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***The Influence of Big Five Personality Traits on
Dual-Process Cognitive Information Processing
Styles in Medical Decision-Making***

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Abstract

We all make decisions, but when medical professionals do it, it can literally mean life or death. Decisions are influenced by many factors. The aim of the present study was to investigate if personality traits as proposed by the Big Five Model influence the Rational and Experiential cognitive information processing styles as proposed by the dual-process Cognitive-Experiential Self-Theory theory in medical decision-making. A sample of doctors and nurses (N=102) from various medical institutions in Macedonia was presented with an online survey containing Big Five Factors Inventory (Goldberg, 1992) and REI-40 (Paccini & Epstein, 1999). The results showed significant relation for Openness and Conscientiousness with Rationality and Agreeableness with Experientiality. Neuroticism showed significant positive influence on one of the sub-dimensions of Rationality, the Rational Ability, but not on Rationality in total. The medical professionals demonstrated clear preference towards Rationality over Experientiality. The importance of these results is further discussed in context of somewhat similar research.

Keywords: dual-process, Big Five, CEST, REI, Rationality, Experientiality, cognitive information processing, medical decision-making

Introduction

A little boy of 21 months is brought to one of the most prominent American teaching hospitals where the pediatric staff is one of the best in the country. Almost everything you can think of is wrong with him. When brought, the boy is pale, withdrawn, underweight, refuses to eat and has constant ear infections. His father left when he was 7 months old and his mother was constantly partying. She either forgot to feed him or jammed forcefully jarred baby food or potato chips in his mouth. A young doctor took his case, and intuitively decided to limit any invasive tests and provide him with a caring environment. The child started eating and his general condition improved. Along comes the pediatric staff of supervisors and they discourage the young doctor's unconventional methods. Instead, they subject the young boy to every invasive test they can think of, since every specialist has a diagnostic route he or she wants to follow. Attacked again by needles, which the young doctor prevented and thus improved his condition, the boy stops eating and eventually dies. The specialists that claimed that if he dies undiagnosed it would be their failure, continued to do tests at the autopsy but never found anything conclusive (Gigerenzer, 2007).

Every day since the moment we are awake, we make all sorts of decisions. Some more important than others, but medical decisions can literally mean life or death. It is of great importance to have the knowledge of how they are made, what influences a doctor like in the example to stubbornly stick to his training or to go with the gut feeling inside him and save the boy's life, perhaps not even being aware what pulled him to make an intuitive decision. To each its own and it is psychology's job to investigate this problem.

Regardless of our profession, we appear to be like a ship engulfed in a temporal navigation through sets of viable alternatives in a sea of all possible alternatives. Do we steer manually or we put our boat on autopilot depends on many things but probably the most crucial is our style of cognitive processing of information, whether it is rational or experiential, conscious or unconscious. Consequently our decisions will be more of an analytic or heuristic nature. But, which way is better and is there a precedence at all?

There is no simple answer to this question. Obviously in the course of evolution both systems were built to help us navigate our ship, so they must each be of some help to us in the

time of need. Perhaps it depends on the environment and situations we are in or maybe our genetic blueprint has a bigger say in it?

This paper will modestly try to contribute to the answer, with the focus being on the people working in medicine. Obviously, there is not just one factor that is contributing to making a decision. But, the aim of this study is to investigate if personality traits from the big five model which are considered as very stable and cross-culturally viable with possible genetic base have influence on the cognitive information processing styles and consequently on the decisions made by medical professionals.

The mainstream position of psychology in explaining this matter is that there are two processes that are governing the psychological principles in making a decision. Thus, the story in this paper starts with the so called Dual-Theory, a dualism concept maybe intuitively recognized by philosophers since ancient times.

Dual-Process Theory

Dual-Process theory is a form of dualism that is loosely described by many psychologists and philosophers as a duality between the brain and the heart (Gigerenzer, 2007). However, there shouldn't be confusion, it is a cognitive dualism and no one opposes that. Dual process theories come in different forms, although scientifically only since the 1970's, but they all claim that there are two distinct mechanisms of information processing and decision making that can be used for the same task (Evans & Frankish, 2009). At the bare minimum, we can talk about the defining differences between *Type 1* processes - fast, automatic, high processing capacity, low effort; and *Type 2* processes - slow, controlled, limited capacity, high effort (Evans & Frankish, 2009). *Type 1* and *Type 2* as terminology are first used in the domain of reasoning (Wason and Evans 1975). Stanovich (1999) talks about *System 1* and *System 2* respectively, terms more commonly used today in many references to dual system theory. For example, Kahneman (2011) also talks about *System 1* and *System 2* as a metaphor of two agents that produce fast and slow thinking. In his theory, Epstein (2003) talks about rational and experiential systems, but however called by theorists they refer to more or less the same thing. One of them is unconscious or preconscious implicit process and the other one is explicit conscious process. Many authors, from Plato to Freud, refer to them in one way or another but only few propose theoretical constructs to explain their nature in detail within broader cognitive settings. In this context a

distinction has to be made between dual-process theories and dual-system theories, where the latter ambitiously try to unify dual-process accounts in overarching theoretical cognitive systems of mental architecture. However, today *dual-process theory* is most commonly used as an umbrella term to denote both (Evans & Frankish, 2009).

Evans and Frankish (2009) point to Reber's studies of implicit learning beginning in the 1960's as probably the oldest work in modern history theoretically addressing the issue of dual processes. Reber (1993) takes the position of the *primacy of the implicit* arguing from evolutionary point of view that unconscious cognitive systems clearly preceded the explicit consciously controlled cognitive systems. He is amongst the first psychologists to coin and use the term *cognitive unconscious*, making an important distinction from the psychodynamic understanding of the unconscious.

The work of Schneider and Shiffrin (1977) is sometimes cited as the origin of modern dual-process theories, which is a proof of the lack of communication between the different fields of psychology. The argument for this is their clear distinction of automatic and controlled processes of attention. Evans and Frankish (2009) consider this claim as uninformed since the work on dual-process accounts on learning and reasoning predate this effort

Another major influence on the generic dual-process theory was the development of dual-process accounts of reasoning in the 1970's when Evans develops his Heuristic-Analytic theory of reasoning. The main onset was the observation that logical processes were competing with non-logical biases in determining the behavior on various deductive reasoning tasks (Evans, 1977).

Of the more important theorists pertaining to dual-process theory is certainly Stanovich, who coined the terms System 1 and System 2. He is also a great contributor in the general debate about dual-process theory and in the efforts to unite the general principles of this concept (Stanovich, 2011). Stanovich and West (1998; 1999; 2004) conducted a series of studies on reasoning and decision making pertaining to dual-process theory advancing the research in the field. One of the most interesting findings of these studies is the link between System 2 and general intelligence and not System 1. This set of studies developed an individual differences approach to dual processing research which is in the great deal the topic of this study. Epstein (2003) is also a proponent of this approach and one of the most influential theorists in the field of dual-process theory. His theory will be explained at length.

A number of dual-process theories have developed over time. The scope of this paper doesn't allow for explaining all the theories in greater detail. As mentioned before, most of them reflect on the developments in their own field, but nonetheless each has something to contribute to one generic theory of dual processing. Some of the theories worth mentioning are certainly The Elaboration Likelihood Model of persuasion by Petty and Cacioppo (1986), Chaiken's (1980) Heuristic-Systematic Model of information processing, Sun's (2002) dual-process model of learning, Strack and Deutsch (2004) offered dual-process theory within the field of social psychology, and several others each of which contributing to the strengthening of the concept of dual-process theory in general.

One overarching theory to comprise all of them hasn't emerged yet but most of the researchers agree on the general principles it might consist of. Some of the most common characteristics representing both systems for which the overwhelming majority of authors agree are that System 1 is evolutionary old, shared with animals, unconscious or preconscious, high capacity, parallel, fast, automatic, intuitive, pragmatic, associative, pertains to implicit knowledge, it's contextualized and independent of general intelligence; System 2 is evolutionarily young, uniquely human, conscious, low capacity, sequential, slow, controlled, reflective, logical, rule-based, relates to explicit knowledge and is linked to general intelligence (Evans & Frankish, 2009).

Cognitive-Experiential Self-Theory

Cognitive-Experiential Self-Theory (CEST) proposes two fundamental information processing systems by which people operate: rational and experiential system (Epstein, 2003). It is a dual process theory that is characteristic in regard to other similar theories in its claims to be a broadly integrative theory in the global context of theory of personality and as such is compatible with many other theories in that field (Epstein, 2003). The author himself never hides the influence of Freud (Epstein, 1994) unlike many contemporary cognitive scientists which would like to distance themselves from psychoanalysis considering it discredited due to severe criticism (Evans & Frankish, 2009; Grünbaum, 1984; Macmillan, 1997). Furthermore, Epstein (1994) claims that CEST integrates the cognitive and the psychodynamic unconscious by assuming the existence of two parallel but interacting modes of information processing.

Epstein (2003) talks about three main assumptions of the cognitive-experiential self-theory that also provide integrative power with other theories (psychodynamic, learning, phenomenological self-theories and modern cognitive scientific views on information processing). The first states two conceptual systems, a preconscious experiential and a conscious rational system, by which people process information; the two systems can operate independently or interactively. Second assumption states that the experiential system is emotionally driven. The third assumption declares equality in importance of four basic needs that in other theories each are assumed as the one most important need.

The emphasis of the theory is certainly on the experiential system and thus the unconscious, since CEST doesn't introduce anything principally new about the rational system except maybe the degree to which it is under the influence of the experiential system, but the important point to be made here is that CEST's unconscious differs greatly in its conception from the one in psychoanalysis and how it operates (Epstein, 2003). Epstein points out that the term rational in rational system as used in CEST doesn't mean reasonableness as used in everyday life, but refers to a set of analytical principles.

Experiential system. Epstein (2003) has an evolutionary perspective on the experiential system in humans. According to him it is the same system that helped higher order animals to adapt to their environments. Not much of rationality was necessary for them to solve the problems they encountered, sophisticated learning from experience is satisfactory method to progress up the evolutionary scale. The main modus operandi of the experiential system is to be rapid, automatic, effortless, holistic, associative, nonverbal and not very demanding for cognitive resources while maintaining its functions unconsciously or in the realm of the preconscious. The experiential system encodes information in two ways, one could be called emotionally laden with memories of individual events and the other is more abstract way that marks the point where Epstein departs from Freud and joins the cognitive perspective, creating background for the cognitive unconscious to come to full light. But this is not a strict distinction between two subsystems, as previously mentioned in the second assumption the experiential system as a whole is emotionally driven; nonetheless it is a cognitive system.

As defined by CEST the experiential system both influences and is influenced by the affect. Slovic (2007) talks about affect heuristic as a concept of guiding judgment and decision

making and Kahneman (2011) considers it as probably the most important of the heuristics and where the heuristic research should go. Damasio (1994) in explaining his Somatic Marker Hypothesis argues that most of our thoughts comprise of images that are given certain emotional or affective *markers* that link them to somatic or bodily states, and these markers are used whenever needed to guide our behavior and the processes of decision making. Epstein (2003) thinks similarly that regardless of the valence, either pleasurable or not, these affects not only guide our behavior usually towards the more pleasurable direction, but they also engrave themselves into the cognition itself. Schwarz (2010) theorizes that people attend to feelings as sources of information, different types of feeling meaning different types of information. This certainly strengthens the cognitive in the cognitive unconscious as a system that is able to process complex information and guide not just our behavior but our thought process as well. In fact, the capacity of the unconscious system in comparison to the conscious rational system is hardly even comparable. The conscious system can only process 10-60 bits per second depending on the context while the unconscious system processes more than 11 million bits per second (Dijksterhuis, 2006). Epstein (2003) thinks that affect-free unconscious is untenable and without affect practically there is no experiential system, concluding that CEST is in fact as much emotional as it is cognitive theory.

Rational system. The rational system on the other side is in many aspects a pure antipode of the experiential according to CEST. It is conscious, deliberate, analytical, quite slow, effortful, affect-free and demands a large portion of the cognitive resources (Epstein, 2003). The rational system is capable for higher levels of abstraction and complexity, complex generalization and discrimination, cause-and-effect comprehension, long term delay of gratification, planning, using inference in line with people's understanding of rules of reasoning and evidence (Epstein, 2003). Evolutionary it is very young and Epstein thinks it has yet to prove itself, although it is the system that separates us from other higher animals and is the source of the progress human kind has made in science and technology. Furthermore, it can understand how the experiential system operates while the opposite is not true. In spite of these facts, Epstein (2003) thinks that the experiential system is superior since we can live only with it as animals prove, but having only the rational system at our disposal even the simplest decisions and behavior, like crossing the street, would be excruciatingly burdensome. Luckily, we don't

have to choose, but learn how to use them in a complimentary manner instead of trying to give more power to one or the other, usually favorising the rational system.

The Rational Experiential Inventory

The Rational Experiential Inventory (REI) used in this study is based on the Cognitive-Experiential Self-Theory (Epstein 1973; 2003) and has been mainly utilized in detecting individual differences in decision making styles resulting from the two cognitive information processing styles of thinking. Paccini and Epstein (1999) developed the actual version that was employed, REI – 40 or REI – revised, building on a previous version REI – 59 created by Paccini, Epstein, Denes-Raj and Heier (1996). The first version (REI – 59) had two scales, Need for Cognition (NFC) and Faith in Intuition (FI). The first scale (NFC) was based on a previously constructed Need for Cognition Scale by Cacioppo & Petty (1982) who aimed to assess the tendency for an individual to engage in and enjoy thinking, which was shortened and modified, while the FI scale was completely new. The designing purpose of these scales in REI was to assess the different cognitive information processing styles pertaining to decision-making as proposed by CEST, NFC for Rationality, and FI for Experientiality. In REI – 40, Paccini and Epstein (1999) added two subscales for each dimension. Namely, for NFC the two subscales were Rational Ability (RA) and Rational Engagement (RE) and for the FI scale Experiential Ability (EA) and Experiential Engagement (EE). RA refers to the ability to think logically and analytically, RA to the reliance on and enjoyment of thinking in an analytical and logical manner, EA refers to the ability with respect to one's intuitive impressions and feelings and EE to the reliance on and enjoyment of feelings and intuitions in making decisions (Paccini & Epstein, 1999). There is also a short form REI-10 and a version for adolescents REI – A which is being used by researchers (Marks, Hine, Blore, & Phillips, 2008).

Personality Traits

In order to understand personality in scientific terms, a nomenclature is needed as well as units of measurement and *traits* seem to be that special unit for personality psychology (Johnson, 1997). Allport (1937) considers them an omnipresent concept that no one questions as fundamental *dispositions* of personality. In his opinion, there are three types: Cardinal, Central and Secondary.

In a nutshell, traits are thought of as consistent patterns of thoughts, feelings or actions distinguishing people from one another (Johnson, 1997). Theorists claim that there are two different forms of traits: outer traits also known as behavioral or phenotypic which are directly observable and inner ones which are emotional and cognitive and are known as genotypic (Hogan, Johnson & Briggs, 1997). Whether genetically based or socially constructed, traits seem to be a very stable part of the personality. It is not very easy to define personality, thus the never-ending discussion about the scope of this field which produces almost as many definitions as there are personality psychologists. Burger (2011) defines it as ‘consistent behavior patterns and intrapersonal processes originating within the individual’. From researchers’ point of view, consistency is the most important part of either personality or the traits, otherwise they would just be elusive immeasurable concepts. When talking about traits Johnson (1997) points out that having a trait doesn’t mean that someone’s reactions are absolutely consistent, people can react consistently to same or similar situations but they can also respond differently in same situations and this behavioral inconsistency does not mean inner inconsistency, the important thing is the capacity to be influenced consistently by reliable situational cues.

Personality psychology can certainly be understood as field of psychology that is most concerned for individual differences and in the context of traits these differences can mean several things. They can be looked at as an attribute of the person and as such can be causal dispositions or categorical summaries or an attribute of the behavior as explanations of it or in predicting it in everyday life or in psychological assessment (Wiggins, 1999). From the point of view of assessment, some issues are of concern. The two main ones according to Johnson (1997) are: first, when we talk about genotypic or phenotypic traits what is or what should be the perspective, from the self or others; second, is trait measurement through questionnaires the right way. Pertaining to the first issue, people can directly experience their own inner traits, but an observer has to infer the inner traits of others and on the other side if outer traits are in the focus, people can directly observe other people’s outer traits but they must infer their own outer traits (Johnson, 1997). Some of the other problems concerning this issue are the controversy surrounding the assessment of unconscious traits, the defensiveness in self-assessment which hurts the measure, the common understanding of language since people might understand different things under the same statement and the validity of outer traits when assessed by an observer which is then valid almost by definition but when assessed by the actor it is

problematic. Pertaining to the second issue, it is questionable if personality assessment questionnaires measure phenotypic or genotypic traits and if different questionnaires measure different kinds of traits (Johnson, 1997).

The Five Factor Model

Usually, the researcher starts with a theory and conducts a study to examine it, but that wasn't the case with the Five Factor Model also known as the model of Big Five personality dimensions. In this case, it was reverse. Data came first, and once researchers noticed that traits cluster along certain points they isolated five dimensions and gave them appropriate names (Burger, 2011). Their names are Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism. In affirmative sense these traits for example for Openness relate to preference for variety and novelty, independence, invention, curiosity, intellect; Conscientious people tend to be orderly, efficient, organized, dependable, self-disciplined; Extraverts are outgoing, fun-loving, affectionate, energetic; Agreeableness relates to being friendly and compassionate, trusting, helpful; Neuroticism represents sensitive, insecure, worrying and self-pitying people (McCrae and Costa, 1986).

The story of Big Five perhaps starts in the 1930's when Thurstone (1934) used factor analysis on sixty adjectives common in describing people's characteristics and managed to find five common factors of intercorrelations between the adjectives that gave him enthusiasm to conclude that personality might not be so complex as to be unexplainable (Wiggins, & Trapnell, 1997).

Fast-forward to the 1990's and that is when Goldberg (1992) developed the version used in this study. He is a strong proponent of the lexical approach considering language as the main gateway through which the most significant or fundamental dimensions of human interaction may be revealed and thinks that linguistic analysis is able to reveal which phenotypical patterns are worthy of explanation (Wiggins, & Trapnell, 1997). With these views his is completely in line with Allport, Cattell, and the rest from this research tradition which is very much alive while other traditions and research endeavors are stagnant, low producing or discontinued. Goldberg builds on Norman's research in the 1960's when the latter developed a hierarchical classification using around 1600 trait descriptive terms grouped in subordinate semantic categories within the broader classes provided by the Big Five model (Wiggins, & Trapnell, 1997). Goldberg (1990)

used 1,431 trait adjectives grouped into 75 clusters for analysis in 3 studies in order to establish across-method generality of trait factor structures and in 10 replications based on different procedures of factor analysis found virtually identical structures emerging. His aim was to provide more adequate sets of factors than those Norman (1963) provided in his research and a comparison with the NEO Personality Inventory developed by Costa and McCrae (1985), a major alternative to the Big Five Markers, a task in which he succeeded (Goldberg, 1992). A version of Costa and McCrae's NEO-PI-R (1992) was also considered for use in this study, but the choice fell on the Big Five Markers inventory developed by Goldberg (1992) because it relies on lexical analysis of trait descriptive adjectives in natural language compared to the NEO inventory which is based on factor analysis of questionnaires. Another argument against Costa and McCrae's NEO PI-R was to avoid some of the items that might have been deemed as provocative by the participants (e.g. "Tend to vote for conservative political candidates") since the goal was to use a questionnaire which had items as culturally independent as possible.

Relevant Research

The first to administer both REI and Big Five were Pacini and Epstein (1999) which is very logical since they created REI. In their seminal paper they examine the new version of REI (REI – revised or REI 40), which is also used in the present study, against several other inventories. For Big Five they used NEO-FFI by Costa and McCrae (1989). The strongest relation of Rationality was found with Openness and Conscientiousness of the Big Five dimensions as well as strong inverse relation to Neuroticism and Agreeableness. The main purpose of their study was to test the new version of REI for which they concluded that is a significant improvement over the previous measures.

Witteman, van den Bercken, Claes and Godoy (2009) researched how the concepts of rationality and intuition are used in theories of dual cognition and the relation of the two information processing styles to personality characteristics. In two studies, they administered REI and Quick Big Five Inventory, to Dutch (N = 774) and Spanish (N = 141) samples of bachelor students respectively. They determined a clear independence of the two thinking styles as measured with REI and significant results for Conscientiousness as predictor for rational style preference and inverse predictor for the intuitive style in the large Dutch sample. Conscientiousness and Openness were found to be statistically significant in relation to

Rationality and Openness for Experientiality for the Spanish sample, but the predictive power was generally weak for this sample. Their general conclusion was that the two styles of dual processing are clearly distinct and cross-culturally valid and the preference for choosing either is reliably measured by the REI not just in United States but in Europe as well.

Reyna and Ortiz (2016) tested the REI's factor structure and internal consistency on Argentinian undergraduate students, since no previous research has done this in Latin American context but only in US and Europe. Also, they investigated the relation of REI's scales with the Big Five personality dimensions. The findings showed good internal consistency values for the two factors. In the context with personality dimensions, the only significant relation found in their sample was between Experiential information processing and Extraversion.

Björklund and Bäckström (2008) investigated the validity of the Rational Experiential Inventory in two studies on Swedish participants ($N = 203$ and $N = 72$), concluding that the test had satisfactory psychometric properties. In the first study they used confirmatory factor analysis to show that structural validity of REI is adequate. The investigations in the second study showed meaningful theoretical correlation of Rationality and Experientiality with some personality traits, demonstrating convergent and discriminant validity. An interesting finding from the second study was that Rationality was inversely related to the risky choice framing effect of the Asia Disease Problem, indicating concurrent validity according to the researches.

PilÁrik and Sarmány-Schuller (2011) aimed to research the predictive power of selected personality factors that are related to emotions in the decision-making process of 92 paramedics (40 male and 52 female, avg. age 29.9, $SD = 9.7$) relying on the theoretical background about emotional intelligence as modeled by Cooper and Sawaf (1997) and CEST by Epstein (2003). They found out gender specific predictors for appropriate decision making, in male paramedics that was emotional stability, extraversion and quick reactions in the Stroop test and for female paramedics two zones of emotional intelligence (low emotional awareness and positive current conditions) and quick reactions in the Stroop test. Their explanation for these results is in line with the gender specific expectations within the paramedic profession and the ability to resist negative emotions in the decision-making process.

Stiell et al. (2012) aimed to determine if emergency physicians regarded their clinical decisions as more rational or intuitive. They tested emergency physicians registered with the College of Physicians and Surgeons of Ontario ($N = 434$, response rate 46.9%) for this purpose

by using REI-40 sent out through postal mail. The sample was mostly men with more than 10 years of experience and median age 41-50 years. In general, the mean Rationality scores were higher than those for Experientiality, but for female respondents the mean experiential scores were significantly higher than those for male respondents. The researchers compared their results with those of Sladek et al. (2008) on New Zealand cardiologists sample (N = 72) concluding that they are very similar.

Jensen et al. (2016) examined decision-making styles of working paramedics (N = 904) and student paramedics (N = 268) by employing REI-40. Both groups showed significant favorability towards the rational decision making style.

McLaughlin, Cox, Williams and Shepherd (2014) investigated rational and experiential decision-making preferences of third-year student pharmacists by electronically administering the REI-40. The research showed that student pharmacists prefer rational decision-making over experiential decision-making. No significant differences were found in relation to gender and race, but younger student's scores (less than 30 years) on Rationality scale were significantly higher than those aged 30 years or older. The same group of researchers in a more recent study (2016) studied the relationship between student pharmacist decision making preferences and experiential learning. Williams, McLaughlin, Cox and Shepherd (2016) checked if the performance on advanced pharmacy practice experiences (APPEs) is associated with the different thinking styles and whether their preference will change following APPEs. They showed that the rational and experiential decision-making style doesn't change following immersion into APPEs but instead the preference for it is independent of the overall APPE performance.

The present study

Decisions made by medical professionals depend on their cognitive information processing style and the choice of that style in a given situation might depend on the personality traits of the person making the choice. That style can be rational, analytic and consciously driven or intuitive, heuristic and unconscious. CEST conceptualizes these styles as Rational and Experiential. The main goal of the present study is to show that at least some of the Big Five personality traits will have predictive power on Rationality, and also that some of the Big Five personality traits will have effect on Experientiality. Openness will have positive effect on

Rationality (H1). Conscientiousness will have positive effect on Rationality (H2). Extraversion will have positive effect on Experientiality (H3). Agreeableness will have positive effect on Experientiality (H4). Neuroticism will have positive effect on Experientiality (H5). The study doesn't assume that any of the personality traits will have significant negative effect.

Medical professionals tend to perceive themselves as rational thinkers and decision makers. The present study will try to demonstrate that medical professionals will have significantly higher scores on Rationality than on Experientiality (H6).

Methods

Participants

The recruitment lasted for a month and resulted in gathering a sample of size $N = 102$ participants, 78 doctors and 24 nurses of which 34 male (33.3 %) and 68 female (66.7 %). They were aged from 18 to 70 years (average 43.41 years, $SD = 11.92$). The range of years of experience was from 0 to 40 (average 16.66 years, $SD = 11.14$), where a value of 0 didn't mean no experience but under 1 year. The recruitment criterion for the participants of this within-subject study required that they are medical professionals (doctors or nurses) and have an active job, preferably with at least some experience. More than 80 medical institutions in Macedonia (public or private hospitals, clinics or private practices) were contacted via email, phone or in-person. Where available, if their email addresses were publicly accessible like for example on the institution website, doctors were contacted by personalized email messages explaining the study and asking for participation. The response rate was weak, but luckily the goal of obtaining at least 89 participants was reached which would account for 95% power of the study with medium effect size .15 and alpha error probability at .05 as calculated with G*Power software for two tails linear multiple regression analysis. The actual power reached was 97% for $N = 102$.

Materials

Big Five. There are several questionnaires used for measurement of the Big Five personality dimensions proposed by the Big Five Model. The Big-Five Factor Inventory (Appendix A) used in this study consists of 50 items comprised of easily readable short sentences that measure five dimensions: Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism. Originally, Goldberg (1992) uses Intellect instead of Openness

and Emotional Stability instead of Neuroticism. For each factor there are 10 items. The answers are given on a Likert type scale with values 1-5 (fully disagree, slightly disagree, neutral, slightly agree, completely agree). Cronbach's alpha reliability coefficients are $\alpha = .84$ for Openness' items, for Conscientiousness $\alpha = .79$, Extraversion $\alpha = .87$, Agreeableness $\alpha = .82$ and for Neuroticism $\alpha = .86$ for this version of the Inventory (Goldberg, 1992).

The items as well as a key used to calculate the score for each participant were provided by the International Personality Item Pool (IPIP) which is placed in the public domain, no written permission was necessary (Goldberg et al., 2006). The Macedonian translation (Appendix B) was made following *The ITC Guidelines on Adapting Tests*, second edition (2017).

REI. To measure individual differences in decision making depending on the cognitive style of information processing, the instrument used in this study was the Rational-Experiential Inventory - 40 items (REI-40 or REI-revised) as proposed by Pacini and Epstein (1999). The REI-revised (Appendix C) designing purpose is assessing preferences for information processing, mainly between two cognitive styles, analytical-rational on one side and intuitive-experiential on the other as proposed by the Cognitive-Experiential Self-Theory (CEST) which is the theoretical background for this inventory (Epstein, 2003). It consists of two scales that measure two main dimensions: Rationality and Experientiality. These two dimensions divide on two sub-dimensions, measured by two sub-scales. The Rationality scale divides on Rational Ability (RA) and Rational Engagement (RE) and Experientiality divides on Experiential Ability (EA) and Experiential Engagement (EE). Each of the subscales consists of 10 items, 20 items per dimension or 40 items in total. Participants ratings are on a 5 point Likert scale (fully disagree, slightly disagree, neutral, slightly agree, completely agree). Cronbach's alpha reliability coefficients for the scales of the main dimensions are for the Rationality scale $\alpha = .90$ and for Experientiality scale $\alpha = .87$. For the sub-scales Rational Ability $\alpha = .83$, Rational Engagement $\alpha = .84$, Experiential Ability $\alpha = .80$ and Experiential Engagement $\alpha = .79$. Epstein and Pacini (1999) also report for non-significant correlation between the Rationality and Experientiality scales, which in their opinion supports the first assumption of CEST that there are two independent interactive conceptual systems by which people process information, a preconscious experiential and a conscious rational system (Pacini & Epstein 1999; Epstein 2003).

The authors of the Inventory allow its full use for non-commercial research and educational purposes without seeking written permission (Pacini & Epstein 1999). The

Macedonian translation (Appendix D) was made following *The ITC Guidelines on Adapting Tests* second edition (2017).

Procedure

A custom made website and a custom made web program were created for the purposes of this study. The technological standards used are open source web design and web development platforms, PHP and MySQL for the core program and HTML 5, CSS 3, JavaScript for the web design. The content management system was set up on the internet domain psihotestovi.mk which provided very easy way to share the questionnaire.

Apart from the large screen version (Desktop PC, laptop etc.), an adapted small screen version for mobile devices was developed to provide better use of the platform and increase the user experience of the participants using Bootstrap web development techniques. Some of the participants that used mobile devices to fill in the questionnaire later commented about the ease of use and that it inspired them to share the questionnaire further, which justified this effort.

The questions were presented one by one (Appendix E) with the purpose of having the participants focus on the current item rather than wandering off or examining previous or succeeding ones. They could choose one of five alternatives on the Likert scale (Appendix E) they felt most comfortable with, spanning from completely disagree to completely agree from left to right on the screen, with the neutral alternative in the middle having partly disagree or partly agree on each of its sides. The choice was marked by clicking with the pointer on larger screens or touching the alternative on touch-screen mobile devices like smartphones and tablets.

On the right side of the screen (or on top for the mobile devices) there was a progress bar (Appendix E) with the item numbers where participants could not just follow their progress but by hovering on an item number see what their choice was for that particular item and if they had a change of heart by clicking on any of the questions they already marked they could get back and change their choice.

Upon starting with the questionnaire, on the first screen each participant was provided with the basic information about the study, stressing that it is anonymous and voluntary, and had to click agree to begin rating the items. Next, there were 10 demographic questions (age, level of education, years of experience, etc.) of which three items were not required (first and second name as well as contact information). After filling in the demographic data, the participant could

start with the inventories by clicking *begin*. The order of appearance for the questionnaire items was first the Big Five Inventory from 1 to 50 and then the Rational Experiential Inventory from 1 to 40 (51 – 90 on the screen) for the total of 90 items. The participant had to click *send* in order to send the questionnaire. After sending the data, a thank you note was displayed on the screen. Also, the program automatically calculated percentage values for the big five dimensions and it returned some basic interpretation of their meaning. This also served as an incentive for participation in the study. Judging from the feedback it motivated some of the participants to share the link for the questionnaire which means it served its purpose well. Sharing buttons for social networks were also provided. It took around 10 minutes on average to fill in the questionnaire.

The program stored the participants' data in a MySQL database from where it could be retrieved for analysis purposes. Since both the DMBS (Database Management System) and IBM SPSS software for statistical analysis have ODBC (Open Database Connectivity) capability the data could be transferred directly from the DMBS to SPSS. Besides the database, as a backup version, data document in .csv and .xls format was sent as an email message every time a participant finished with the questionnaire and clicked on *send*.

Worth mentioning is that, as a shortcut in order to make the analysis process easier, the software automatically calculated the values for the Big Five and REI dimensions for every participant based on their ratings on the Likert scales for the items of the questionnaire and stored them in the database from where they could also be retrieved for analysis when needed.

Ethical Considerations

The research that took place didn't harm any participant in any way, physical or psychological. All of the participants in the study were adults and they had to confirm first that they understand the nature of the study in order to participate in it and were clearly informed about the right to cancel their input at any time. The only thing that was asked from them was to rate the items of an online questionnaire that was completely voluntary and anonymous. A special care was taken in choosing inoffensive and as culturally independent items as possible. The inventories used are well-known, highly respected and standardized for the purposes implemented in this study. All of the ethical requirements on *Ethics of Research Involving Humans* were met and no complaints were received whatsoever.

Results

This research aimed to investigate if personality traits influence cognitive processing styles in medical professionals. Statistical analysis was conducted in order to prove or disprove this scientific hypothesis.

Demographics

The sample used for this study consisted of doctors and nurses ($N = 102$) of which the majority were doctors as shown in Table 1. Female participants comprised two thirds of the total number or 66.7 % while 33.3 % were male participants, the frequency distribution of Gender is also presented in Table 1.

Table 1

Frequency distribution of Gender and Medic Types

	Frequency	Percent	Cumulative Percent
Gender			
Male	34	33.3	33.3
Female	68	66.7	100,0
Total	102	100.0	
Medic Type			
Doctor	78	76.5	76.5
Nurse	24	23.5	100,0
Total	102	100,0	

The sample was relatively well distributed by age and experience in years as can be noticed in Table 2. The mean age was 43.41 years ($SD = 11.92$). The majority of the participants had work experience between 11 and 20 years as shown on Table 2 or close to one third of all of the participants. The mean for Experience for the whole sample was $M = 16.66$ ($SD = 11.14$).

Table 2

Frequency distribution of grouped data by Age and Experience in years

	Frequency	Percent	Cumulative Percent
Age			
Under 30	20	19.6	19.6
31 - 40	23	22.5	42.2
41 - 50	28	27.5	69.6
51 - 60	25	24.5	94.1
Over 60	6	5.9	100.0
Total	102	100.0	
Experience			
Under 5	22	21.6	21.6
6 - 10	12	11.8	33.3
11 - 20	33	32.4	65.7
21 - 30	20	19.6	85.3
Over 30	15	14.7	100.0
Total	102	100.0	

Descriptive Statistics

The Means, Standard Deviations as well as the Minimum and Maximum received as response from the participants for these variables is presented in Table 3. We can see that Conscientiousness and Agreeableness have the highest means in the Big Five set of variables, $M = 31.94$ ($SD = 5.56$) and $M = 31.00$ ($SD = 6.49$) respectively, while not much further away is Openness with $M = 29.93$ ($SD = 4.98$). From the REI set, Rationality has substantially higher value than Experientiality with $M = 3.88$ ($SD = .58$) over $M = 3.33$ ($SD = .65$). In the sub-scales of REI, Rational Ability has the highest mean with $M = 4.09$ ($SD = .65$) and the lowest is the one of Emotional Engagement with $M = 3.03$ ($SD = .7$). A paired-sample t-test was conducted to examine the preference for the two thinking styles. There was a significant average difference between the scores for Rationality ($M = 3.88$, $SD = .58$) and Experientiality ($M = 3.33$, $SD = .65$); $t(101) = 6.15$, $p = .001$.

Table 3

Descriptive Statistics of the Variables

	N	Mean	SD	Minimum	Maximum
Big Five					
Openness	102	29.93	4.98	16	39
Conscientiousness	102	31.94	5.56	12	40
Extraversion	102	21.75	7.67	1	37
Agreeableness	102	31.00	6.49	3	40
Neuroticism	102	19.52	8.36	2	37
REI					
Rationality	102	3.88	.58	1.7	5.0
RA	102	4.09	.65	1.2	5.0
RE	102	3.66	.65	2.2	5.0
Experientiality	102	3.33	.65	1.8	4.7
EA	102	3.63	.07	1.9	5.0
EE	102	3.03	.07	1.4	4.6
Demographic					
Age	102	43.41	11.92	18	70
Experience	102	16.66	11.14	0	40

Correlations

The main question in this study is whether the personality traits represented by the Big Five dimensions influence the cognitive processing information styles as measured by REI. The correlation between these two sets of dimensions certainly hints if this is the case or not. The results of the correlation analysis presented with Pearson r values are presented in Table 4.

Based on the results of this research Openness is very significantly correlated to Rationality $r(100) = .45, p < .001$. Separately for the sub-scales, the values are for Rational Ability $r(100) = .33, p < .001$ and Rational Engagement $r(100) = .47, p < .001$. Conscientiousness is also very significantly correlated to Rationality $r(100) = .37, p < .001$. For Rational Ability $r(100) = .41$ and a bit weaker for Rational Engagement $r(100) = .25, p < .05$. Both of these dimensions don't have that kind of influence on Experientiality. In that domain

Agreeableness is significantly related to Experientiality with $r(100) = .31, p < .001$ and separately for the sub-scales Experiential Ability $r(100) = .33, p < .001$ and Experiential Engagement $r(100) = .25, p < .01$. Worth mentioning is the relation of Neuroticism with one of the sub-scales of REI, the Rational Ability $r(100) = .21, p < .05$, although it is not correlated with Rationality as a whole and even has a negative direction, an insignificant one, for the other sub-scale of Rational Engagement.

Table 4

Correlations Between Big Five and REI Dimensions and Sub-Dimensions

	Rationality			Experientiality		
	Total	Ability	Engagement	Total	Ability	Engagement
Openness	.450***	.329***	.474***	.136	.111	.141
Conscientiousness	.367***	.409***	.246*	-.033	.053	-.114
Extraversion	-.081	-.029	-.116	.159	.138	.157
Agreeableness	-.127	-.106	-.121	.314***	.330***	.253**
Neuroticism	.108	.206*	-.012	-.148	-.098	-.176

Note: * $p < .05$ ** $p < .01$ *** $p < .001$ (2 – tailed); N = 102;

Multiple Regressions

Hierarchical multiple regression was performed in order to determine if Big Five Dimensions have predictive power on Rationality. For the purposes of the analysis, evaluation of the assumptions was performed. The ratio of participants to independent variables was in accordance with the assumptions necessary for the multiple regression analysis. The tests for normality, linearity and homoscedasticity of residuals were satisfactory, thus no transformation of variables on these accounts took place. Using the $p < .001$ criterion for Mahalanobis distance no outliers among the cases were found. Additionally, no missing data among the cases of N = 102 or suppressor variables were found. The Durbin-Watson test showed that the residuals are independent. The collinearity diagnostics showed no cause for concern about multicollinearity and singularity, all variables entered the equation without violating the default values for tolerance and VIF. After finalizing the evaluation of the assumptions a hierarchical multiple linear regression analysis was performed. Age, Gender and Experience were the variables to control for, and they were entered first. Next entered were the variables of main interest, the Big

Five. The summary of this two-step process resulting in obtaining two models for the hierarchical multiple regression procedure with Rationality as independent variable is shown on Table 5. No significant results for the control variables from Model 1 were derived. Model 1 explained just 1.1 % of the variance in Rationality and it wasn't significant. The very significant change in F ($\Delta F = 10.680$) at level of $p < .001$ showed that the Big Five variables entered in the second step significantly improved in explaining the variance of Rationality. That conclusion was even strengthened by the values of $R^2 = .37$ and R^2 change $\Delta R^2 = .36$, meaning that more than a third or 37% in the variance of Rationality was predicted by the personality trait factors $F(8, 93) = 6.88, p < .001$. The summary of Model 2 reflects this, showing strong significance $p < .001$, for Openness ($\beta = .446$) and Conscientiousness ($\beta = .330$) and somewhat weaker significance $p < 0.5$ in the opposite direction for Agreeableness ($\beta = -.199$).

Table 5

Summary of Hierarchical Regression Analysis for Variables Predicting Rationality

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	β
Constant	3.830	.296		1.723	.494	
Gender	.130	.132	.107	.063	.117	.052
Age	.000	.010	.010	-.002	.008	-.042
Experience	-.001	.010	-.020	.003	.009	.063
Openness				.052	.010	.446***
Conscientiousness				.034	.009	.330***
Extraversion				-.005	.007	-.061
Agreeableness				-.018	.009	-.199*
Neuroticism				.009	.006	.134
R^2		.011			.372	
F		.369			6.882***	
ΔR^2		.011			.361	
ΔF		.369			10.680***	

Note: * $p < .05$ ** $p < .01$ *** $p < .001$; $N = 102$;

Another hierarchical multiple regression analysis was performed, this time with Experientiality as dependent variable. The procedure was very similar as the previous for Rationality as DV. Prior to performing the analysis, evaluation of the assumptions was performed and deemed satisfactory. The introduction of Experientiality into the set of variables didn't seem to spoil the set in breaking the assumptions. First entry was Age, Gender and Experience and second entry the Big Five factors. The summary of the models for this hierarchical multiple regression is presented in Table 6. The first model explained 6.9% of the variation in Experientiality, but it wasn't significant. Model 2 showed some significant result $p < .05$ for Agreeableness ($\beta = .245$). The change in F ($\Delta F = 2.596$) was significant at level $p < .05$ meaning that the variables added in the second step significantly improved the prediction. Big Five variables accounted for explanation of 18.3 % of the variation in the independent variable ($F(8, 93) = 2.611, p < .5$).

Table 6

Summary of Hierarchical Regression Analysis for Variables Predicting Experientiality

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	β
Constant	3.875	.321		2.993	.630	
Gender	-.239	.143	-.176	-.120	.150	-.088
Age	-.016	.011	-.289	-.016	.011	-.287
Experience	.013	.011	.219	.011	.011	.191
Openness				.015	.013	.119
Conscientiousness				-.012	.012	-.103
Extraversion				.009	.009	.112
Agreeableness				.024	.011	.245*
Neuroticism				-.009	.008	-.119
R^2		.069			.183	
F		2.436			2.611*	
ΔR^2		.069			.114	
ΔF		2.436			2.596*	

Note: * $p < .05$ ** $p < .01$ *** $p < .001$; N = 102;

Discussion

Interpretation of the results

The main research question this study tried to answer was whether personality traits can have an effect on medical decision-making by influencing the choice of cognitive information processing styles, or personality has no significant role in it. The scientific hypotheses were investigated by measuring personality traits with the Goldberg's (1992) Big Five Factors Inventory and dual-processing styles with Epstein's (1999) Rational Experiential Inventory.

Based on the results, it is safe to say that some traits have significant influence on choosing between a more analytical or more intuitive way of thinking. Also, medical professionals seem to have a clear preference towards the rational in comparison to the experiential style of cognitive processing.

Some traits have a bigger say in influencing this choice. As expected, Openness and Conscientiousness definitely represent the largest pieces of the cake when influence on Rationality is at stake. Neuroticism also has its say but on one of the sub-dimensions on Rationality, namely the Rational Ability and not on Rationality in total as a composite dimension. This comes as somewhat of a surprise, since this dimension hasn't been mentioned as positive predictor for Rationality in previous research. Agreeableness and Extraversion showed reverse but not significant direction in influencing Rationality. Interestingly, these levels were reached in the study of Paccini and Epstein (1999).

On the other side, Agreeableness seems to be the only significant predictor for Experientiality. Friendly and compassionate doctors and nurses perhaps go with their gut, at least sometimes, when making medical decisions. This reminds us of the doctor from the example at the beginning, trying to save the boy's life. It would certainly fit in the mental sketch we can draw about his personality after reading the anecdote.

Openness is the trait that leads the way in predicting Rationality, significantly contributing in explaining the variance of this variable although not equally for the two sub-dimensions. It has a greater impact on Rational Engagement meaning that it can predict enjoyment in thinking in analytic manner more than the ability to think in the same way, represented by the Rational Ability sub-dimension.

Conscientiousness is next in line in predicting Rationality in total, but from the perspective of the sub-scales, the situations is somewhat reversed as for Openness. Conscientious medical professionals seem to have emphasized Rational Ability while Rational Engagement is present in a lesser degree judging from the lower value of the level of significance and the value of correlation.

It is not much of a surprise that highly intellectual people like doctors, with a sense of novelty and creativity, characteristic for the personality trait of Openness, which are also very organized and efficient manifesting Conscientiousness, would prefer the rational thinking style. They are perhaps the most wanted traits in the selection of medical students and later medical professionals. These attributes, depicting confidence in their rational capacity, are desired if not required by their patients, employers and society at large.

The Big Five dimensions as a set showed greater predictive power for Rationality of about 37% than for Experientiality, around 18%, meaning that personality traits influence the cognitive processing styles but are biased for the rational-analytic way of thinking.

Age, gender and the length of work experience play no significant role in influencing the choice of medical professionals on the thinking style when making a decision.

Connection with previous research

There is not much research that has been done in investigating the interaction of Big Five inventories with REI, and none of them uses Goldberg's Big Five Markers version. As for the sample, only one uses health care professionals, on Slovak paramedics (PilÁrik & SarmÁny-Schuller, 2011), while the choice for Big Five is NEO FFI. Paramedics are emergency medical technicians that are not trained in diagnostics or extensive medical care as the medical professionals used in the sample of the present study. In their study PilÁrik and SarmÁny-Schuller (2011), which has substantially different research design than this study, they group dimensions measured by different instruments in several factors. Clear interaction of REI and Big Five is not reported, but they mention Neuroticism and Extraversion as predictive factors in decision making of the paramedics. Neuroticism, as mentioned played a small part in this study, but extraversion showed to be insignificant predictor.

The first time REI-40 was administered (Paccini & Epstein, 1999) along with a Big Five Inventory, in that case NEO-FFI by Costa and McCrae (1989) and on a sample of undergraduate

students even more biased towards female participants than the sample of the present study, was in the study when this Inventory was developed. Paccini and Epstein (1999) reported very similar values for the correlation of Openness and Rationality of medium correlation and very strong significance. Slightly stronger correlation was found in this study of medical professionals but substantially stronger value for the correlation of Conscientiousness and Rationality in comparison with the mentioned study, very significant in both cases. Agreeableness was found to be significant predictor for the experiential style in both researches and Paccini and Epstein (1999) registered influence of Extraversion also, which was not detected in the present study.

Reyna and Ortiz (2016) also found some significant results for the predictive power of Extraversion on Experientiality in their study of undergraduate students, but obviously that connection wasn't made in this sample of medical professionals.

Witteman et al. (2009) found significant results for Conscientiousness as predictor for Rationality in the large Dutch sample, but not for Openness as this study. It was found along Conscientiousness in the smaller Spanish sample, but that one had generally weak predictive power. Nonetheless, the tendency is there and is concurrent with the present study of medical professionals.

This study showed a clear preference for the rational thinking style over the experiential. Previous research supports this finding. Stiell et al. (2012) demonstrated it on emergency physicians, Sladek et al. (2008) on cardiologists and Jensen et al. (2016) on working paramedics and student paramedics where both groups showed significant favorability towards the rational decision-making style. McLaughlin et al (2014) also support this, in their study of rational and experiential decision-making preferences of third-year student pharmacists where no significant differences were found in relation to gender. Unfortunately none of these studies investigated personality traits as predictors for the cognitive information processing styles.

Importance of the Study

There are few points of novelty that this study introduces. As mentioned, of the small number of studies investigating personality traits in interaction with dual-process thinking styles, no previous research has used Goldberg's (1992) version of the Big Five Marker Inventory. That measure of personality traits was built on the longstanding tradition of lexical approach in determining the fundamental personality traits unlike Costa and McCrea's effort which is based

on factor analysis of questionnaires. But, it is their NEO FFI versions that are predominantly used in the research designs relevant for this study. The importance in this sense is that using an Inventory based on adjectives used in common language as this study does pertains to the generalization of results that can be more easily achieved in that way.

Another novelty is the sample composition which comprises doctors and nurses, highly trained medical professionals. As already explained, the only other study that uses health professionals is that of PilÁrik and SarmÁny-Schuller (2011), but they used different research design and paramedics. Nurses are somewhat disregarded when composing samples of medical professionals, although they are usually highly trained and in many occasions the first responders and influencers in situations of medical decision-making, especially in emergency cases.

The location of the study is also a novelty point since no previous similar research has been done in Macedonia or in the region. This contributes to the generalization of future research endeavors done in similar research designs. Partially, it already does, pertaining to the part where preference for rational or experiential decision making styles on medical professionals were investigated (Sladek et al., 2008; Stiell et al., 2012; McLaughlin et al., 2014; Jensen et al., 2016), by confirming their findings.

The results of this study clearly show us that personality traits can be a predictive factor in medical-decision making styles. This is true without a doubt for the traits of Openness and Conscientiousness in the context of the rational analytic way of thinking and also Agreeableness for the more intuitive and heuristic approach towards decision making. These findings should certainly be presented to medical professionals as knowledge about how they make the decisions in their workplace. This knowledge can be applied in the process of education for the new medical students in adjusting both the way they are taught and how they apply their training afterwards. Dual process theory claims no precedence for the cognitive processing systems, although Epstein (2003) clearly has a preference, and medical students should learn how to employ their experiential system more, since the results show clear preference in the other direction, for the rational thinking style. The analytic conscious cognitive system has the capacity of processing 60 bits of information per second, and the unconscious intuitive system closely to 12 million of bits of information (Dijksterhuis, 2006). Doctor's should understand that going with their gut, is not choosing the inferior but as many authors would agree (Epstein, 2003; Dijksterhuis, 2006, Gigerenzer 2007, Gladwell 2005) the superior cognitive mechanism. It is not

a dangerous method, but something that can actually save lives. We can only imagine that if the specialists from the example in the beginning had more profound knowledge about the psychological principles governing dual-process decision making they would've allowed the young doctor to continue with his treatment and the story would have a happy ending.

Limitations and directions for further study

As in every study that uses self-reporting questionnaires, the honesty of those self-reporting and their insight, ability to properly assess what is demanded by the items in the inventory is questionable. Luckily the inventories used have high levels of validity and reliability (Paccini & Epstein, 1999; Goldberg, 1992; Björklund & Bäckström, 2008; Witteman et al., 2009; Reyna & Ortiz, 2016). However, that can never change the insight achieved by an experimental setting where the dimensions of need for the research can be assessed without the filter of the participants.

The sample used in this study was sufficient for the statistical analysis performed, but a larger sample would probably be more informative. Also, a more balanced sample in relation to the gender of the participants would be a better way to go, although it would not be a guarantee for different results as it didn't show to be very influential in this study. A case in point is the present sample which was well balanced in distribution of Age and Experience but they didn't show to be influential variables in the general results. Different versions of the inventories measuring the dimensions researched in this study or different measures altogether for these dimensions would be an interesting variation to use and check the stability of the results.

Determining whether there is an influence of the personality traits on thinking styles was the aim of this study but also understanding the mechanisms it happens in the context of dual-process theory is of no lesser importance. Further clarification should be achieved with experimental designs in settings of cognitive neuroscience as well as simulation experiments. In that sense a similar study with expanded design allowing for support of fMRI data of the brain areas used in the process of the actual medical decision-making might show to be very informative.

People are not some mythical cognitive superheroes with limitless capacity that can process all the necessary data using impeccable logic in real time. Software based expert systems can do that better and faster. The revelation of this and similar studies can be used as background

knowledge in designing modern AI based Medical Expert Systems for decision-making. This study could motivate software designers to create not only systems based on normative logic, but on multivariate and fuzzy logic as well in order to simulate the mechanisms of the experiential, intuitive cognitive processing system. In situations where you don't have access to medical staff, and have medical issues, this can show to be of utmost importance. Imagine you are on a mission on Mars or exploring the darkest arias of this planet or any situation for that matter where the only thing you have is the Medical Expert System on your computer. Normative knowledge based on formal logic can only go so far. In novel situations you need different, heuristic approach, that has shown to be of great importance in modern AI endeavors and this should certainly be a direction to go.

Conclusion

This study uses sample of medical professionals, but as previous research shows the results are concurrent in great deal regardless of profession. Maybe the level varies. It demonstrates that personality traits, at least some of them, have predictive power on the preference for cognitive information processing that leads to decisions we all make in the course of our lives. This should generate an interest in everyone to at least inform themselves about the result of this study and how it was achieved and in the context of psychology hopefully provides another piece of the puzzle in explaining the modus operandi of dual-processes in relation to personality. We have been or will be at some point faced with a serious medical decision and it certainly helps to know the mechanisms and tendencies in reaching that decision. It is maybe even more important for the medical professionals themselves. In conclusion, personality traits as defined by the five factor model, or in particular Openness, Conscientiousness and Agreeableness were shown to have some influence on the rational and experiential cognitive information processing styles medical professionals use when making their decision.

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Appendix A

Big Five Factors Inventory Items (Goldberg, 1992)

1. Am the life of the party.
2. Feel little concern for others.
3. Am always prepared.
4. Get stressed out easily.
5. Have a rich vocabulary.
6. Don't talk a lot.
7. Am interested in people.
8. Leave my belongings around.
9. Am relaxed most of the time.
10. Have difficulty understanding abstract ideas.
11. Feel comfortable around people.
12. Insult people.
13. Pay attention to details.
14. Worry about things.
15. Have a vivid imagination.
16. Keep in the background.
17. Sympathize with others' feelings.
18. Make a mess of things.
19. Seldom feel blue.
20. Am not interested in abstract ideas.
21. Start conversations.
22. Am not interested in other people's problems.
23. Get chores done right away.
24. Am easily disturbed.
25. Have excellent ideas.
26. Have little to say.
27. Have a soft heart.
28. Often forget to put things back in their proper
29. Get upset easily.
30. Do not have a good imagination.
31. Talk to a lot of different people at parties.
32. Am not really interested in others.
33. Like order.
34. Change my mood a lot.

35. Am quick to understand things.
36. Don't like to draw attention to myself.
37. Take time out for others.
38. Shirk my duties.
39. Have frequent mood swings.
40. Use difficult words.
41. Don't mind being the center of attention.
42. Feel others' emotions.
43. Follow a schedule.
44. Get irritated easily.
45. Spend time reflecting on things.
46. Am quiet around strangers.
47. Make people feel at ease.
48. Am exacting in my work.
49. Often feel blue.
50. Am full of ideas.

Appendix B

Big Five Factor Markers Inventory Items – Macedonian Translation

1. Сум тој што и дава живост на забавата
2. Не чувствувам многу грижа за другите
3. Секогаш сум подготвен/а
4. Лесно запаѓам под стрес
5. Имам богат речник
6. Не зборувам многу
7. Ме интересираат луѓето
8. Насекаде оставам мои нешта
9. Опуштен сум во најголем дел од времето
10. Имам потешкотии да разберам апстрактни идеи
11. Се чувствувам удобно меѓу луѓе
12. Навредувам луѓе
13. Обрнувам внимание на детали
14. Се грижам за работите
15. Имам бујна фантазија
16. Се држам во позадина
17. Сочувствувам со чувствата на другите
18. Креирам хаос од нештата
19. Ретко се чувствувам тажно
20. Не ме интересираат апстрактни идеи
21. Ги започнувам разговорите
22. Не ме интересираат проблемите на другите луѓе
23. Веднаш ги извршувам обврските
24. Лесно ми попречува нешто во активноста
25. Имам одлични идеи
26. Имам малку што да кажам
27. Имам меко срце

28. Често заборавам да ги ставам нештата на свое место
29. Лесно се вознемирувам
30. Немам добра фантазија
31. Зборувам со многу различни луѓе на забавите
32. Не сум вистински заинтересиран за луѓето
33. Сакам ред
34. Многу го менувам расположението
35. Брзо ги сфаќам работите
36. Не сакам да привлекувам внимание
37. Одделувам време за другите
38. Ги избегнувам обврските
39. Имам чести промени во расположението
40. Користам тешки зборови
41. Не ми пречи да сум во центарот на вниманието
42. Ги чувствувам туѓите емоции
43. Следам распоред
44. Лесно се иритирам
45. Поминувам време размислувајќи за работите
46. Тивок сум меѓу непознати
47. Ги ослободувам луѓето од напнатоста
48. Строг сум во работата
49. Честопати се чувствувам тажен
50. Полн сум со идеи

Appendix C

Rational Experiential Inventory Items (Paccini & Epstein, 1999)

1. I have a logical mind.
2. I prefer complex problems to simple problems.
3. I believe in trusting my hunches.
4. I am not a very analytical thinker.
5. I trust my initial feelings about people.
6. I try to avoid situations that require thinking in depth about something.
7. I like to rely on my intuitive impressions.
8. I don't reason well under pressure.
9. I don't like situations in which I have to rely on intuition.
10. Thinking hard and for a long time about something gives me little satisfaction.
11. Intuition can be a very useful way to solve problems.
12. I would not want to depend on anyone who described himself or herself as intuitive.
13. I am much better at figuring things out logically than most people.
14. I usually have clear, explainable reasons for my decisions.
15. I don't think it is a good idea to rely on one's intuition for important decisions.
16. Thinking is not my idea of an enjoyable activity.
17. I have no problem thinking things through carefully.
18. When it comes to trusting people, I can usually rely on my gut feelings.
19. I can usually feel when a person is right or wrong, even if I can't explain how I know.
20. Learning new ways to think would be very appealing to me.
21. I hardly ever go wrong when I listen to my deepest gut feelings to find an answer.
22. I think it is foolish to make important decisions based on feelings.
23. I tend to use my heart as a guide for my actions.
24. I often go by my instincts when deciding on a course of action.
25. I'm not that good at figuring out complicated problems.
26. I enjoy intellectual challenges.
27. Reasoning things out carefully is not one of my strong points.
28. I enjoy thinking in abstract terms.

29. I generally don't depend on my feelings to help me make decisions.
30. Using logic usually works well for me in figuring out problems in my life.
31. I think there are times when one should rely on one's intuition.
32. I don't like to have to do a lot of thinking.
33. Knowing the answer without having to understand the reasoning behind it is good enough for me.
34. Using my gut feelings usually work well for me in figuring out problems in my life.
35. I don't have a very good sense of intuition.
36. If I were to rely on my gut feelings, I would often make mistakes.
37. I suspect my hunches are inaccurate as often as they are accurate.
38. My snap judgments are probably not as good as most people.
39. I am not very good at solving problems that require careful logical analysis.
40. I enjoy solving problems that require hard thinking.

Appendix D

Rational-Experiential Inventory – Macedonian Translation

1. Имам логички ум
2. Преферирам сложени наспроти едноставни проблеми
3. Верувам во моите претчувства
4. Не размислувам многу аналитички
5. Им верувам на моите први импресии за луѓето
6. Се обидувам да избегнам ситуации кои бараат длабоко мислење за нешто
7. Сакам да се потпирам на моите интуитивни впечатоци
8. Не расудувам добро под притисок
9. Не сакам ситуации во кои морам да се потпрам на интуицијата
10. Напорното и долго мислење за некоја работа ми дава мала сатисфакција
11. Интуицијата може да биде многу корисен начин за решавање проблеми
12. Не би сакал да зависам од личност која себеси се опишува како интуитивна
13. Ги сфаќам работите на логички начин многу подобро од повеќето луѓе
14. Обично имам чисти, објасниви причини за моите одлуки
15. Не мислам дека е добра идеја човек да се потпре на интуицијата при носење на важни одлуки
16. Размислувањето не е моја замисла за активност во која уживам
17. Не ми претставува проблем ако треба внимателно да размислам за работите
18. Кога се работи за доверба во луѓето, обично им верувам на претчувствата
19. Обично можам да осетам ако некој е во право или не, дури и да не можам да објаснам како го знам тоа
20. Учењето нови начини на размислување многу би ме заинтересирало
21. Речиси никогаш не грешам кога си ги слушам најдлабоките претчувства кога треба да најдам одговор
22. Мислам дека е будалесто да се носат важни одлуки врз база на чувствата
23. Се поведувам од срцето како водич за моите постапки
24. Честопати се потпирам на моите инстинкти кога треба да решам како да постапам

25. Не сум многу добар при решавање на комплицирани проблеми
26. Уживам во интелектуални предизвици
27. Внимателното обмислување на работите не ми е јака страна
28. Убаво ми е кога размислувам во апстрактни поими
29. Вообичаено не зависам од помошта на моите чувства при носењето важни одлуки
30. Употребувањето логика обично добро ме служи при решавањето на проблемите во мојот живот
31. Мислам дека постојат околности кога човек треба да се потпре на својата интуиција
32. Не сакам да треба многу да размислувам околу нешто
33. Знаењето на одговорот е доволно добро за мене па макар и да не го разбираам објаснувањето кое стои зад него
34. Потпирањето на претчувствата при решавањето на проблемите во мојот живот обично добро ме служи
35. Немам многу добар осет за интуиција
36. Ако се потпирам на моите претчувства, честопати ќе правам грешки
37. Сметам дека моите претчувства се исто толку често неточни колку што се и точни
38. Моите брзи заклучоци веројатно не се толку добри колку што се на повеќето луѓе
39. Не сум многу добар при решавање на проблеми кои изискуваат внимателна логичка анализа
40. Уживам во решавање на проблеми за кои се бара напорно размислување

Appendix E

Screenshot of the user interface view of the Questionnaire



Figure 1. Screenshot of the user interface view of the Questionnaire, illustrating the parts on the screen used for: 1.Item position, 2.Likert scale, and 3. Progress bar.