changes faster than the agents themselves[4]. However, the return which seems fixed from an objective point of view; is variable according to the agent's subjective point of view, and agents who entered the decision horizon may not have made a judgment on this issue yet. For this reason, the time visitors spend on websites follows a course close to the Weibull distribution which is a reliability-engineering concept.

Components matching the Weibull distribution show a negative aging trend. The longer the component has been in service, the less likely it is to fail. Similarly, the visitor is likely to leave the website in the first few seconds (Liu, et al., 2010) because visitors know that most web pages are useless for their purposes, and they avoid spending too much time on these pages (Nielsen, 2011). The few remaining visitors find great harmony with what the page has to offer and now have more reasons to stay longer. The *T* values of the subjects participating in Study I and Study II followed a non-parametric course resembling the Weibull distribution (see, Appendix A-2). This cue advised us to look at the subject's propensity to engage in the presented problem. Correspondingly, V values obtained from the subjects refer to the harmony between the subject and the target.

The tension between the cost of the decision process and the benefit of it; for example, 'should the hunter be content with small prey or bear the cost of a large prey?' has been discussed under the headings such as Optimal Foraging Theory (Sinervo, 1997; Manatunge & Asaeda, 1999; Werner & Hall, 1974), Foraging Models (Bautista et al., 2000) and Optimality Theory (Parker & Smith, 1990), however solely Charnov (1976) discussed the decisive moment in time-space by asking 'how long to spend collecting the resource before leaving the source?' (Kefa et al., 2018). According to Charnov, animals balance 'inter-patch travel time' and 'foraging time in a patch' when feeding from discrete nutrition patches. His Marginal Value Theorem (MVT)

[1] As a result of the second law of thermodynamics, rare systems are generally more complex and cause a greater amount of disorder to exist (Rifkin & Howard, 1993).

[2] This term refers the period of time that an individual takes from the moment he focuses on a goal until he takes action and will be symbolized with "*T*". There are two conditions for a period to be considered as *T*: **a)** The focus must not be interrupted and **b)** *T* must not be terminated because the individual has given up on the goal.

[3] Optimal Stopping (%37): When should research be stopped?

[4] Because a system can exist as long as its entropy is low compared to its surroundings.

draws attention to the ‘optimal foraging time' because, spending too much or too little time in a patch causes the animal to endure the trip between patches to acquire a portion of food that cannot afford the travel cost, or causes to spend too much effort on ineffective supplementary food in a patch. The MVT in its pure form is not usable for the current study, because in humans **a)** the transition from one decision goal to the next is a mental leap, it happens instantaneously, has no cost, or the cost is not measurable as is the case with moving from one patch to another. **b)** Most of the benefit items (targets for action) that are the subject of this study are not similar to Charnov's food patches, that is, their content does not gradually decrease, on the contrary, these benefits appear mainly after the moment of action, at least within the framework of the problematics used in Study I and II, and benefit items of different goals are not equivalent in their ingredients like different patches. Last of all, **c)** the effect of ‘future goals’ (other patches) on the individual's moment of action is strongly questionable:

In the preliminary research of Study I, it was assumed that goals for the near future would affect *T*, and related measurements were integrated into the experiments. The subjects were asked about the activities they are planning to do when they left the finger-raising experiment and the value they assigned to these activities. In another version, subjects were given four different experimental topics and asked to rate them in terms of their significance. Some of the subjects were then told that they will participate in the experiment that they had rated low just after the finger-raising experiment, and the other group was told that they will participate in the experiment which they valued high. The future benefit is subject to a discount rate by people (Rachlin et al., 1991; Frederick et al., 2002). Referring to this, the prospective discount tendency of subjects was measured by the test kit[5] used by Frederick et al. (2002). Scenarios where each subject's discount coefficient was applied to the values they assigned to their future goals and not applied, were evaluated. Overall impression and regression analysis on 40 observations ($p > .15$ with an r^2 of .016) showed that the high or low value assigned to the action planned to be done in the close future does not have a significant effect on the *T* value. Research indicates that individuals’ working memory has the ability to focus only on a single target at a time (Miller, 1956; Baddeley et al. 1975; Cowan & Rouder, 2009; Zhang & Luck, 2008) supports this finding.

When subjects focus on a goal, it can be thought that they lose their conscious bond with their future goals, as when playing a video game we cannot understand how time pass, unless an unconscious process reminds us that we have 'wasted too much time'. It appears that before such an impulse affect the subjects in the preliminary research, they acted and ended the experiment. 'History' was also not included in the agenda: Subjects participating in Studies I and II were asked whether ‘they had left a job unfinished to participate in the experiment’, and if their answers were positive, the importance of the job they left was questioned. No significant difference was observed between the *T* value averages of the subjects who interpreted the job they left as 'partly urgent' or 'urgent' and those of the remaining subjects[6].

In Charnovian cases, *T* increases as the cost of transition between food patches increases, and the decrease in the amount of food supply over time in a patch suppress *T*. If we cannot use future goals as benefit factors and if emerging benefit during *T* is uncertain or it is not easy to measure the observed change in benefit over *T*, at least within the methods of this study, **a)** how can we determine the cost and the gain of the human decision process or **b)** which other

[5] Imagine you have the following options: **a)** Either you will receive 500 TL now or **b)** One year later you will receive X TL. If you had chosen the second option, what would be the minimum acceptable value of X for you?
[6] Still, those who declared that they had abandoned an important work, were excluded from the further analysis of Study I and II.

factors should our models be based on? The first question was discussed under the title of "Story, Time and Action". The following section discusses the second question.

3. Interpreting the Continuum Leading the Action

If the factors that would affect *T* are theoretically countless, then which factors should we use and why, in a frugal estimation algorithm designed for Study I and Study II type problems? There are two types of decision situations that allow or do not allow analytical reasoning. Study I simulated situations that did not give the individual reason to conduct an analytical process. When you decide to raise your finger on the table, when you want to leave the house for no reason, or when you respond to the mobbing you have been exposed to for a while with an emotional outburst, you do not carry out an analytical mental process, you follow your feelings and instincts. In such cases, the options for action are few and the real problem is choosing between 'waiting a little longer' for an obvious behavior or 'acting now'. If action is preferred, it is not rationalized or justified by analytical reasoning before the action. But in situations similar to the problem designed for Study II, the individual compares options by conducting a kind of feasibility study or constructs a story that justifies the heuristically prominent option, without comparing it to other options. These type of situations presents the decision maker problems that can appreciate an analytical process, but as Kahneman (2011) stated, the individual can use either System 1 or System 2 in these situations.

To identify the factors that influence the 'moment of action', it is necessary to understand what a decision (process) is. Herbert Simon (Harter, 2014, 251-252) states that all classical decision-making models can be reduced to a simple two-stage process. The first step is to generate alternative solutions to the perceived problem. The second step is to choose one of these alternatives. Again according to Simon (Barros, 2010, 457), how rational the chosen alternative depends on how compatible it is with pre-established ends. To him, the specification of these ends is a question of value and, hence, is beyond the scope of science. In this framework, two basic dimensions that are embedded in the decision process come to the fore: **1)** 'Value assigned to the goal' (**V**), which has an abstract nature. **2-a) '**generating options' and **2-b)** 'choice of one of the available options', which has an analytical nature, if the generation and the selection is not taken in a heuristic way. The factors of this study will be derived from these two dimensions. However, in both experiments conducted in this study, ready-made options were presented to the subjects; they were not allowed to discover them. Therefore, this study investigates the *T* value of the individual who has completed option generation. Smaldino and Richerson (2012) discussed how the generation of options is framed by environmental constructs such as culture, intrinsic constructs such as personality, and even those which are not even considered unconsciously. According to this picture, option generation can be thought of as a process of intuitive pruning which analytical operations like 'sequential search' accompanying it, and it looks like what happens after the options become clear.

Let us first consider the intrinsic nature of the decision process. Desire leads man to action (Güngör, 2018, 20) and since desire is directed towards something deemed valuable, the value and the conscious action are closely related and as justified in the first sentences of the title "Benefit, Cost and Action", you would expect *T* to increase, as the V increases.

Indeed, the only factor that showed joint success in estimating the *T* values of subjects who participated in an intuitive task such as "raising a finger for no reason" for Study I and a reasoning task such as "analyzing a complex murder scene" used for Study II was the value of the target. 916 observations in the current study showed that the higher the value of a goal, the greater the preparation time devoted to it (see, Appendix A-4 and A-5). Morita & Shinoda (1994) also found a positive relationship between the dwell time on the website and the interest

in the article published on that page. The reason for this fundamental trend is debatable. For example, in Study I, there is an alternative cost to keeping the finger on the button, unless it serves a valuable purpose. The more meaningful or valuable the experiment, the more negligible the said alternative cost. The value that a person attributes to a goal can sit between a place close to the border of worthless, and a place that meets the concept of priceless, as observed in the values that subjects assign to an ordinary work of art in Çağlar's (2019, 211) study. This immense range also gives us an idea of the potential power of V to predict *T*.

We have implied that the extrinsic dimension of Simon's definition of decision, which is **a)** generating decision alternatives, **b)** choosing between these alternatives, or **c)** justifying a heuristic choice; may require 'analytical mental activity' or System 2 (Kahneman, 2011) which can be used synonymously. If a heuristic process is taken for these three pathways, it means that the generating, selection or justification processes will be completed very quickly, but it is impossible to predict exactly whether the individual will use System 1 or System 2, and these two forms can be used together repeatedly in the decision process. However, we have a reliable scale of which path an individual tends to take: the CRT. Although a sharp relationship was not observed between the CRT value and the *T* (see, Appendix A-5, CRT value is called HRA) under the title of Study 2, there is a significant relationship. In addition, 90% of the subjects participating in the experiment of Study II supported their decision by at least establishing one relationship between a piece of information and the decision option, that is, System 2 was activated.

To understand how would System 2 works, Kahneman's (2011, 20) example can be simplified to '24 x 3' and this operation can be analyzed in terms of Baddeley & Hitch's (1974) Working Memory Model: The individual * Divide the problem (20 + 4) x 3 * Keep one of the parts (4) in Phonological Store (Short-term Memory) * Multiply the remaining part (20) by 3 via Central Executive (For this, recall the information about the multiplication operation from long-term memory) * Keep the result obtained (=60) in Short-term Memory * Recall the other piece (4) and multiply by 3 (=12) via Central Executive (Working Memory) * Recall the other piece (60) and add it to the piece in hand (=72) (For this, retrieve the information about the addition process from long-term memory).

The problem has been redefined by broken down into parts, then these parts were associated with each other again in an original way and eventually a new whole, different from the old one was reached. Three different operations come to the fore in this process: **a)** Loading information into short-term memory and extracting information from it **b)** Extracting information from long-term memory **c)** Associating pieces of information with each other (In this example there were three associations: multiplying 20 by 3 and 4 by 3 and also adding 60 to 12). These transactions can also be traced in any day-to-day decisions. To make a judgment for the victim presented in Study II, the individuals first defined the image as meaningful sub-units: Subjects cited tangible items and sometimes abstract inferences. Then they put these pieces together by establishing cause-effect relationships and came to a judgment about the whole image that they did not have at first sight, or they justified their prejudgments by constructing a story.

Any heuristic process involves a recall[7] according to Klein's (2003) RPD model, and a recall process takes 500 milliseconds (Jafarpour et al., 2014) or according to Waldhauser et al. (2016) it takes only 100-200 milliseconds. In addition, the need for short-term memory will decrease if the problem is constantly within the observation range of the subjects (Postle & Pasternak, 2009, 783), as in Study II. So, following the memory recall operations will not help us much

[7] According to the RPD model, it occurs when the perceived problem recalls a problem pattern mapped to past experiences.

in estimating *T*. We must focus on the remaining options. We should question **1)** how many pieces of information the individual processes, **2)** at what level he relates them to each other, and **3)** how fast does the individual establish these relationships? The E scale was designed for the first two items, and analytical capacity (represented by the IQ icon) was also active for these items. To integrate processing speed into the algorithm, a representation of the subjects' IQ was measured. How E and IQ scales work is discussed in detail under Study II.

In summary, to estimate the *T* value of the individual in Study II type problems;

- The value assigned to the target should be questioned. **(V)**
- It should be questioned whether the individual is more inclined to use System 1 or System 2. **(CRT)**
- When using System 2, it should be known how many pieces of information the individual tends to process and at what level to associate them. **E** scale was designed for this purpose.
- It should be known at what speed the individual performs the above tasks. **IQ** value was used for this.

Among the factors in Appendix A-9; V, R, IE and SC (Self-Confidence) are intertwined with the concept of 'willpower'. All others refer to more involuntary factors. As Ajzen (1985) argued with the concept of 'perceived behavioral control', low Self Confidence can override willpower. Since V is an important component of our 'H. Simon inspired & Time-based Decision Model', SC factor must be considered. Individuals with low Self Confidence may be expected to avoid making an effort. Contradictorily, analytical operations may include verification processes and insecure individuals may repeat the process or try to justify it from another viewpoint to be sure.

- Therefore, different levels of Self-confidence can have complex effects on the duration of analytical procedures. The **SC** factor was used to test these situations.

Simon's decision process satisfies Study II type problems. What factors other than V should we follow for Study I type processes? In this case, analytical factors will not be on the agenda, but factors that would affect impulsive processes will need to be followed; such as personality traits, emotional exhaustion, stress level, general activity level, mood, or factors that can be associated with the individual's recent history.

The Big 5 Personality Theory inevitably comes to the fore, because Big 5 acts as an anchor or a connector that simultaneously references numerous personality factors. The story of this theory began when Gordon Allport, who hold the view that every important character trait was encoded in language, filtered 18.000 words related to personality from the Webster Dictionary. Corresponding words to the immediate feelings and synonyms were sorted out. Over the years, factor analyzes have narrowed this list down to 5 key factors, which are thought to encompass all possible personal characteristics to some extent (Dutton, 2017). One other reason for the generous use of Occam's Razor on possible personality patterns is that they are so numerous[8] that they limit the feasibility and validity of experiments.

All possible factors could not be questioned, as the duration of the experiment had reached an unbearable time for the subject. Therefore, the factors sensitive to change in time and space, such as measures of morale and emotions were primarily left out of the decision tree. Stress and discharge are thought to be an important factor for Study I type situations and the fact that this factor has not been questioned, is one of the shortcomings of Study I. Expected roles of

[8] The personality patterns of negativist, narcissist, dependent, depressive, avoidant, and schizoid from the DSM 5 (2013) classification might be correlated with the *T* value, in Study I type situations.

the aforementioned factors on *T* and their relationships with each other will be discussed under Study I and Study II.

4. Study I

It was tested which factors of Big 5 had an effect on *T* and discovered that Neuroticism (N), Introversion versus Extroversion (IE) and Responsibility from the inventory; and also Self Esteem (SE) from the outside of the inventory have significant or promising relationships with *T* value. The Responsibility and Self Esteem factors were excluded from the final analysis of Study I, as their predictive power was rather weak.

- **Neurotic or Emotionally Stable (N)**

Neurotic (N) individuals are more likely than average to experience emotions such as anxiety, worry, fear, anger and disappointment (Thompson, 2008). These people react more violently to sources of stress. According to Ormel et al. (2012), neuroticism can be explained by the phenomena of rapid arousal and difficult relaxation after stimulation, some interpret this as a lack of self-control and poor ability to manage psychological stress. Within the framework of the Finger Lift Experiment, a high N value, in general, reflected negatively on *T* value as expected, while high emotional stability reflected positively. This situation can be handled in more than one way in the light of the literature: When an individual acquires a goal, this goal creates an uncertainty associated with the goal, because it is not known whether the future action will be successful or not. Since the neurotic individual is sensitive to the source of stress (uncertainty) and cannot cope with the negative emotions created by this source (there are cases where he can cope), he wants to eliminate it as soon as possible, therefore he acts as quickly as possible. The individual with high emotional stability, on the other hand, has the luxury of sensing the process, as he feels little stress. Since each preparation investment he makes reduces the uncertainty about the goal, this can create a feedback cycle that attracts the individual to the process even more. While the neurotic is on the alert to end the process, the individual with emotional stability can hear the voices whispering to him the right time.

- **Introvert or Extrovert (IE)**

Jung (2013, 112-113) says that we should divide people into two big classes, Introvert versus Extrovert **(**IE**)**, according to the center of their selves has shifted towards their outer or inner worlds. Eysenck suggests that extroverted personalities constantly seek cortical stimulation. Introverts already have a stimulated mental arrangement, so they do not want extra stimulation (Winston, 2018, 337-338). So, it should be expected that extroverts will tend to abandon the stimulation-deprived process they experience while waiting with a focus on their goal. Indeed, preliminary research and observations for Study I confirmed this assumption, and introverts left the experiment significantly later than extroverts (see, Figure 1 for IE and *T* relation & Appendix A-4 for their negative correlation).

- **Cognitive Load (CL)**

Cognitive Load is defined as demands and parasites that affect the individual while focused on the problem. These parasites are not related to the problem, and they can be sounds, images, or emotional charges. Since Working Memory is critical (Nestler et al., 2009, 319-320) and limited (Miller, 1956) for the decision-making process, it was thought that cognitive inputs independent of the focused problem would limit the *T* value. Those who participated in the experiment with a mobile phone were more prone to exposure to external stimuli than those who participated in the isolated quiet room. Indeed, the averages of 95 measurements from face-to-face experiments and 424 measurements from mobile experiment data are 13,306

(n=95) and 10,896 (n=424) seconds, respectively, and this 2,4 second difference is significant (Independent Samples, Z = -3,881, p < .00). The presence (authority) of the researcher in the room may have also played a role in this situation, although he remained completely silent during the experiment.

4.1. Methodology

For Study I, a situation had to be created that do not push the individual to carry out an analytical process. So, the subject should have a goal, but **a)** the goal should not lead to any significant or foreseeable results **b)** while the result is significant, the magnitude of the motivational accumulation must render the significant result insignificant or inconceivable. Predictable or significant results bring choices to the agenda. For example, in Study II, the subject had to decide like a detective and his decision brought him to a right or wrong point (at least that's what the subject thought). When the subject had to choose between one of the options, the analytical process started. If there is no predictable outcome or if the individual does not evaluate outcomes for any other reason, why does the subject take action? Because of a reflexive overflow of emotional accumulation. Inspired by a personal experience, the author asked subjects to 'raise their fingers whenever they wished' in the preliminary research. This behavior had no reason other than the researcher's 'suggestion' and had no consequence. ‘Suggestion’ represented the motivation that accumulated over time, and this accumulation together with the cost of the time passed, eventually led the individual to action.

Thereby, Study I sought to answer the question: “When do people take action when they have a goal that does not dictate to them a point of time and that only requires refraining from inaction”. When the idea of ‘measuring the moment of movement with the action of raising a finger’ came up, the problem of determining the exact moment of the action was also arose. A sensor was needed, and the stopwatch button of smartphones helped the researcher in this regard. To activate the stopwatch, the red button must be pressed and pulled on Iphone brand phones, and this action must be repeated to turn the stopwatch off. While the stopwatch is running, if you press the button but do not remove your finger, it will continue to run until you lift your finger. Next to the start and stop buttons, there is another button that resets the total times or determines the lap time while the stopwatch is running. The subject was prevented from seeing the following seconds by using a leather case that only allowed the start-stop button and the tour button to be exposed when the phone was worn, and covered the entire screen behind. While the subject was focusing on the tip of his finger, it was not desired to be affected by the counter running on the screen.

In the **preliminary research**, subjects were subjected to the finger lift experiment before the questionnaire was administered. The procedure was as follows: When the subject enters the room, the researcher welcomes and asked to sit in the chair in front of the mobile phone, inside its leather case. The researcher starts the stopwatch and asks subjects to simply put their index finger on the red-lit stop button, by saying *"you will participate in an experiment, stay still and relax”.* The researcher continues, *"Now I want you to focus on the tip of your index finger"* and after 5 to 6 seconds, he adds, *"I want you to stay focused a little more".* The subject still does not know the purpose of the experiment or his position in the experiment. Fingertip focus was requested from the subjects, which would lead them to a partial meditation[9] because **a)** the various emotions or mental stress carried by the subject from his daily life to the experiment room were not desired to affect the moment of raising the finger, regardless of the factors we wanted to measure. **b)** The preparation period, which was in question before the decision in

[9] During the preliminary research, except for 3 subjects, no subjects remained focused long enough (2 minutes) to warrant the researcher's warning.

life, had to be substituted in the experiment. The individual was asked to focus, and when he passed from the focusing phase to the experiment phase, he was provided to do a task related to but separate from the finger lifting task, “focusing on his finger”. **c)** When the individual was told "you can lift it any time you want" as soon as he puts his finger on the button, a space in which people's personal differences will manifest would not be obtained. In other words, the distribution of the *T* values of the subjects would cluster very close to the starting point.

10 to 12 seconds after the subject starts to focus, the researcher presses the lap button on the screen (so the time is reset for the subject) and as soon as he does this, he tells each subject the same thing: *“This is an experiment, I give you time. Raise your finger whenever you feel like it”*. The subject raises his or her finger to contribute to the experiment when he-she likes it; so the second lap time is saved by the phone as the *T* value. Between the time of starting the experiment and infinity (theoretically, the subject has the right to wait forever), the subject has two choices: to remain inactive or to raise the finger at one point. The researcher asks the subjects to do the latter but leaves this moment of action to their initiative. In the preliminary experiments, all subjects instinctively continued to look at their fingertips until they lifted their fingers.

After the experiment was over, the subjects were asked, *“Why did you raise your finger at this moment?”*. A secondary question was asked to eligible subjects, *“Why did you remove it so soon?”* or *“Why did you remove it so late?”* The most common answer, which states that the process worked well, was *"I just felt like it"*. The following answers to these questions were not directly used in the analysis, but they helped the researcher to exclude 7% of the subjects from the analysis:

- I began to be hypnotized, and the things around me began to disappear. / My eyes were strained so I quit. / I have a focus problem, so I couldn't stay long. / I would have waited longer if my eyes hadn't blurred. / My eye burned, so I quit. / I just got off work. I'm so tired. / I'm in a hurry, I'll catch up somewhere. / I went into a kind of sleep mode.

Immediately after the finger lift experiment, the subjects were asked to *"How meaningful they found the experiment"* for the V value, through a seven-point Likert Scale, and then the IE, N, and Self Esteem scales were applied. Subjects, naturally unfamiliar with the technical aspects of the experiment, were not asked how valuable it was, but instead the word "Meaning" was opted that corresponded to the concept of 'what is worth doing' based on the close relationship between meaning and value (Moore, 1914). Subjects chose one of seven statements ranging from 'very meaningless' to 'very meaningful'.

Online Experiment Process: Since the opportunity to work face-to-face completely disappeared with the acceleration of the Covid19 epidemic in Turkey in February 2020, the experiment process was moved to a website[10] compatible with mobile phone participation, with the help of a software developer based in Ankara. The link to the site was distributed via whatsapp and e-mail accounts, with the snowball sampling method. Since moving the finger at any time is a fundamental human action such as walking and breathing, no restrictions other than the minimum age limit (18) were considered for the sample. After participating in the experiment, randomly selected volunteers were asked to forward the link of the website to the people they saw as appropriate. A total of 484 complete responses were obtained. For the reasons explained in operational details, 60 of these data were eliminated, and 424 healthy data were obtained, 205 of which were male, with a median age of 31 and a range of ages between 18 and 73 (mean age 32,15).

[10] www.whendoweact.com. This website was used for the experiments of Studies I and II.

Based on the idea that the subject's finger movement should be obtained directly, the use of a mouse was avoided, so the website was programmed to detect whether the participant's connection was from a desktop or mobile device. For this reason, those who tried to participate in the experiment from the desktop encountered the following message: “This experiment is designed for mobile phone users. Please access our site with your mobile device”.

Operational details of the Online Experiment Process of Study I are presented in Appendix B-1.

- **Analysis Procedure**

Decision Tree is an approach that uses a set of If-Then rules to classify samples into categories of interest and was used for both Studies I and II. The algorithm finds the most important independent variable and sets it as the root node, which is followed by bifurcating to the next best variables. The tree flows in a top-down manner from the root node to the terminal leaf nodes (the class prediction) (Worachartcheewan, et. al., 2010).

TP (True Positive) and FP (False Positive) rates of different machine learning algorithms available in WEKA[11] were tested. It was seen that Random Committee Algorithm yields better performance results and used for Study I dataset. These indicators have been used to measure the prediction performance for both Study I and II: Cohen’s Kappa is frequently used to test interrater reliability (McHugh, 2012). The sensitivity (also called ‘recall’, i.e. the fraction of positive examples that are predicted correctly) is given by TP/(TP+FN). The specificity (also called ‘precision’, i.e. the fraction of negative examples that are predicted correctly) is given by TN/(TN+FP), where TN is the number of true negatives. The Matthews correlation coefficient (MCC) is defined as (Firouzi, et. el., 2006):

$$MCC = \frac{TP \times TN - FP \times FN}{\sqrt{(TP + FP)(TP + FN)(TN + FP)(TN + FN)}} \quad (1)$$

The value of MCC is 0 for a random assignment and 1 for a perfect prediction. The classification performance is also measured by mean area under the curve (AUC or ROC Area), which is a reliable metric of classifier performance (Rokach & Maimon, 2008).

The decision tree assigned the subjects to three classes which are defined as follows: Dataset consisting of 424 subjects is sorted from the earliest (0,03 sec.) to the latest one (120 sec.). The 141st individual (acted in 2,3rd sec.) and the 283rd individual (acted in 10th sec.) who divide the dataset into three equal goups were marked. Time period between zero to 2,3 sec. was called “early”, time-period between 2,3 sec. and 10 sec. was called "moderate" and period between 10 sec. and 120 sec. was called "late". Since the sample size is large enough (Neuman, 2014), it is assumed that each individual might be added to this set will act before the 120th second. Three classes were preferred, but the reference set could also be divided into two, four or more classes. As the number of classes increases, the success of the assignment will decrease, but eventually the TP Rate should be compared with the success of a random distribution of the subjects to the classes. When you randomly assign subjects to three classes, your success in predicting their true time to act is expected to be 33%.

[11] Waikato Environment for Knowledge Analysis, version 3.9.6 used.

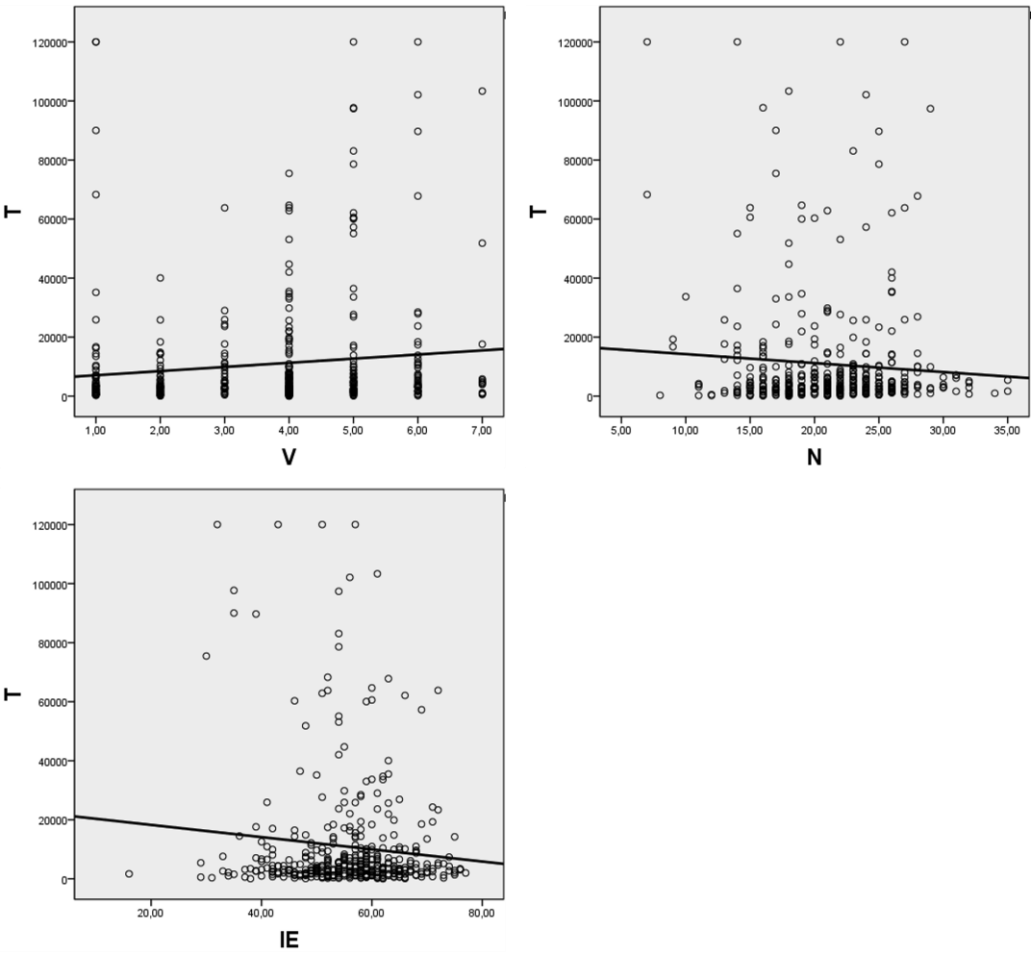

Figure 1. The Scatterplot of V, N and IE factors with *T* value for each subject, in Study I

4.2. Analysis

The geometric mean *T* value of 424 subjects participating in Study I is 4,08 sec. while SD is 20,2. There is no significant difference between male and female subjects in terms of the mean *T* value. As theoretically expected, when V value and the level of introversion increased, the *T* increased, but according to correlation analysis (see, Appendix A-4) N seems to be disengaged, although the scatter plot supports the theoretical background. The scatter-plot distribution of *T* values corresponding to each V, N, and IE values and their lineer projections are shown in Figure 1.

As a result of the classification performed by the Random-Committee Algorithm with the 15-fold stratified cross-validation method, 33,8% of the subjects were assigned correctly (Kappa: 0,007 and ROC Area: 0,48). This value is not better than the success that can be achieved by chance (33%). One of the contributing factors to this failure may be the lack of correlation between the N value and *T*. However, the reflection of an increase in N value on *T* can change radically for different combinations of V and IE values.

Based on detailed analysis of the dataset, this contingency was refined as follows: **a)** Those who value the experiment seem to wait relatively long before acting. In addition to that if this group have an anxious character this period is extend further. But if group do not value the experiment, an anxious character does not lead to a greater *T* value. As Ekman & Davidson (1994) stated, if not at the level of panic, anxiety prompts us to pay closer attention to things we care about; and closer attention (Johansson, 2007) generally means more time and effort. **b)** Low neurosis raises *T* values in introverts (IE^l), while it is ineffective for extroverts (IE^h)

but again this contingency is more valid for subjects with high V values. It is possible to assert theoretical speculations for this observation without going into an extensive discussion. Extraversion also contains mechanisms that will deactivate the anxiety of the individual (Naragon-Gainey et al., 2014) however, in this study, the value attributed to the target seems to play a moderator role in the relationship between IE and N.

According to these theoretical inferences, the N values of the subjects who met the following conditions in the data set were adjusted by the coefficients of 1,1 or 1,2:

If $V^x > 4$ and $IE^x < 44$ and $N^x < 19$ then N^x . 1,2
If $V^x > 4$ and $N^x > 25$ then N^x . 1,1

The outcome variable and the new attribute set was analysed by means of the Random-Committee Algorithm, and are presented in Table 1. In this new situation, **37,3 %** of the subjects were correctly classified. Low statistical values (Kappa: 0,05 or ROC Area: 0,52) question the success achieved, which is hardly better than a random distribution anyway.

Table 1.
Performans Summary of Decision Tree Prediction with factors of Study I, after N Adjustment

Random-Committee

								Confusion Matrix		
Stratified Cross-Validation	15	Folds						**a**	**b**	**c**	
Correctly Classified Instances	158	**37,26**	**%**					65	49	27	**a**	early
Kappa Statistics		0,05						51	47	44	**b**	moderate
Mean Absolute Error		0,43						44	51	46	**c**	late
Total Number of Instances		424										

	TP Rate	**FP Rate**	**Precision**	**Recall**	**F-Measure**	**MMC**	**ROC Area**	**PRC Area**	**Class**
	0,46	0,33	0,4	0,46	0,43	0,12	0,53	0,36	early
	0,33	0,35	0,32	0,33	0,32	-0,02	0,48	0,33	moderate
	0,32	0,25	0,39	0,32	0,35	0,07	0,55	0,36	late
Weighted Avg.	0,37	0,31	0,37	0,37	0,37	0,05	0,52	0,35	

The poor result obtained may be due to the inaccurate selection of the factors, or may be due to the nature of the experiment. The 'finger lifting experiment' is a highly specialized simulation of Study I type situations, unlike the problem in the experiment used for Study II, it is disconnected from everyday life and does not contain the emotional overtones conveyed by Study I type situations. This also may be one reason why the time between quick-actors and late-actors was short in the experiment. Still, Figure 1 has provided us valuable insights into how factors V, N and IE might come into play in Study I type situations.

5. Study II

According to our 'H. Simon inspired & Time-based Decision Model', when subjects encounter a problem that requires them to use their analytical abilities, the *T* value should be expected to be affected by analytical capacity (IQ), propensity to use that capacity (HRA), and confidence in this capacity (SC). It can easily be predicted that the tendency to avoid a quick heuristic decision will prolong the analytical reasoning process. Also, the high mental speed which is a sub-component of high analytical capacity (Stormoen et al., 2014), can shorten the decision process, but low analytical capacity also can shorten the decision process by leading to a limited data base. For ex. Stanford Binnet IQ Test measures short term memory. Higher memory means more items to be included in the analysis agenda. Our research confirmed this contradictory foresight and will discuss it soon.

Nevertheless, having a large cognitive database devoted to the problem, having the potential to establish relationships between pieces of information in this database, and avoiding heuristic

inferences; do not guarantee that the decision-maker will use a high level of mental effort or time for his ongoing analytical deductions. That's why we have created the value (E) which refers to the tendency of establishing high level of associations between pieces of information in solving the problem. E, contributed successfully to the estimation of the *T* value and can also be used as an output of the reasoning process. The correlation of these factors with *T* and among themselves can be seen in the Appendix A-5.

Before examining the aforementioned factors, let us emphasize that (V) continued to be an important component in determining the moment of action in Study II. (N) value was completely ineffective, and the effect of (IE) was considerably weakened, although it could be observed. Therefore, N and IE were not used in Study II.

- **Heuristic or Analytic (HRA)**

Within the scope of Study II, three different Cognitive Reflection Tests were applied and the factor showing the average scores of the subject was named **HRA** by combining the three letters of the **H**eu**r**istic versus **A**nalytic concepts. HRA is the factor that establishes the strongest correlation with the *T* value after the E and V factors. A Cognitive Reflection Test (CRT) is a task designed to measure a person's propensity to spend more time on the problem by activating System 2 to override a quick but incorrect heuristic response and find the correct answer (Frederic, 2005). As observed in Figure 3, the *T* value increases as the HRA score increases.

The validity of the CRT, which consists of three original items, is related to the fact that the participants had not encountered it before. Some studies (Haigh, 2016) show that about half of the volunteer peers participating in the research have been addressed to at least one of the questions before. Therefore, after each CRT question, we asked our participants whether they had encountered that question before. Of the 469 subjects, 16% stated that they were faced with the first question, 12% with the second question, and 18% with the third question. It is reported that familiarity with the CRT significantly increases correct answers (Thomson & Oppenheimer, 2016, 108; Stieger & Reips, 2016), but there are also studies argue that increases in correct answers are minor and situational (Meyer et al., 2018). So, we tested our subjects. While 46% of the subjects (N=78) who declared that they had encountered the first question gave the correct answer, 22% of those who were unfamiliar with the question (N=391) reached the correct answer, and this difference is significant (Independent Samples, $F = 32.178$, $p < .00$). While 71% of the subjects (N=59) who declared that they encountered the second question gave the correct answer, 33% of the unfamiliar subjects (N=410) reached the correct answer, this difference is also significant (Independent Samples, $F = 2.120$, $p < .00$). While 84% of the subjects (N=86) who declared that they had encountered the third question gave the correct answer, 85% of the unfamiliar subjects (N=383) reached the correct answer and this slight difference was not significant (Independent Samples, $F = 0.127$, $p > .86$). Despite these data, those familiar with the questions were not excluded from the data set, as **a)** approximately 14% of the respondents were familiar with the first two questions, and **b)** the shrinkage of the data set limited the number of factors that could play a role in the decision tree.

- **The Analytical Capacity (IQ)**

Intellectuality and **IQ** (Intelligence Quotient) are controversial concepts, however, when people are asked how an intelligent person is, you realize that they circle a point emphasized by David Wechsler, one of the founders of the concept of IQ (Bartholomew, 2004, 4-5): *"... to deal effectively with his environment ..."* Howard Gardner also touches on this point; *"...skills of problem-solving, enabling the individual to resolve genuine problems or difficulties that he*

or she encounters …" and Sternberg (2005) defines successful intelligence similarly, as the ability to adapt well to the socio-cultural context.

To get an idea about the intellectual capacities of the subjects participating in Study II, IQ tests were not used, since it would require persuading each subject to practice for more than half an hour and because it would be an online process, the answering process could not be kept under control. Instead, the participant was asked for the ALES score, which gives an idea of an individual's analytical capacity, which is also a prerequisite for starting postgraduate education in Turkey. Academic Personnel and Graduate Education Entrance Exam, or ALES with its short name, is very similar to the GRE exam used in the USA, and although the GRE is not the same as IQ tests, as Lele (2013) states, it measures the capacity to cope with verbal and numerical problems. While both exams measure verbal reasoning, they test abilities such as drawing conclusions from discourse, grasping the perspective of the text, summarizing the text, and distinguishing important points. While measuring numerical reasoning, they present the participant with problems that can be solved using algebra and geometry and test their ability to analyze data. Unlike the GRE, ALES do not measure 'analytical writing ability'[12].

ALES has been performed in Turkey since 1997. Of the peers participating in Study II, 56% entered ALES after 2014, 76% after 2010, and 1% before 2000. ALES question typology and the distribution of various question types in the exam did not change much after 2000, but it was thought that a possible change in the difficulty of the exam over time would affect our analyzes negatively and the ALES entry dates were divided into two as before and after 2010; the shares of those with high, medium and low scores in the total were examined. According to the analysis based on OSYM (www.osym.gov.tr) statistics, while the rate of those who took ALES and got high scores between 2000 and 2010 was 14%, this rate did not change for those who took the exam between 2010 and 2018 and got high scores (14%). On the other hand, while the rate of those who scored low in ALES before 2010 was 12%, this rate reached 19% after 2010. ALES has gained considerable popularity as undergraduate and graduate quotas have experienced a populist expansion in Turkey over the past 20 years. Until the early 2010s, those who were confident in their analytical skills took ALES (0.0020 of the population for 2005[13]), while a wider crew started to take the exam in the 2010s (0.0035 of the population for 2020). Rather than the increase in exam difficulty, the natural decrease in the average intellectual capacity of the test taker plays a role behind this 7% difference, since the proportion of high achievers has not changed.

Each participant obtains three different scores from ALES: verbal (SOZ), numerical (SAY) and equal weight (EA) and uses any of them. During the online experiment, the subjects were asked to present their highest score, the type and year of this score. Since the whole study focused on the changes in *T* value, the question of whether the analytical abilities represented by these scores are equal even if two different types of ALES scores are equal[14], is worth considering if the mean *T* values of the groups belonging to different score types differ from

[12] For a comparison of the numerical reasoning questions of the two exams, see:

a) **ALES:** https://dokuman.osym.gov.tr/pdfdokuman/2017/ALESSONBAHAR/2017_ALES_Sonbahar_Soru_Kitapciklari.pdf

b) **GRE:** https://www.ets.org/gre/revised_general/about/content/quantitative_reasoning/

[13] The number of candidates who entered ALES in 2005 is 136.669, the population of TR 2005 is 67.743.052 and the number of people who entered ALES in 2020 is 294.000, and the population of TR 2020 is 83.614.362 (resources: www.osym.gov.tr & www.tuik.gov.tr)

[14] Scores are not equivalent: There is a significant difference (Independent Samples, $F = 17.472$, $p < .00$) between the CRT mean values of SOZ group (0,98, N=58) and EA group subjects (1,45, N=186). However, the difference between the EA group and the SAY group (1,63, N=100) was not significant (Independent Samples, $F = 0.621$, $p > .10$).

each other, but such a difference has not been discovered. For this reason, methods such as conducting the analyzes separately for three different score types or balancing SOZ and EA scores according to analytical ability, were not used, and ALES scores were used regardless of their type.

- **IQ and the T**

The relationship of the IQ variable with *T* value is insignificant (see, Appendix A-5), but the response of the *T* to the increase in the IQ variable takes radical forms in specific selections of the data set. The factor driving these particular interactions is HRA. We have discussed this situation theoretically, since the IQ factor adjusted according to this dynamic would contribute to the forecasting success in some cases.

HRA takes four different values, and we determined the low and high value thresholds using the mean of the *T* values corresponding to each value.

Table 2.
T Value Averages for Different HRA Levels

	Low	***T***	**Medium**	***T***	**High**	***T***
HRA	1	*21961*	2 and 3	*28397*	4	*35080*
observation frequency	37		320		73	

Then a scatterplot graphic was used to show how *T* changed as IQ increased while HRA was low and high. In Figure 2, a steady increase in *T* is observed as IQ rises while HRA is low. On the other hand, a uniformity is seen when HRA is high. In the graph, the two curves overlap between IQ values of 68 and 89. This gap was used as the 'Moderate IQ level' for the entire study. Note that individuals with low HRA levels do not have an IQ above this gap, and individuals with high HRA levels do not have an IQ below this gap.

As Frederic (2005, 35) mentioned, high CRT points indicate the tendency to resist the first response that comes to mind, so it is likely that the other cognitive abilities of individuals with high CRT points, will be activated at a higher capacity. It can be argued that, when the individual with high HRA also has a high cognitive capacity (IQ), his selective perception is prone to **a)** obtain more types of data (Database Size) and **b)** more unusual data (Database Originality) about the decision object. **c)** The individual does not use all the data caught in his selective perception while conducting his reasoning; he refers to the small amount of data he finds appropriate within the database (Active Database Size), because the brain tends to find solutions that require the least mental effort (Toplak et al., 2013; Stanovic, 2009). However, individuals with high cognitive capacity tend to select relatively larger amounts of data from this database for reasoning than an individual with low capacity. As seen in Appendix A-6:

- While the IQ^h group consisting of 57 subjects referred to 23 different data (like, cigarette, gun, letter, stool, ashtray etc.), the IQ^l group which was very close to the size of this group with 59 subjects, only referred to 12 different data. When the 'Data Type Frequency' of each group is divided by the group sizes (N), the IQ^m group also lags behind the IQ^h group in terms of 'Database Size'.
- It seems that the IQ^l group did not go beyond the first eight data[15], which all subjects found useful with high frequency, but the members of the IQ^m and IQ^h group used different data which were not widely agreed upon, to feed their decision reasons. In this case, the 'Database Originality' index (Extraordinary Data Frequency / Total

[15] The first 8 data were **a)** used by three groups **b)** used by each group at least twice. A data that does not meet these two conditions at the same time is assumed to be extraordinary.

Frequency) of the IQ^l group is 4 / 91 = 0,04, while the index of the IQ^m group is 74 / 598 = 0,12 and the index of the IQ^h group is 22 / 129 = 0,17.

- While the cognitive capacity increases, observed logarithmic increase of originality is also observed in the case of 'Active Database': The number of data selected for use is approaching a limit even though the cognitive capacity increases. In Appendix A-6, the total number of data (Total Frequency) used by the subjects of each group in the singular, dual, trio and quatro rationales is given; 91, 598 and 129 data respectively. The amount of data per person in each group (Active Database Size = Total Frequency / N) is 1,54, 2 and 2,26, respectively.

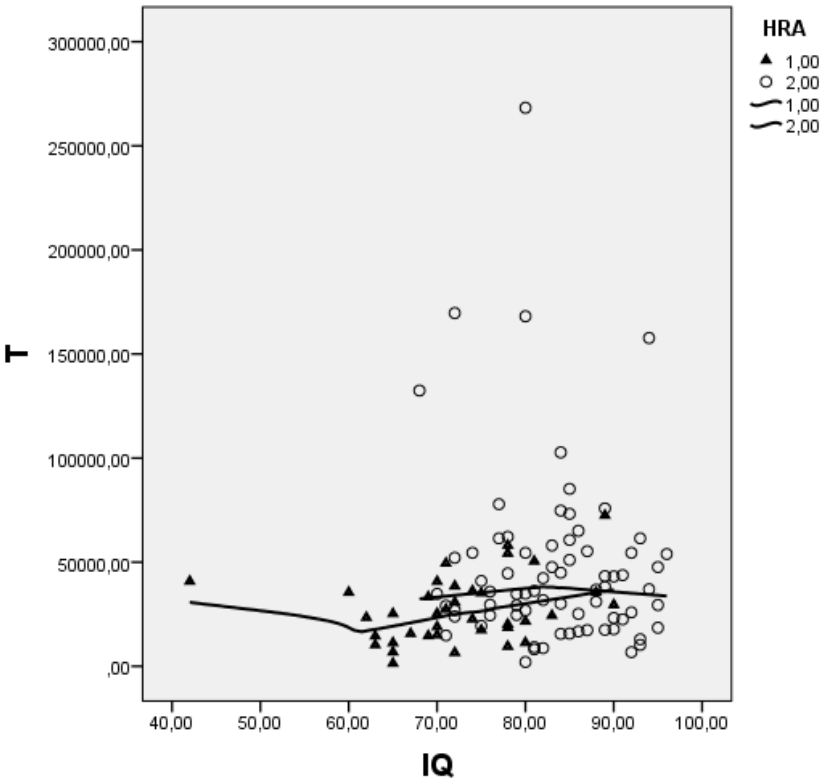

Figure 2. The Relationship of IQ and *T* factors while HRA is Low or High[16]

Let's call the product of the two factors (Active Database Size x Database Originality) that challenged subjects, as 'Problem Load'. These two factors are created by the cognitive capacity of the subject trying to construct a decision rationale. As IQ capacity increases, database originality and active database size increase, so the problem load increases. Because it is easy to deal with non-original, ordinary, that is, easily associated data[17], and it is easy to construct a story by associating fewer data. It is even easier to take action with a small number of easily correlated data. Referring to the definition of IQ and since there is a linear correlation between IQ values and response speed (Danthiir et al., 2005, 219), we can call the subject's IQ capacity as 'Analysis Capacity'.

[16] Prepared with Scatterplot Loess, 90 % points of fit

[17] According to Sarnoff Mednick (Kaufman, 2014), creative people show a superior skill in associating things that seem distant and unrelated, so it is relatively easy to associate the first things that come to the mind of the majority in relation to a topic.

As can be seen in Appendix A-7, while the increase in the Problem Load gradually decreases[18]; IQ, that is, the Analysis Capacity, continues to increase linearly. Therefore, when HRA is high, as IQ increases, the *T* value first remains unresponsive to it and then gives a negative response, as seen in Figure 2. However, since subjects with low HRA levels keep their reasoning windows limited, they are constantly in contact with the maximum problem load, so the change in the problem load is not reflected in the *T* values. A different dynamic is in the circuit in this group: Those with high IQs among individuals with low HRA levels may be attracted to the problems they face for other reasons. General culture level and IQ level are correlated (Furnham & Chamorro-Premuzic, 2006). This information implies that individuals with high IQs are more inclined to spend time on almost any topic, including the experiment in which they participate. In addition, IQ and HRA have the highest correlation value (see Appendix A-5). They are partially transitive in character or can be considered as different expressions of a whole. These dynamics may be behind the increasing *T* value as IQ increases while HRA is low, as seen in Figure 2.

- **The Extensity of Analytical Reasoning (E)**

It has been observed that some subjects who attribute high value to the experiment (V) and have high analytical capacity (IQ) and also have high score in CRT tests (HRA), unusually have low *T* values and do not adequately justify their decisions. On the other hand, it was not possible to see that subjects with low V, IQ and HRA values, made extensive justifications. After examining the rationales of the subjects, it turned out that some individuals with high analytical abilities tend to use a larger database and correlate this data as much as possible compared to their peers. This cognitive disposition was called as **E value**, and for this value, the breadth and depth of the individual's intellectual activity were measured. The breadth corresponds to the 'Active Database Size' defined under the heading IQ. Depth refers to the extent of data which are rendered indispensable to each other.

In this section, ‘data’ is used to mean a piece of information that cannot be further broken down and it is naturally associated with one of the 'decision options'. In Study II, the subject has two decision options, one of which is to choose: **a)** 'woman committed suicide' and **b)** 'woman was murdered'. As a rule, data is a tangible thing, for example, in an answer such as *"the woman has smoked repeatedly, she should have a bad mood, she committed suicide"*, the cigarettes in the ashtray are a single data, but the inference based on it (distressed mood) is not. Data could be either inside the picture shown to the subject or it could be injected from the outside by the subject, these rare injections are not inferences based on the information in the image, they are information that is independent of the image but can relate to other data. For example, the information that 'people are extremely calm when close to suicide' was used by a subject and cannot be derived from the image. All data used by 430 subjects are listed in Appendix A-6.

How is the E Value Calculated? As in the example above, a description that associates a single data with a decision option is called 'singular' and gets 1 point on the E scale. The E scale assigns a small value to the breadth of the 'Active Database', while rewarding the depth exponentially. For example, subject ID945 thinks that the victim was murdered, and his defense is: *“Since she smokes a cigarette with her left hand, she is left-handed, and the gun should not be in her right hand.”* This answer is called 'dual' and deserves 4 points: The indication that the 'cigarette was in the victim's left hand' is a single data, while the indication that the 'weapon was in the right hand' is another data, but these data were not independently associated with

[18] We point out that Active Database Size and Database Originality are things presented by subjects. These can be the quantities and qualities that the subjects prefer to deal with by using their selective perceptions. We think that as cognitive capacity increases, perceived environmental complexity increase exponentially.

the decision option. They first left out the option of suicide by being associated with each other, thus providing a rationale for the decision option.

The following statement of subject ID161 who thinks the victim committed suicide is a 'trio', no matter how short, and deserves 12 points: "Assuming that she has her back to the table, the bloodstain on the wall becomes clear when she shoots her head with the gun in her right hand." The subject used three pieces of data: **a)** The blood stain on the wall **b)** The gun in the woman's right hand and **c)** The following assumption, which can be summarized as 'Sitting direction and place': The woman must have turned her back to the table for some reason, with reference to the expected relationship between the table or the window and the human being. If the woman's back is turned to the window, and the gun is in her right hand; while these two data are fixed, the location of the bloodstain is consistent. The accuracy of the bloodstain's location requires the knowledge of the woman's sitting direction, and the knowledge of which hand holds the gun, at the same time. For an explanation to be a trio, when one of the data is missing, a link that confirms the decision option cannot be established between the remaining two data. For example, if the subject did not draw attention to which hand holds the gun, no correlation could be established between the sitting direction and the blood stain on the wall supporting the decision option. Or, if the subject did not refer to the blood stain, no correlation could be established between the hand with the gun and the direction of sitting. A trio statement appears to contain three dual reasons, so a 12-point weight is assigned.

Table 3.
Calculating the E Value

DECISION OPTION	SUBJECT DESCRIPTION	ANALYSIS	SCORING				
			Singular *1	Dual *4	Trio *12	Quatr *24	E Value
Murdered	*Nobody commits suicide half way through their cigarette.*	Subject left out the option of suicide with reference to a single data. The aforementioned data is the cigarette that the woman is holding in her hand.	1	0	0	0	**1**
Committed suicide	*I think she wrote a farewell letter and was in a depressed mood from the cigarette in her hand and the many cigarettes in the ashtray.*	Data: **a)** farewell letter **b)** cigarette in hand **c)** cigarettes in the ashtray. The loss of one or two of the data does not harm the bond that the subject establishes between the remaining data and the 'claim to have committed suicide'. These bonds are clear: *farewell letter and suicide **cigarette or ashtray, hence depressed mood and suicide. While data can be linked separately with the decision option, they are not related to each other.	3	0	0	0	**3**
Committed suicide	*The room is not messy, no signs of struggle. The gun in her hand is in line with the blood on the wall, I think there is a suicide letter on the table.*	**Two Singular: a)** Subject left the murder option out using the 'room overview' data and **b)** supported the suicide option with the suicide letter data. **Dual:** To support the claim that the 'victim committed suicide', the subject established a relationship between the 'gun in victim's hand' and the 'trace of blood'. When the woman sits on the stool, her head height corresponds to the blood mark on the wall.	2	1	0	0	**6**
Murdered	*Someone who smokes with her left hand is more likely to be left-handed. It's thought-provoking that she committed suicide with her right hand.*	**Dual:** The subject supports his decision with the relationship he established between the cigarette in the left hand and the gun in the right hand. It can't be suicide because the gun is in the right hand but the woman is left-handed.	0	1	0	0	**4**
Murdered	*The person used her left hand while writing, this indicates she is left-handed, but the gun is in her right hand. In addition,*	**Two Dual: a)** The relationship established between the pen and the gun. The position of the pen indicates that the woman is writing with the left hand, but the gun is in the right hand. If so, he couldn't have committed suicide. **b)** Cigarettes at	0	2	0	0	**8**

DECISION OPTION	SUBJECT DESCRIPTION	ANALYSIS	SCORING				
			Singular *1	Dual *4	Trio *12	Quatr *24	E Value
	judging from the direction of the cigarette butts in the ashtray, it is seen that there is more than one person in the room.	the far end of the ashtray are associated with an other data (a person who has been in the room) injected into the image: this person smoked the cigarettes.					
Committed suicide	*The gun is in the woman's right hand, which means that the bullet entered from the right and pushed the stool to the left, and the traces of blood also indicate this.*	**Trio:** The subject associates the weapon, stool and bloodstain data with the assumption that 'the woman is sitting with her back to the window'. Numerous dual responses were received linking the gun to the bloodstain, but the subject integrated the direction of the stool's fall into these two: The bloodstain must be correlated with the gun in order for us to be sure that the gun in the woman's hand was fired. In order for this relationship to exist, the woman must sit with her back to the table, and the falling direction of the stool proves this to us.	0	0	1	0	**12**
Committed suicide	*She used her glasses while writing the letter and took them off again. If she was murder, she'd probably be wearing glasses.*	**Trio:** The letter, glasses and gun (bullet leaving the barrel) were used together. The bullet flying to the victim and victim's glasses were handled with two different situations: The bullet is coming, if it is suicide, the glasses must have come off, otherwise they must have been worn. It's suicide since the glasses are off. The relationship between the letter and the situation of the glasses cannot be associated with the decision option when 'who is the hand holding the gun' is not active. Without the letter, the glasses and the gun cannot be associated with the decision option.	0	0	1	0	**12**
Murdered	*Night-time. The lamp should have been plugged in when writing a suicide letter. If she wanted to do it in dim light, she could turn the lamp off with the button. The ashtray, drink and pen are on the left and the lamp is on the right, so the woman must be left-handed, but her gun is in her right hand. The index finger must be on the trigger to fire the gun, but it's not. If she had committed suicide while smoking, the cigarette would have been over. The gun and cigarette seem to have been given later.*	**Quatr:** The subject uses the following four data together to support the claim that "the victim did not write a suicide letter - so the case is murder": **a)** It was night, referring to the darkness in the window **b)** The lamp was not plugged-in **c)** The letter-like paper on the table, and **d)** The lamp switch. If a suicide letter is being written, the lamp should be on since it is night (this is a trio), but perhaps the victim wanted to write in a dim light - as a rule the lamp should be on - but the victim could turn it off by pressing the button. An explanation that did not include the button of the lamp could be refuted by the claim that "the victim may have wanted to write in the dark", the subject integrated the fourth data (the button of the lamp) into the trio as a defense against this possible claim. **Dual:** The indication of the ashtray, drink and pen being on the left side (the victim is left-handed) and the gun being in the right hand are brought together. **Two Singular:** Finger not on trigger and smoking unfinished.	2	1	0	1	**30**

Sometimes two duals may share identical data, in this case the subject created two duals from three pieces of data. For example, subject ID70 claims that the victim was murdered and argues: *"When woman is writing at the table with her left hand and drinking Coke, she cannot fire the gun with her right hand. Besides, if she had fired the gun with his right hand, the blood stain should have been in the opposite direction."* In this example, 'woman is left-handed', 'gun is in the right hand' and 'bloodstain on the wall' data; is associated by establishing two duals between left-handedness & gun, and gun & bloodstain. In this example, a trio cannot be mentioned, since leaving one of the data out of the equation does not destroy the relationship between the

other two data, so the subject gets 4 + 4 = 8 points. Quatro explanation is assigned 24 points. The E scale does not care whether the answer is correct, it is a visual dilemma presented to the subjects, and there is no correct answer. In Table 3, the reasons for the decision declared by some of the subjects are shared, and how each justification is analyzed and scored is shown. These procedures were performed separately for 430 subjects.

While examining the table, it is possible to come across the common handicap of qualitative studies; we cannot completely separate the analysis process from subjective nuances.

- **Self Confidence (SC)**

Based on the idea that **a)** lack of self-confidence can wipe out the desire for the goal and **b)** indecision and hesitancy would cause the individual to spend more time for making decisions relative to the determined personality, a scale was sought to distinguish between people who trust or do not trust their abilities (mediately decision-making ability). Nine statements were obtained from five scales[19] under the concepts of Self-Confidence, Self-Esteem and Self Efficacy, and the score obtained by the subject from these items was called the self-confidence, briefly **SC** value. The statements used are shared in Appendix A-8. SC did not correlate with *T* but seems to draw a bell curve similar to but more radically than IQ. You can notice low T values for both low and high SC values in Figure 3. Unlike IQ, SC did not change its effect on *T* for the values of other factors, indeed SC has no significant correlation with other factors (see Appendix A-5).

It seems easier to hypothesize why subjects with high self-confidence would act earlier than those with moderate levels of self-confidence, than to explain why subjects with low self-confidence act similarly. High levels of self-efficacy, self-esteem and self-confidence can lead to the 'Overconfidence Effect' (Judge et al., 1997). Intuitively, it can be predicted that high confidence in the decision will reduce the effort spent on the decision. On the other edge, referring to Ajzen's (1985) term ‘perceived behavioral control’, it could be argued that those with low self-confidence are less motivated to reason because they have more pessimistic expectations about the consequences of their decisions.

- **The Value Assigned to the Goal (V)**

In order to obtain the Value Assigned to the Goal **(V)** in Study II, three questions were asked after the sample problem was shown to the subjects, and two of the answers were obtained on a 7-point Likert scale and one on a 5-point scale: **a)** How important is it for you to be a part of the experiment you will be participating in soon? **b)** How important is it to you to be successful in the experiment that you will participate soon? and **c)** How much do you enjoy trying to solve these types of puzzles? Questions built on the concepts of being a part of something meaningful (Value or Meaning), achievement (ambition) and enjoyment (pleasure) refer to the following needs when we look at it from a Maslowian perspective: The need for self-actualization and the search for meaning through the concept of 'value'. The need to be respected through the concept of 'success' and the need to have fun, have a good time or seek pleasure, which can substitute the need for social relations through the concept of 'enjoyment'. The variable 'Success' has a significant correlation at the level of .48 with 'Enjoyment' and at the level of .76 with 'Value', so it can be said that the variables diverge moderately from each other. The correlation between the V value obtained by averaging the three expressions and the *T* value is higher than the correlation between the expressions one by one.

[19] Rosenberg Self Esteem Scale (1965), Kolb’s Self Confidence Scale (1999), Day & Hamblin’s Self-Confidence Scale (1964), Erwin & Kelly Identity Scale-Confidence Subscale (1985), Helmreich & Stapps’ Texas Social Behavior Inverntory-1974 (Perkins, 2018).

5.1. Methodology

There was a need for an attractive problem that would lead individuals to make decisions by using their analytical abilities. It should be able to appeal to individuals with different education and intelligence levels, it should not be too difficult or too easy for some part of the society, and it must be visual-based to be easy to understand. There had to be a dilemma to separate the decision process from education, culture, experience, learned analysis processes and for the discussion universe to expand.

Based on these criteria, laboratory tasks were designed first, but finally decided on a little-known but public domain image[20]: In the cartoonish picture, which focuses on the 4 m^2 corner of a room, a woman is lying on the floor with a gun in her right hand and a cigarette in her left. There is a bloodstain on the wall, a table in front of the window and an overturned stool on the floor. Inside the room, there are many objects that hold clues, from a single slipper to a full trash can, from an unfinished letter to a full ashtray. The subject's task is to decide whether the woman, who turns out to be dead, was murdered or committed suicide.

In late 2020, the experimental process of Study II began to be published at *www.whendoweact.com*. The link to the site was distributed via Whatsapp and email accounts in the same manner used for Study I. To guarantee the ALES scores, it was stated that the participant's postgraduate education was preferred. 489 complete responses were obtained. For the reasons explained in the 'Operational Details of the Experiment', 59 of these data were eliminated, and 430 healthy data were obtained, 223 of which were male, with a median age of 32, and an age range of 23 to 60 (mean age of 33,2). Unlike the first experiment, participants were allowed to participate in the experiment from their desktop computers. There was no significant difference between the *T* values of the subjects participating from the desktop and the *T* values of the subjects using their mobile phones.

Operational Details of the Experiment Process of Study II are presented in Appendix B-2.

- **Analysis Procedure**

Study II has an analysis procedure similar to Study I but the time-frames defining the classes have changed as the dataset has changed: 430 subjects is sorted from the earliest (1,4 sec.) to the latest one (371,2 sec.). The 143th individual (acted in 20,5rd sec.) and the 288th individual (acted in 38,1rd sec.) who divide the dataset into three equal parts were marked. Time-period between zero to 20,5 sec. was called "early", the period between 20,5 sec. and 38,1 sec. was called "moderate" and period between 38,1 sec. and 371,2 sec. was called "late". TP (True Positive) and FP (False Positive) rates of different machine learning algorithms available in WEKA were tested. It was seen that the Random Forest Algorithm yields better performance results and used for Study II dataset.

[20] The illustrator of the image was searched for permission to use, but could not be reached. The image is used by many websites such as reddit.com without reference to its source.

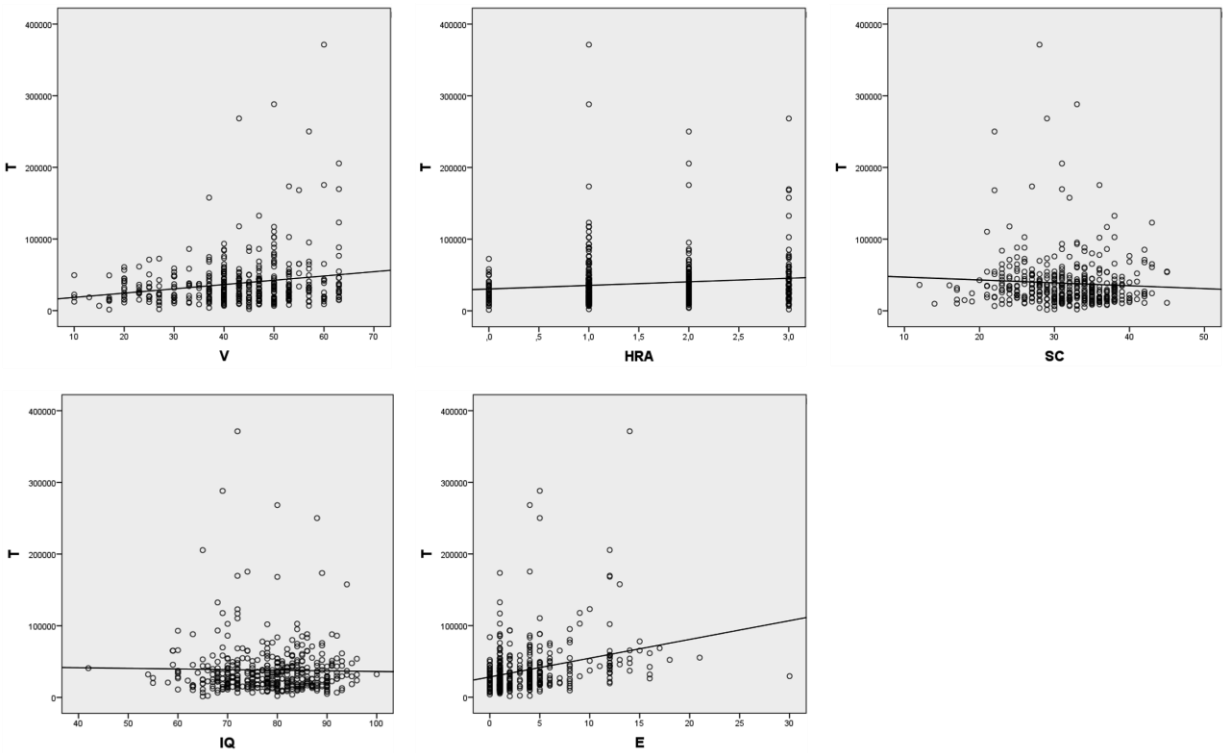

Figure 3. The Scatterplot of V, HRA, E, IQ and SC factors with *T* Value for each subject, in Study II

5.2. Analysis

The geometric mean *T* value of 430 subjects participating in Study II is 28,8 seconds while SD is 36. There is no significant difference between male and female subjects in terms of the mean *T* value, but male subjects deviated more (SD for males 43 sec., for females 26,6 sec.). As theoretically expected, *T* increased as V, HRA and E values increased. According to Appendix A-5, the relationship between SC - *T* and IQ - *T* values seem to be insignificant. The scatter-plot distribution of *T* values corresponding to each V, HRA, E, IQ and SC values and their lineer projections are shown in Figure 3.

The analysis of the outcome variable and the attributes together by means of the Random-Forest Algorithm are presented as Confusion Matrix and as related Statistics in Table 4. With the 15-fold stratified cross-validation method of the Random-Forest Algorithm, **44,5 %** of the subjects were correctly classified, means 44,5 % of the subjects were assigned to the time-frame which they actually acted.

Each subject predicted in the Confusion Matrix is shown in the columns. For example, of 142 subjects who act early, 73 were predicted to act early, so the prediction success (TP Rate) in the early class is 73 / 142 = 51 %.

However, depending on the structure of the dataset, Confusion Matrix may not prove the model's sufficiency. So, we should have a look at other indicators. According to Kappa Statistic, the algorithm performed 16 % better classification than the baseline classifier, but there is wide disagreement about the usefulness of Kappa (Dettori & Norvell, 2020; Delgado & Tibau, 2019). Matthews Correlation Coefficient (MMC) is more informative than Kappa according to Chicco et. al, (2021) and the max. value of MMC is '1' which means perfect classification, while '0' means that the prediction made was similar to random guessing. As opposed to other measures ROC Area (AUC) does not depend on the imbalance of the training set (Rokach & Maimon, 2008, 35) and when it is 0,5, it means the model has no class separation capacity. When it is 0,60 as in our model, this means there is a 60 % chance that the model will

be able to put subjects in their true classes. A value between 0,6 and 0,7 is considered 'moderate performance' (Allwright, 2022).

Table 4.
Performans Summary of Decision Tree Prediction with Factors of Study II

Random-Forest										
Bagging with 100 iterations and base learner								**Confusion Matrix**		
Stratified Cross-Validation	15	Folds						**a**	**b**	**c**
Correctly Classified Instances	191	**44,5**	**%**					73	46	23 **a** early
Kappa Statistics		0,16						55	51	38 **b** moderate
Mean Absolute Error		0,40						42	34	67 **c** late
Total Number of Instances		429								
	TP Rate	**FP Rate**	**Precision**	**Recall**	**F-Measure**	**MMC**	**ROC Area**	**PRC Area**	**Class**	
	0,51	0,33	0,43	0,51	0,46	0,17	0,63	0,40	early	
	0,35	0,28	0,39	0,35	0,37	0,07	0,53	0,37	moderate	
	0,47	0,21	0,52	0,47	0,49	0,26	0,65	0,52	late	
Weighted Avg.	0,44	0,27	0,44	0,44	0,44	0,17	0,60	0,43		

Removing any of these five factors from the attribute set negatively affects the final discriminant success, regardless of composition.

6. Story, Time and Action

Under the title of "Benefit, Cost and Action", the MVT was referred to and discussed how this theory is dysfunctional in its pure form, when it comes to human. Still, MVT can offer us a basis for the 'rational human's *T*-value, in Study II type circumstances. We should pursue the reasons that compel the individual to construct a comprehensive decision rationale, and also the reasons prevent the same individual from further developing it. Then, let these factors balance each other out.

Study II gave us an output of the subject's reasoning process during the Preparative Interval: Variable 'E' is an objective[21] output, '*T'* on the other hand is a universal cost factor. Sheppard & Vernon's (2008) meta-analysis of 172 studies on information processing speed over a 50-year period, conducted with a total of 53.542 participants, shows that there is a significant, linear correlation between intellectuality and mental speed[22]. So, in terms of being the subject of an analytical activity, 'time' flows slowly for an individual with high IQ than for someone with low IQ. Now it would be appropriate to consider different IQ groups separately to increase the coherence of the model with the data set.

There is evidence that older adults have greater limitations in attentional selectivity, sustainability, allocation, and working memory performance than younger adults (Gazzaley & Rosen, 2018) and there is a moderate correlation between decision delay and age (Rabbitt & Govard, 1994) but on the contrary a significant negative correlation was discovered between the *T* values and the age of the subjects included in Study I ($r = -.19$, $p < .01$)[23]. This may be due to young people's relatively high interest in new experiences, such as the experiment they

[21] It can also be thought that subjects obtained a subjective benefit from their explanations. Referring to the Cognitive Dissonance Theory (Festinger, 1957), we get a kind of satisfaction when we work on a problem and come up with a solution, because for emotional stability to last, it must be assumed that a job worth the investment has emerged. This sense of satisfaction is immediate and is separate from the satisfaction we get when we exposed to the positive outcome of our action. Referring to the same theory, it can be argued that there is a direct correlation between 'E' and this sense of satisfaction, since subjects spend more time (on average) for higher E values (see Appendix A-5).

[22] Under this concept, there are various categories such as 'reaction time tasks', 'general information processing speed', 'short and long-term memory processing speed'.

[23] The correlation is meaningless for Study 2.

participated in (Camp at. al., 1984), as a matter of fact in Study II, a negative correlation was found between the value that subjects attributed to the experiment and age ($r = -.11$, $p < .05$). Since the relationship of age with the *T* value seems situational and a large sample pool is needed to examine other factors, the age variable was not considered, nor was it used as a *T* predictor.

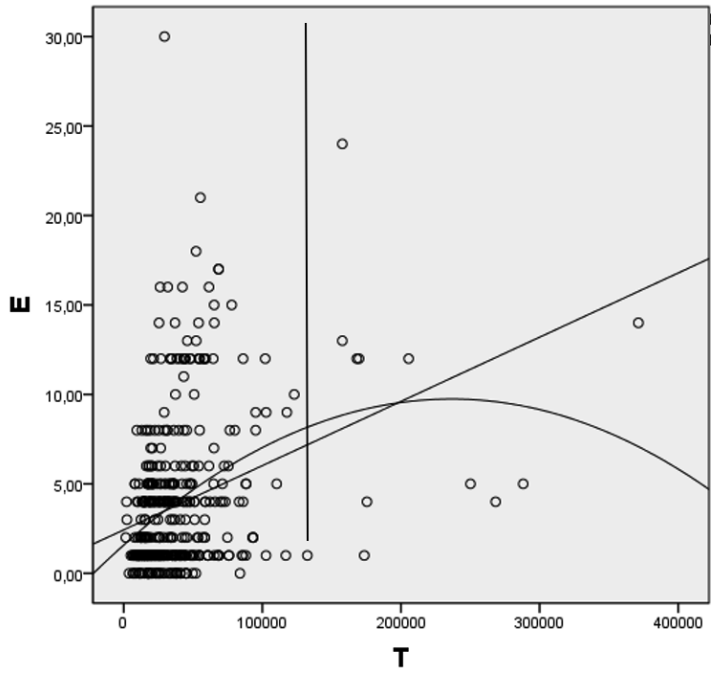

Figure 4. T and E value Relationship for 430 subjects of Study II

We would like to remind the reader that we do not know how E value appears due to the change in *T*. Because the points in Figure 4 are not E values corresponding to different *T* values of an individual, each point shows the moment when an independent individual gives up producing E value with his free will. We need to infer the relationship from the *T* to E distribution in Figure 4 (N = 430, r^2 linear 0,099 ve r^2 quadratic 0,122): We observe that quadratic function is more successful than linear in explaining the distribution. However, it cannot be said that E corresponds to the increasing *T* value in a quadratic character, because a developed value of E cannot decrease. So, it is envisaged that the curve, describing the dynamic between E and *T*, rises rapidly[24] as on the left side of the vertical line and converges to the maximum point forever after hitting a kind of wall.

This curve can be expressed mathematically as:

$$K_i = A + \frac{1}{Q_i} + \varepsilon_i \qquad (2)$$

Using the E and *T* values, the equation was estimated by the LS method and the "Estimation Model of Decision Extensity" (Figure 5) was created with the obtained β_0 and β_1 parameters[25]. The decision maker experiences diminishing returns over time and so the curve of cumulative extensity of the rationale (E) shows an exponential decay.

Study II also gave us V value, which could represent the individual's "will to develop a decision rationale". Valuable goals trigger a will for themselves. HRA was evaluated together with V,

[24] The quadratic function established for the subjects on the left side of the vertical line has an exponential character.
[25] EViews version 12 and R version 4.1.1 used

as a high HRA value represents an inclination that provides resistance to 'rapid heuristic response'. These low-level-correlated factors was added to eachother and named as "complicating factors" and are represented by the 'W' symbol. One last assumption is needed: The decision maker is assumed to make decisions as to maximize the net rate of E value during preparative interval.

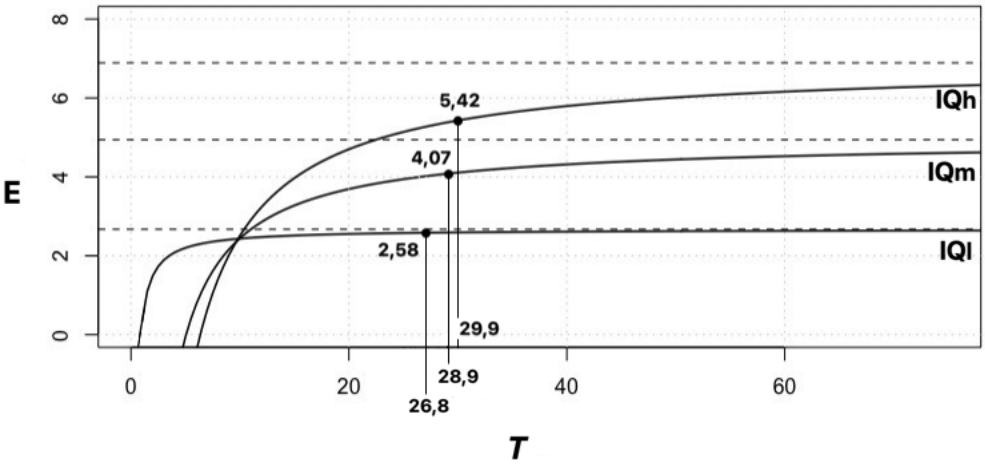

Figure 5. Estimating the E Curve for Three Different IQ Levels

The decision model in Figure 6 indicates the optimal time for a decision maker who is building a rationale in order to maximize the E value. The left of the origin expresses the degree of the 'complicating factor' (W), while the right side express the 'time taken to generate a decision rationale' (*T*). As W increases, the decision maker is willing to spend more time for a smaller increase in E.

To support this model, W is expected to be positively correlated with *T* / E for each IQ group:

- W significantly predicted the increase in *T* / E for IQ^l group, but the explanatory power is pretty weak [R^2 = .06, F (1,64) = 4,35, p < .04].
- However, no relationship was found between W and *T* / E in the IQ^m [R2 = 0.00, F (1,308) = 0,07, p < .78] and IQ^h group [R^2 = .008, F (1,71) = 0,6, p < .42]. At first glance, the correlation between *T* and E in IQ^h group (0,27) is lower than in the IQ^l group (0,40).

In the current study, 'the complexity level of the explanation (E) emerges at the end of the thought process' was measured. Referring to Klein (2003), we assume that individuals heuristically invoke simple or complex mental templates corresponding to low or high E values and then construct them analytically using the data. When the explanation process ends prematurely, that is, when the template cannot be constructed, the correlation between *T* and E is broken. The longer the intellectual process takes, the greater will be the uncorrelation that would emerge when the reason is born premature.

On the other hand, singular explanations are prepared with short thought processes. If you add short answers one after the other and if the last intellectual effort ends prematurely, the uncorrelation between *T* and E will not be great. Indeed, while the members of the IQ^l group often added singular explanations to each other, the IQ^m and IQ^h group preferred the dual or more complex explanations. Assuming that both groups are equally likely to produce premature processes, it will be understood why correlation is weaker between *T* and E in the IQ^m and IQ^h group.

As a matter of fact, when the stories given by the IQ^l subjects for their decisions were examined, it was seen that subjects in the IQ^l group were often not content with a single singular reason

and tended to support their stories with more singular reasons. On the contrary, we observe many subjects in the IQ^m and IQ^h groups who are content with a single dual reason. This also implies that subjects assumed more complex explanations were more convincing, at least up to a point. Complex things are rare and, according to Cialdini (2007, 180), rare arguments are relatively persuasive because they are more valuable.

If IQ^m and IQ^h groups suffer from a measurement problem, then any attempt to measure the extent of mental effort with tools such as fMRI, would increase the performance of this model. Since we cannot change the current measurement format, we have no choice but to examine Figure 5 more closely.

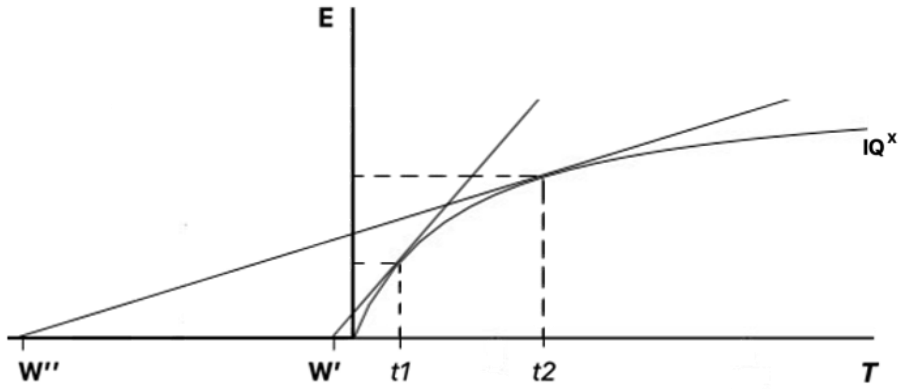

Figure 6. The Charnovian Model for the Decision Moment of Action in Study II Type Situations

The mean of the 'realised E values'[26] (E^r) and (E^r / *T*) values for each IQ group are presented in Table 6. IQ groups were formed by considering the distribution in Figure 2. E^r is naturally below the possible maximum E value (E^p) for the groups, as it is for each individual. The efficiency (*e*) of IQ^m and IQ^h groups are close to each other, when the average of the *T* values they bear for the average E^r values obtained for each group.

Each group missed the optimum moment of action, corresponding to the maximum *e* point on the curve. For example, the IQ^h group reaches the highest possible *e* value on the curve at about 13 seconds (3,51/13 = 0,27), but this group's average actuation time is about twice as high as 13 seconds. Presumably one reason for these consistent delays is the inherent cohesion of the stories being constructed. Stories cannot be split up. At least one dual explanation equals to 4 points and greater than 3,51. With a value of 0,03, the IQ^l group achieves low efficiency. With the extra effort causes this reduction in efficiency, the IQ^l group may be trying to reach a threshold, an absolute E value ($E^a \cong 2{,}53$) that makes the story meaningful or persuasive.

Table 6.
Average E^r, E^p and T values for IQ Groups

IQ groups	IQ-mean	n	*T* mean (sec)	E^r	$e = E^r/T$	E^p	E^r / E^p
IQ^l	63,7	60	26,8	2,53	0,03	2,67	0,94
IQ^m	78,5	310	28,9	3,83	0,13	4,94	0,77
IQ^h	91,2	59	29,9	4,61	0,15	6,89	0,66

E^r: Realized E values of each group, E^p: possible maximum E value, *e*: Efficiency of each IQ group when the average of the *T* values they bear for the average E^r values compared

[26] The actual mean E values of the groups (2,53 for IQ^l; 3,83 for IQ^m and 4,61 for IQ^h) and the E values derived from the *T* values in Figure 5 (2,58 for IQ^l; 4,07 for IQ^m and 5,42 for IQ^h) are naturally not the same but they converge.

A *T* value above 29,9 for the IQ^h group and 28,9 for the IQ^m group will reduce the *e* value below 0,15 and 0,13 because the E obtained for each unit of *T* starts to decrease radically. So, we can set the following hypothesis:

> *"People tend to delay their decisions until they can construct a meaningful and convincing story (E^a) with minimal data, but do not delay the decision* ***a)*** *when they reach a point where the scope of the justification is no longer increased sufficiently or* ***b)*** *when they realize that they cannot build the mental template they invoke heuristically, with each extra effort spent."*

E^r / E^p values are changing for different IQ groups. IQ^l group seems trying to secure the E^a value with 94%. So why does the IQ^h group avoid realizing its potential? Individuals with very high E values also have high *e* values (see, Appendix A-3). This situation may indicate that successful individuals, like individuals who fail to produce comprehensive justifications, anchor their E^r value to E^a and thus regress. It should be noted that the cost of time is also a factor of pressure on all subjects who tend to spend time for the E value. Christian & Griffiths (2017, 49) reported that subjects subjected to the secretary problem acted just before the optimum point of 37 %. They attributed this to the cost of time in people's lives which was not due to the design of the experiment. The experimental image used for Study II offers a large amount of data and allows subjects for numerous inferences, the said subjects could spend more time constructing more comprehensive stories.

It's also conceivable that people typically invoke heuristic templates that correspond to their personal E^p values, but the story they build accounts for 66 % to 94 % of this framework - on average - due to the factors we've discussed. Every explanation born premature, but to a different extent.

Although this model provides a clue for understanding how rational people limit the scope of their solutions, it is insufficient for predicting when an individual would take action. While the average of the *T* values measured for 430 subjects in Study II was 28,7 seconds; *T* values of subjects showed a distribution ranging from 1,4 sec. to 371,2 sec., while the standard deviation is 38,5. If there is an optimum value of *T*, individuals deviating from this optimum must have been affected by third-party factors such as V, HRA, SC, IE or by factors that we did not measure like 'tendency to invoke heuristic templates that cannot be constructed'.

Now the hypothesis can be revised:

> *"People tend to delay their decisions until they can construct a meaningful and convincing story (E^a) with minimal data, but do not delay the decision* ***a)*** *when they reach a point where the scope of the justification is no longer increased sufficiently or* ***b)*** *when they realize that they cannot build the mental template they invoke heuristically, with each extra effort spent; unless* ******* *the corresponding E is too far from the value of E^a and* ******** *third-party factors takes radical loads."*

In Appendix A-3, 58% of the 351 subjects clustered at 1, 4, 8, and 12 E values; 118, 54, 10 and 24 subjects, respectively. The *e* values peak at these accumulation points, except for the E1 point[27], and consistent decreases are observed in the cells after them. Potential E value is created by the cognitive capacity of the individual and while the cognitive capacity is constant, the agent trying to increase the E value suffers a loss of efficiency. A subject who is an example of this situation may only create a singular explanation next to a dual one, rather than creating

[27] It is generally accepted that the analysis of a problem begins with the definition of the data about it (Wang & Chiew, 2010). It can be thought that the subjects, who are faced with the visual, options are given, perform a general screening that brings them closer to each other in terms of *T* value before proceeding to the reasoning process.

another dual explanation per unit of time. It is noteworthy that the variable V has consistently risen just after the points E1, E4, E8 and E12 as we predicted and the increase in the E9 point was found to be significant (Independent Samples, $F = 4.372$, $p < .02$).

Accordingly, in Study II, we have traced the factors that bend the personal optimum, and the success of Decision Tree II can be increased by pursuing more factors.

7. Discussion

This study proposed two models that predict when an individual will take action from the moment he focuses on achieving a goal. Each decision tree divided the observed time interval (the distance between the last active agent of the reference set and the zero point) into three, and Decision-Tree II with Random Forest Algorithm predicted which of these three classes the predicted individual would belong to, with 44,5 % success, while the natural success rate is 33%. This achievement might be improved up to 10 points when the shortcomings under the 'Limitations' are overcome. We would like to emphasize that this success was not achieved in a laboratory setting where subjects were isolated. Subjects participated in the experiment in their ongoing daily lives, often using their mobile phones.

This study also defined the decision process as the task of generating a decision rationale in Study II type situations and discussed the relationship of the produced rationale with the *T* value and the intellectual capacity. Our study showed that, when people focus on a decision goal, they are isolated from their past and future, but are affected by the cognitive loads unrelated to the goal in a way that shortens the process. The preparative interval (*T*) might used to construct a justification for the decision. The rationale is constructed by aggregating a conservative amount of raw data, accompanied by the 'patterns' discussed by Klein (2003, 28). People tend to delay their decisions until they generate a rationale, they believe is convincing. Complex justifications with a high E value are more convincing -up to a limit- so it has been observed that subjects with low analytical capacity tend to accumulate many simple justifications. We believe that this minimum threshold also anchors individuals who have built comprehensive justifications and are able to build more comprehensive justifications. Therefore, and for some other reasons, as the analytical capacity increases, the gap between the complexity of the explanation and the maximum possible complexity increases.

During the preparative interval, as subjects complicate their reasoning, the law of diminishing returns comes into play radically after a point, and the point at which the subjects end the preparative interval deviates from the optimum, for the following reasons: The radical values they assign to the goal, their tendency to use the analytical capacity, tendencies to associate pieces of information, their introversion versus extroversion, their different levels of self-confidence or the cognitive loads originating from the external environment. There is literature indicating that the following factors, which were not investigated in the current study, may be among these reasons: Low Blood Glucose Level, Mental Depletion Level and the external factors which broaden the cognitive channel capacity.

We believe that one of the significant contributions of this study is that it has illuminated how analytical capacity interacts with dwell time (*T*) hypothetically: It has been observed that, as the analytical capacity increases, dwell time first increases but then starts to decrease if the individual tends to use System 2. If individual uses System 1, increasing analytical capacity increases *T* linearly. This whole process is more complicated than it seems because cognitive problems in daily life are not fully given, they are somewhat constructed by the individual, so high analytical capacity creates more challenging problems for itself, but as the analysis capacity increases linearly, the complexity of the problem does not increase at the same rate, as the individual use filters. If the individual tends to use System 1, he is confronted with a

primitive form of the problem he has radically filtered out. This primitive form does not complicate in proportion to the analytical capacity and is in-sensitive to changes in this capacity. However, as factors such as curiosity awaken with the increased analytical capacity, the dwell time begins to increase for indirect reasons.

Being able to predict when an individual will act, will create countless externalities. Still, we can speculate on how this knowledge might resonate in various fields:

Let's say you have a few Wikipedia pages open in your web browser. Since you are on the eve of a decision about your financial assets, you give importance to the subject you are researching. You are not inclined to make heuristic decisions and have a high tendency to use the information you will get from three web pages by linking them. These factors mean that you will spend time on the pages, but you can reason relatively quick about the information you acquire because you have a high IQ, and you will leave the pages a little earlier than moderately confident people because confident people like you need fewer extra checks. You are in a café and someone is telling you something, under the assumption that you are in that place for a limited time, since external loads are common to your computing capacity, the time you devote to pages decreases a little. As Wang et al. (2016) stated, your decision-making speed increases relatively, since the Wikipedia page is supported with images, increasing the efficiency of the information flow.

Factors affecting the *T* value can be classified as analytical (IQ, HRA, E and RV) and emotional (V, SC and S) factors (see Appendix A-9). Analytical factors can be classified as duplicator (HRA, E and also IQ) and reducing (IQ and RV), while emotional factors can be classified as self-directed (SC) and goal-oriented (V, S). This kind of modeling may facilitate the use of the attributes introduced in this study in different areas with different factors. The effect of the reducing analytical factor on *T* value will be variable according to the level of the duplicator factor. For example, while the high IQ level of an investor who is prone to making heuristic decisions will reflect positively on the *T* value of his research on the stock offered, it will not reflect on an analytical investor. In most corporate decision-making procedures, people still make the final evaluation. Adequate knowledge on decision-makers may make it possible to take advantage of buying before big buyers enter and selling before big sellers exit.

Considerable progress has been made in predicting crime in the last 50 years. These studies, in addition to identifying individuals who are prone to crime, estimate the probability of repetition of crime (Milgram, 2012), hot-spots where crime can occur, and the distribution of crime at these points over time when the possible perpetrator is anonymous (Kounadi et al., 2020). Published studies focusing on when individuals in the red list will likely commit the act are very limited. A version of Decision Tree I built on V, N, IE factors, with the contribution of SC factor, CL factor and a factor representing stress discharge; can be used to predict the range of catharsis created by the emotional accumulation of individuals prone to crime under certain environmental conditions. In this version the V factor will work in reverse.

- **Notes**

Factors used in this study, such as the value attributed to the goal, extraversion, neuroticism, level of focus, length of the mental reasoning process, the mental workload (Kröger et al., 2020); can be deduced with algorithms that follow eye movements, pupil size, iris characteristics, and movements of the muscles around the eyes.

The procedure which obtains the E value from the aforementioned image can be a general validity scale that is not unique to this study, and can be used to decide the *T* value for numerous decisions. To reach a clear conclusion, E needs to be applied to different decision objectives and compared with various thinking styles.

7.1. Limitations

In the experiments of this article, subjects had no option to refuse the action in the middle of the experiment. Those who refused had not participated in the study anyway and a some part of them was eliminated from the database because they did not fill in the required parts after the experiment. However, the participants were free to decide when to take action. Therefore, the inferences of this study refer to the individual's undivided reasoning processes towards the goal and for those who ultimately act. The findings of this study are dubious for decision processes where the individual leaves the process and returns.

A suspicious situation was encountered when examining data from subjects to generate E values. About ten subjects examined the image for only 10 seconds, but they made long, detailed explanations that deserved relatively high E value in a disproportionate way that could not be explained by any cognitive capacity. As we mentioned in Appendix B-2, the picture was brought back to the screen because some people do not have a strong visual memory and it was avoided to say to these people 'you will be asked for an explanation after you examine the image and make a decision'. However, this could lead to a problem we call 'over-analysis', which threatens the quality of the E value. The individual may have come to a decision in a short time, but since he was in front of the picture while writing his reasons, he could have started to deal with the situation at length and made more than the analysis he made while deciding. The opposite may also have happened; a subject with a high *T* value may be content with an extremely short explanation because he has been bored. The theoretically consistent and significant correlation between the E and the *T* value tells us that these two phenomena do not occur frequently, but it is certain that these examples that we could not detect, erode the explanatory power of the E factor. On the website, the following question could have been conveyed to the subjects, revealing this error: “Did you write down more reasons than you used when making your decision?” or “Did you write less than you thought while writing your justification?” Eliminating these errors will increase the success of the prediction.

There is another handicap regarding the E value. E is derived from the evaluation made about the image. Therefore, it is related to the pattern of the image, and we do not yet know how generalizable it is to a person's other decisions. But the procedure for obtaining E is highly adaptable. For example, if you ask an experienced CEO, which data he uses before making specific decisions you will get clear answers, and if you observe the connections he makes between the data, you would apply the above procedure to this information and you can obtain a personal E value.

The curves of Figure 5 have built on points where subjects stop developing the E value, but these curves modeled the E values that subjects will obtain for different *T* values. This discrepancy has been compensated with the following two assumptions; **a)** Subjects with the same IQ level, will give a similar E response to a similar *T* value **b)** An increasing E value cannot decrease after a point, it converges towards a maximum point. To clarify, in Study II, *T* values of different durations could have dictated to some of the subjects to obtain the corresponding E values.

Mental depletion and blood glucose level have an impact on the quality of analytical mental processes, or the amount of effort expended on these processes (Danziger, et al., 2011; Tyler & Burns, 2008; Gailliot & Baumeister, 2007). In Study II, these factors could be controlled, by asking subjects how hungry they were during the experiment or whether they had completed a difficult mental task before the experiment. In Study I type cases, the current stress level or when and at what level the decharge occurred might be an important factor. This factor has not been measured and hence is one of the shortcomings of Study I.

Study II has a bias toward the general population, since it excludes participants who do not have ALES scores. In other words, the general intelligence and education level of the individuals examined in Study II are slightly above the average of the population. 20% of the participants are academicians and almost all the others are master's graduates or students. So, we cannot say that we can observe the real effect of the IQ variable with the full spectrum in this study. This may be good news for the success of Decision Tree II, but it could also be bad news given the large number of participants who scored 0 or 1 on the E value. However, we would like to remind you that the E value was not obtained by an interview with the participant. Some of the participants purposely scored lower, probably because they wanted to finish the experiment in a short time and exit.

In Study II, subjects produced a story for choosing one of the two alternatives, we do not know whether the *T* value will change positively when three or more alternatives are involved.

Author Contributions

MEÇ the correspondent author, conceptualized the article and the experiments, conducted the experiments and the analysis, interpreted the findings and wrote the article. MN, mathematically estimated the curves in Figure 5.

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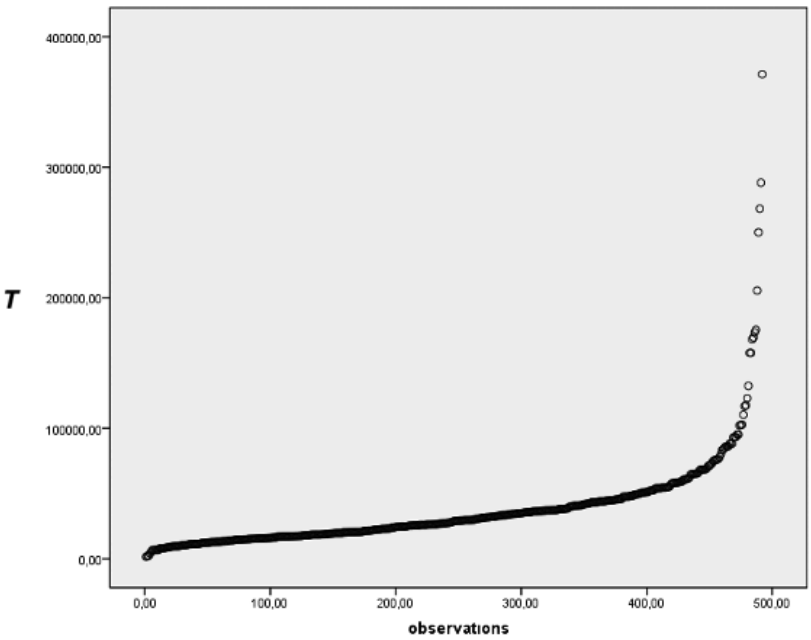
Appendix A

1) Study I and Study II Data:

Study I data:
https://docs.google.com/spreadsheets/d/11FKOMCjXLbUQhy6n9WRUPtTQhVhY6hRb/edit?rtpof=true#gid=38442955

Study II data:
https://docs.google.com/spreadsheets/d/1IOGHvPiPcopdrHnPYfW_MNueM-QqFjvW/edit?usp=sharing&ouid=110953231540579166586&rtpof=true&sd=true

2) '*T*' Value Distribution for Study II



3) E Groups and Related Statistics

N	36	118	29	10	54	33	13	2	10	3	2	1	24	3	4	1	4	1	1	1	1
E	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**21**	**30**
T	26,2	32	25,8	31,9	38,4	50,2	42,9	42,8	46,3	83,1	86,8	43,2	56,9	85,2	131,8	77,8	40,4	68,4	52,1	55,2	29,4
E	0	0,39	0,97	1,18	1,29	**1,25**	1,69	1,94	2,15	**1,40**	1,58	2,76	2,64	**1,73**	1,39	2,50	4,91	3,46	4,80	4,37	10,75
IQ.HRA	202,4	202,6	192,1	196,3	216,2	223,9	220,6	251	219,6	218	147	276	240,9	255,3	263	308	241,5	144	288	348	380
V	4,2	4,14	**4,43**	3,9	4,3	**4,5**	4,2	4,6	4	**5**	4	4	4,3	**4,8**	5,1	5	3,8	4,7	4	4	3,3

The data in the table do not include IQ^{I} group subjects

4) Corralation Table for Study I

Means, Standard deviation and Pearson Correlation Matrix (n = 424)

		M	**SD**	**min - max**	**1**	**2**	**3**
1	*T*	10,8	20,2	0,03 to 120			
2	V	3,7	1,6	1 to 7	.11*		
3	N	21	4,7	7 to 35	- .07	- .01	
4	IE	55	9,4	16 to 77	- .09*	. 06	- .06

T: Preparative Interval V: assigned value N: neurosis IE: introvertion versus extrovertion
* correlation is significant at the 0.05 level (2-tailed)

5) Corralation Table for Study II

Means, Standard deviation and Pearson Correlation Matrix (n = 430)

		M	SD	min - max	1	2	3	4	5
1	*T*	38	37	1,4 to 371,2					
2	V	4,2	1,1	1 to 6,3	.18**				
3	E	3,7	4,1	1 to 31	.29**	.13**			
4	HRA	1,5	0,8	1 to 4	.12*	.01	.22**		
5	IQ	78,6	8,9	42 to 96	- .02	- .10*	.13**	.35**	
6	SC	31,3	5,7	12 to 45	- .06	.08	.00	.06	- .09*

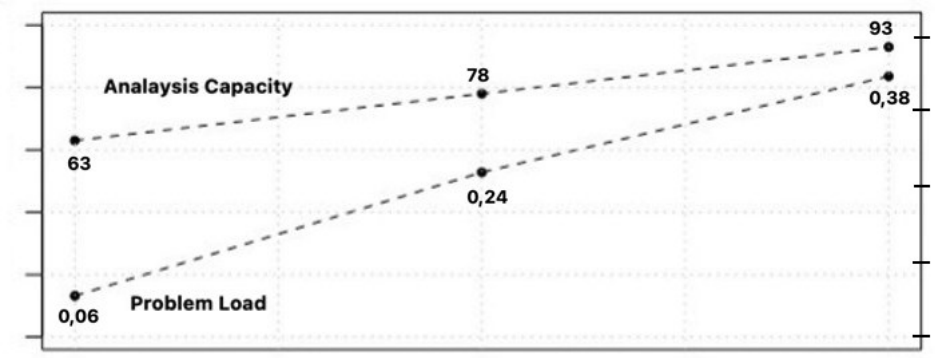
E: Decision-making extensity HRA: Total CRT test scores; IQ: Ales values; SC: Self Confidence
** correlation is significant at the 0.01 level (2-tailed) / * correlation is significant at the 0.05 level (2-tailed)

6) Study II, Statistics Related to E Value

		IQ^l		IQ^m		IQ^h	
IQ average		63,5		78,5		91,2	
N		59		293		57	
		Amount	**Score**	**Amount**	**Score**	**Amount**	**Score**
Singular (*1)		60	60	292	292	54	54
Dual (*4)		15	60	120	480	23	92
Trio (*12)		2	24	29	348	7	84
Quatro (*24)		0	0	0	0	1	24
Total		85	144	456	1120	91	254
E average			**2,44**		**3,82**		**4,45**
				f r e q u e n c y			
Data	Cigarette	21		136		18	
	Blood Stain on the Wall	20		109		25	
	Gun	20		115		29	
	Letter	6		53		10	
	Stool	10		24		5	
	Ashtray	3		16		3	
	Sitting or Falling Direction	5		59		12	
	General Condition of the Room	2		12		5	
	Sub Total	**87**		**524**		**107**	
	Cigarette Box			3			
	Bullet Casing			1			
	Table Lamp Plug			2		1	
	Coke Can (Drink)	1		7		1	
	Pencil	1		13		2	
	Slipper			13			
	Live flowers in vase			7		2	
	Blood on Womans Short			1			
	Location or Direction of the Lamp			1		2	
	Books on the Table			1			
	Glasses			7			
	Handle of the Window			1			
	Woman was Standing vs Sitting			3			
	Width of the Room			1			
	Direction and Number of Butts in the Ashtray	1		1		1	
	Gunshot Wound at the Head	1		2		3	
	Nighttime					1	
	Last Cigarette in the Ashtray					1	
	Holding the Gun Tight					1	
	Direction of the Slipper			3		3	
	Freshly Lit Cigarette					1	
	Empty Bottle in the Bin			2		1	
Injections	An External Cause					1	
	Finger Muscles in Death			1		1	
	The Effect of the Gravity on the Hand			1			
	Calming Mood Close to Suicide			1			

	Someone Entering the Room from the Perspective		2	
	ORIGINAL DATA FREQUENCY	**4**	**74**	**22**
	TOTAL FREQUENCY	**91**	**598**	**129**
Active Database Size	Total Frequencys / N	1,54	2	2,26
	DATA TYPE FREQUENCY	**12**	**30**	**23**
Database Size	Data Type Frequency / N	0,2	0,1	0,4
Database Orginality	Extraordinary Data Frequency / TOTAL FREQUENCY	0,04	0,12	0,17
PROBLEM LOAD	(Act. Database Size) x (Database Orig.)	0,06	0,24	1,6

7)



8) Self Confidence Scale Statements: 1) I generally tend to see myself as an unsuccessful person (R) **2)** I would rather be myself than be someone else **3)** I trust myself **4)** I'm not afraid to make mistakes **5)** Sometimes I think I'm inadequate (R) **6)** I focus on my successes rather than my mistakes **7)** There is no insurmountable problem for me **8)** I delay my decisions (R) **9)** I can easily make a decision

9) Characteristics of the Factors Associated with *T* Value

		V	**HRA**	**E**	**IQ**	**SC**	**IE**	**N**	**M**	**G**	**CL**	**S**	**RV**	**H**	**F**	**E[a]**
	Study I Type Factor	X					X	X			X	X				
	Study II Type Factor	X	X	X	X	X			X	X	X		X			X
Emotional	Self Directed					X										
	Goal Oriented	X										X				
	Related to Willpower	X				X	X					X				X
Analytical	Complicating		X	X	X											
	Reducting				X								X			
	Cognitive Capacity				X				X	X	X		X			
	Cognitive Style		X	X			X	X								X
	Cognitive State	X				X			X			X				
Functional	Linear	X	X	X			X				X					
	Non-linear				X	X		X								X
	Poor Function										X		X			
	Possible Function								X	X		X				X
	Dysfunctional													X	X	

Notes: V stands for, Value Assigned to the Goal; **HRA** is for, Heuristic vs Analytical Decision Making Disposition; **E is** for, Decision Making Extensity; **IQ** is for, Intelligence Level; **SC** is for, Self Confidence Level; **IE** is for, Introversion & Extroversion Level; **N** is for, Neuroticism Level; **M** is for, Mental Depletion Level; **G** is for, Blood Glucose Level; **CL** is for, Goal Independent Cognitive Load; **S** is for, Stress Discharge; **RV** is for, Recall Velocity; **H** is for, History (Abandoned Action); **F** is for, Future (Planned action) and **E[a]** is for Treshold (Anchor) E Value

Appendix B

1) **Experiment Process for Study I:** Subjects who access our web site with mobile device went through the following stages, respectively:

- Welcome. The purpose and scope of the experiment you will participate in will be explained at the end of the flow. Your personal information will not be collected.
- Now please move to a quiet place where you can sit in front of a table.
- Is your environment quiet? YES – NO
- Please put your mobile phone on the table and sit in front of it.
- Are you ready? YES - NO

On the screen of the phone of the subject who clicks 'Yes', a black background appear with a striking red button at the bottom and the following explanations emerge:

- Let's do a trial before we move on. Please put your index finger on the red button.

When the subject puts his finger on the button, the written description changes and says:

- Focus your eyes on the tip of your finger and wait.

After eight seconds, if the subject has not lifErhis finger during this time, the phone vibrates and a white screen appears with the following statement:

- Trial completed successfully. Now we go to the experiment.

The screen goes black again, the red button appears at the bottom and the description says:

- Please put your index finger on the red button. Focus on the tip of your finger with your eyes. The experiment will begin soon. The texts on the screen are erased and a voice recording is heard from the researcher's voice:
- *This is an experiment; I give you time. Raise your finger whenever you feel like it*[28].

As soon as the statement is finished, the website's stopwatch starts running. When the subject raises his finger, the *T* value is obtained, and the following questionnaire is conveyed with a thank you letter:

- Why did you raise your finger at this moment? **a)** I just feel like / There is no reason / It felt pointless to wait[29] **b)** Because I was dizzy / I was too hasty, I couldn't be patient / I was hypnotized, things started to disappear / I have trouble focusing, I couldn't stay long / My eye was strained or burned / I was in a hurry. Those who marked option 'b' were eliminated from the data set.

In the preliminary research, there were a few subjects who remained focused on their finger for more than 2 minutes and only lifted their finger at the warning of the researcher. In the online version, there were three subjects who did not lift their finger for 120 seconds (2 minutes) (see, Appendix A-1).

The website was prepared for this possibility, and after 2 minutes, although the subject did not lift his finger, the screen changed, and the following question was asked to the subject:

- Why didn't you lift your finger? **a)** I didn't feel like it / There's no reason **b)** I got hypnotized / I went into a sleep-like state. Option 'b' eliminated and the *T* value of those who marked option 'a' naturally appeared as 120 seconds.

After this stage, the V value from the subjects was obtained by a 7-point Likert scale:

[28] In Turkish, the word 'raise' in the statement is at the very last of the sentence. In this respect, it is not possible to encounter subjects who raise their fingers without understanding the condition of 'whenever you feel like it'.

[29] These answers were given by 93% of the subjects in the preliminary research.

- The subjects were asked: “To what extent do you think the finger-raising experiment you just participated in was meaningful?”

For the health of the experiment, the subjects were asked as a re-test question, ‘Whether they performed the finger lift experiment they had just participated in while sitting or standing’. The standing experiment could bend the *T* value as it could tire the subjects' arms to varying degrees, so those who selected the standing option were eliminated from the data set.

Then, the demographic information of the subjects was taken, and they were subjected to five-point Likert-type questions of the IE, N, and Responsibility scales.

Sixteen statements used to measure Introversion & Extroversion and seven statements used to measure Neuroticism obtained from Francis et al. (1992), Eysenck & Eysenck (1975) and Deyoung et al. (2007). Six expressions defined as 'Industriousness' but used under the name of ‘Responsibility’ obtained from Deyoung et al. (2007).

In both Study I and Study II, two control questions which are testing whether the subject actually read the questions were placed into the set of questions consisting of the aforementioned scales, and a small number of subjects who fell into the two traps together were excluded from the data set. In both Study I and Study II, since it was estimated that some subjects could participate in the experiment more than once through the website, the anonymous fingerprints of the mobile phones that participated in the experiment were listed by the website. Comparing the fingerprints, the researcher left out the entries of the digital tools used for the second or third time, other than the first connection date and time, from the data set. It is possible for a subject to participate in the experiment more than once using different phones, although it cannot be controlled, this rare situation is not considered to be a significant loss for the health of the data set.

2) **Experiment Process for Study II:** Subjects who clicked on the link were transferred to the website and encountered the following message:

- Welcome. You will participate in an academic research. Your identity will not be taken.
- Please switch to a quiet environment, put your phone in airplane mode and join with your desktop computer if possible.

In order that the experiences of the subject while analyzing the image, such as the feeling of success or failure, do not affect the value that the subject attributes to the experiment; the questions determining the V value had to be conveyed to the subject before the analysis process. To achieve this, the subject was first shown a sample picture[30] and said:

- Preliminary Information: In the experiment that will start a little later, you will be shown a picture similar to the one below and asked whether the individual committed suicide or was the victim of a murder.

This image is programmed to stay on the screen for a limited time. On the next page, the subjects were asked, accompanied by likert-based answer keys:

- How important is it for you to be a part of the experiment you will be participating soon?
- How important is it to you to be successful in the experiment that you will participate soon?
- How much do you enjoy trying to solve these types of puzzles?

[30] In this painting, whose artist cannot be reached similar to the main image, there is a man sitting at his desk with the impression that he is dead, in a room where things are scattered on the floor. There are many clues, including a knocked down chair, a broken bottle of drink hitting the wall, and a person seen running away from the window behind.

Then the subject was asked if he/she was ready, and when the subject clicked 'I'm ready' button, a new page appeared on the screen with a question and an explanation at the top and the main picture with two options. As the page appeared, the stopwatch was started in the background. The question was placed at the top of the screen: "Do you think the woman in the picture committed suicide or was she murdered?" Just below it there were the explanations of "Your Time is Unlimited" in large fonts and then "You can tick one of the options at any time" in small fonts. Under this explanation, **1)** Committed suicide **2)** Was murdered, options are placed. The subject could enlarge the picture with his fingers while using a smart phone. When one of the options was clicked, the stopwatch recorded the elapsed time as the *T* value, and the following question was presented to the subject on a new page:

- Has your process of evaluating the image interrupted for any reason, due to activities such as someone coming to your place, a ringing phone, a noise coming from outside, a pen falling on the floor, getting up to close the window? Yes or No. Those who stated that they were interrupted were excluded from the data set.

After this information was received, an explanation box and a question appeared on the bottom of the screen, allowing the subject to explain with the keyboard, accompanied by the main picture that was displayed again:

- For those who selected the murder option, "Why do you think the woman was murdered?" and for those who checked suicide, "Why do you think the woman committed suicide?" Opinions of the subjects are taken in writing and were used to derive the E value.

Since some people do not have a strong visual memory, the image was re-screened so that the subject could write the complete reason for the decision he had just made, but this led to a problem we call 'over-analysis' and threatened the quality of the E value. In fact, this problem which arising from the inability to conduct the experiments face-to-face was discussed under the title of 'Limitations'.

Then another question was asked that checks the health of the *T* value:

- Do you currently have an unfinished or queued job that pushes you to rush or finish the experiment quickly? Yes or no. Those who said yes were asked:
- Could you value the urgency of this job? **a)** Not very urgent **b)** Urgent **c)** Quite urgent.

Those who marked Urgent and Quite Urgent were eliminated from the data set. After this phase, a preliminary explanation for the CRT questions appears on a new page: "You will have approximately 1 minute for each of the next three questions. When your time is running out, the countdown from 15 seconds will start and when the time is up, the answer box will close". At the bottom of this page there was a 'I'm ready' button. When the subject clicks this button, three CRT questions are presented to the subject in order on separate pages:

- A bat and a ball cost 1.10 Turkish Liras (TL) in total. The bat costs 1.00 TL more than the ball. How much does the ball cost?
- In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?
- Alper received both the 15^{th} highest and the 15^{th} lowest mark in the class. How many students are in the class?

On the next page, the subjects were asked whether they used pen and paper while answering the questions. There was no difference between these two different ways of answering in terms of the accuracy of the answers given to the CRT questions. Apart from the scale used for the SC value, in order to obtain a self-confidence value, the subjects were asked, "How many of

the questions you just answered may have been correct?" Subjects selected one of the options **a)** All **b)** 2 **c)** 1 **d)** None. Then, the subjects were asked whether they encountered three CRT questions, and their ALES scores and score types were obtained. After obtaining demographic information, IE, N, and SC scales were administered to the subjects.