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Cognitive Style, Time Pressure and Additional Information as Influential Factors in the Decision-Making Process: an experimental study

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1. INTRODUCTION

The accumulation of research in applied social sciences shows that there is no way to neglect subjective factors and different cognitive styles in decision making (Alves et al., 2021; Phillips et al., 2016; Sincorá, 2022, 2021). When studying the behavioral perspectives of decision-making (Simon, 1987), it is observed that cognitive aspects can also affect the behavior of the agents involved in the decision-making process (De Neys, 2018). Thus, in order to understand the respective influence on the cognitive dimension, the Dual Process Theory (TPD) is the foundation that lays the foundations for this current discussion (Kahneman, 2011). In dual process models, intuitive decision-making processes (Type 1) are typically characterized as fast, automatic, effortless, and emotional; whereas deliberative decision-making processes (Type 2) are characterized as being slower, more controlled and more laborious (Thompson & Markovits, 2021).

It is noted that several experimental manipulations were conducted to study how the cognitive processing of individuals affects their behavior in decision making in scenarios involving choices, and one of them referred precisely to the manipulation of time in decisions (Crescenzi et al., 2021); Letmathe & Noll, 2021). Other studies applied tasks that addressed the analysis of information made available during the decision-making process (Fehrenbacher et al., 2018; Luft et al., 2016). In this way, the latent interest of the scientific community in the variables "time" and "information" in recent developments in decision theory can be perceived (Sincorá & Oliveira, 2022).

Lohse, Simon and Konrad (2018) mention that the impact of time constraints on decision making has only recently emerged as the focus of economic research. In this way, time is evidenced as an important resource, both for organizations and for society in general, stimulating the use of time-saving technological devices and processes, with a view to increasing productivity and the performance of human activities (Škerlavaj et al., 2018). Therefore, it is clear that time is a factor considered critical and incorporated in all human activities, becoming increasingly important for individual and business decision-making (Letmathe & Noll, 2021).

Regarding information, it is seen as raw material for all stages of the decision-making process – intelligence, conception, selection and implementation (Tang & Liao, 2021). Specifically, financial instruction information, conceived as a form of knowledge, is essential for making sound financial decisions and, among other things, optimizing both organizational and personal financial well-being (Sunderaraman et al., 2020). Moreira Costa, De Sá Teixeira, Cordeiro Santos, and Santos (2021) argue that financial literacy has become a highly relevant need, not only because individuals now live in a world where they have to make more such decisions, but also because they seem to be extraordinarily ill-prepared for it (Lusardi & Mitchell, 2014). Thus, it is understood that the more useful and relevant such information is and, at the same time, available in the decision-making context, the greater the chances that the individual will satisfactorily conduct their choices.

However, based on the literature review undertaken, it was observed that empirical research does not specifically address the effects of time pressure and the values generated by information on

managerial decisions (whether strategic, tactical or operational) (Bon & Broersen, 2017; Sharma et al., 2014; Sincorá & Oliveira, 2019), especially when comparing the behaviors of cognitively more reflective individuals and cognitively less reflective individuals – this still seems to be unclear in the literature. Therefore, the present study is thus focused on individual differences in cognitive styles, given the suspicion that its investigation helps to explain human peculiarities in decision-making.

In this way, based on the motivations presented, research in this area becomes necessary, as it could minimize the *gap* between theory and practice, as well as provide new *insights* and knowledge about the influence of the role of time pressure and additional information from financial instruction in decision-making processes carried out by cognitively more reflective and less reflective individuals, thus contributing to advancing the field of theoretical study, without forgetting the consequent practical contributions. Therefore, this research directs efforts to answer the following question: **Is there a difference in the influence of time and information on the performance of individuals, when comparing the decision-making process of those who are more cognitively reflective in relation to those who are cognitively less reflective?**

Based on these purposes, therefore, a study with an experimental approach was carried out, involving a 2x2 factorial design (Field & Hole, 2003), which aimed to measure the effects of the relative influence of time pressure and additional information on decision-making performance individuals participating in the research, considering their level of cognitive reflexivity. The relevance of this proposal, in turn, is based on the perception of the latent need to deepen investigations that deal with the psychological characteristics of decision-makers, especially because of the difficulty in measuring characteristics linked to human cognition (Ackerman & Thompson, 2017).

2. DEVELOPMENT OF HYPOTHESES AND RESEARCH MODEL

Regarding the influence of time pressure and additional information, in the decision-making process of cognitively more and less reflective individuals, it appears that several researchers assume that performance variations in the Cognitive Reflection Test (CRT) - used to understanding the level of reflexivity of thought –, can be taken as a way of detecting whether an individual has a cognitive inclination to solve problems and make decisions in a predominantly less reflexive way (based on Type 1 processing), or if he has a predominantly more reflexive cognitive bias (based on Type 2 processing) (Alós-Ferrer et al., 2016; Frederick, 2005; Sinayev & Peters, 2015; Thomson & Oppenheimer, 2016; Toplak et al., 2011). Furthermore, they agree that the performance of individuals shows possible differences in terms of the ability to detect and correct incorrect intuitions – the core of the Dual Process Theory, within a standard interventionist perspective.

Furthermore, with the accumulation of research over the years, it has recently been discovered that the CRT is primarily a measure of numerical capability, and that this numerical capability makes the CRT able to predict better decisions. This is because, in order to correctly answer the three test items, the individual needs to have the knowledge to use the proper equation, be able to subtract, multiply and divide and, perhaps most importantly, know which operation is appropriate. If the number skill is not high enough, then an intuitive error is likely to arise (Sinayev & Peters, 2015).

The theoretical discussion of Cognitive Reflection has been linked to the Dual Process Theory and normative patterns of decision making (Frederick, 2005), in particular because CRT is believed to monitor the intuitions generated by Type 1 processes in such a way that, if cognitive reflection is high enough, intuitive errors will be detected by Type 2 processes, and the problem will be solved (Sinayev & Peters, 2015).

Therefore, it is understood, from the Dual Process Theory, that individuals who tend to have high cognitive reflection will be those called cognitively more reflective (or analytical), as they often engage in choice processes employing "reflective reasoning"; while individuals called cognitively less reflexive will often incur "automatic reasoning", subject to heuristics and biases in their choice processes. Therefore, based on the assumption that the behavior of more reflective and less reflective individuals clash in the decision process, and that, at the same time, everyone is cognitively limited – due to their limited rationality (Simon, 1955, 1987) –, understanding how these differences in behavior are configured when affected by time and information seems to be reasonable for a more specific understanding of the current decision-making phenomenon. Thus, the first general hypothesis of the research is postulated:

H1. *More reflective individuals and less reflective individuals are affected in different ways by time pressure and additional information in the decision-making process.*

In this line of argument, regarding the influence of the time variable, an important factor that affects people's control over their cognitive processes is precisely time pressure. (Ordóñez et al., 2015). However, in the absence of the obligation to perform a task in a rushed manner, people will exercise greater control over their own processing system in order to maintain the quality of performance (Buckert et al., 2017; Gazdag et al., 2018; Kirchler et al., 2017; Lallement, 2010). However, in the face of the pressure that is exerted – usually when high – , it is observed that the individual may not be able to continue to adequately control the processing of their information, culminating in a possible drop in performance (Hahn et al., 1992). So when the decision is difficult and deadlines are tight, people are encouraged to speed up their deliberations because "there isn't much time," leading to lower performance. Furthermore, when time becomes restricted and conservative, the decision maker tends to "cut" his thinking, leading him to a situation of "cognitive closure" (Wright, 1974), thus inducing the use of processes of the Type 1 (less reflective).

While moderate time pressure leads to a more focused and committed collection of relevant information (Payne et al., 1996), and improvements in performance can even be observed, these, in turn, are explained by the variable commitment during the execution of the task. decision-making process. Thus, the more difficult a task becomes (up to a point), the more an individual or group can commit to solving it (Smith & Hayne, 1997). Within this logic, there are theorists who bet on the positive effects of time pressure (Isenberg, 1981; Kelly & Karau, 1999), recognizing that it is responsible for increasing the motivational effect in achieving a given objective. Thus, sometime pressure or time constraint (i.e., an explicit deadline) can be beneficial for task performance (Locke & Latham, 1984), mainly because it supposedly stimulates greater focus, concentration and effort in decision makers. Other studies of the relationship between performance and time pressure indicate an inverted U-shaped function, in which a low to moderate increase in pressure is associated with a better performance or work rate; but an increase in time pressure, beyond some limits, is associated with a decline in performance (Mann & Tan, 1993).

In view of the discussion undertaken, it is valid to reflect that, under high time pressure, both more reflective individuals and less reflective individuals will drastically reduce the amount of information processing, culminating in inferior (bad) performances within the two groups of profiles cognitive. While, under moderate time pressure, it is suspected that more and less reflective individuals will be able to achieve positive performance results, although it is suspected that only the most reflective will strive for this.

Thus, based on the evidence from the theoretical body, it is possible to assume that individuals who tend to be cognitively more reflexive (analytical) in their choice processes, up to a certain (moderate) level of pressure, the motivational effect and the attentional focus caused by it will stimulate the individual to fulfill his task, striving for good results, from the use of Type 2 processes - characterized by being controlled, deductive and slow. However, it is assumed that cognitively less reflective individuals, even under conditions of low to moderate intensity time pressure, will have a lower performance, given that the temporal restriction will probably reinforce the cognitive characteristics of information processing in this group, which, in turn, is normally based on automatic, effortless, associative, affective and quick reasoning, which can result in unfounded perceptions on the decision-making context. Therefore, the first secondary hypothesis is inaugurated:

H1a. *Cognitively more reflective individuals, when affected by time pressure, tend to have a better decision-making performance when compared to cognitively less reflective individuals.*

However, regarding the influence of the variable additional information on the decision-making process, it appears that financial instruction information seems to be fundamental to facilitate the process developed by the individual to reach a satisfactory result (Carpena & Zia, 2020; Cude et al., 2020; Dundure & Sloka, 2021; Heinrich & Schwabe, 2018; Hong et al., 2020; Johnson & Premila, 2017; Lusardi, 2019; Sunderaraman et al., 2020). Experimental studies reveal that the provision of information contributes to the quality of the decision, since the appropriate provision of information about the problem tends to result in a better quality of the solution (Mayer et al., 1997).

In this way, it is reflected that the presentation and management of an adequate (and/or balanced) amount of information can empower the individual to increase the quality of his performance and his choices, since decision-making performance is the result of processing human information. According to the experimental study by Hahn, Lawson and Lee (1992) , when the decision-making scenario involves a relatively low informational load and provides additional relevant information, the subject's performance on the task tends to improve, since the capacity of the cognitive system – such as attention and working memory (Toreini & Langner, 2019) – do not be challenged. In terms of Connolly and Thorn (1987), effective general performance in judgment tasks generally involves both the acquisition of information and the integration of acquired information. Iselin (1988), in turn, states that the provision of information affects the accuracy of judgment, providing *insights* into how to improve the performance of decision-making processes. In this way, the set of findings converge to a linear relationship between the additional information provided and the quality and performance of the decision.

However, Pröllochs et al. (2018) states that, although traditional behavioral theories suggest that agents seek as much information as possible to make an informed decision, recent studies indicate that humans can also be motivated to avoid acquiring additional information. This is because: (i) information can threaten cherished and rooted beliefs about oneself, others or the world; (ii) the information may require unwanted changes or actions; and (iii) the information or the decision to learn the information can lead to negative emotions, generating a potentially unpleasant emotional response (Sweeny et al., 2010). These human characteristics become even more salient in financial contexts, where information made available in the form of news, reports or instructions is intended to serve as an important basis for making financial decisions. McCormack and Trkman (2014), however, clarify that the decision maker must always view data and information as an asset, a resource, which can and deserves to be transformed into an advantage in different domains, including decision-making (McCormack & Trkman, 2014).

In general, it is understood that the information load positively impacts the performance results of decision-making processes, especially in the case of a context "free" of time pressure. Therefore, when time is not constrained (i.e., absence of time pressure), it is assumed that individuals can make better use of the information resource available and, when such information is cognitively processed by a more reflective, characteristically controlled, effortful reasoning, deductive and slow, the individual probabilities of achieving positive performance results are potentially greater, depending on the use they make of this information. Whereas, when such data and information are not taken into account - in part or in their entirety -, due to the involvement of the individual in processes based on perceptions, personal impressions, quick and effortless judgments, or even the fragility of their Type 2 deliberative processes (low analytical capacity), being unable to detect inconsistencies and/or errors through the adoption of intuitive processing (Type 1), the probability of generating inferior performance results is greater. That said, the second secondary research hypothesis is outlined:

H1b. *Cognitively more reflective individuals, in the presence of additional information, tend to have a better decision-making performance when compared to cognitively less reflective individuals.*

Now, when the joint influence of time pressure variables and additional information on the decision-making process of more and less reflective individuals is evaluated, some peculiar aspects are verified.

As shown in the literature is summarized as an overload information effect likely to emerge through the interactions between the time constraint and the information that is made available during the decision-making process (Hahn et al., 1992). Time pressure, in turn, seems to act as a double-edged sword. Although its presence seems necessary to provoke some effect of information overload, inducing the realization of more intuitive decision-making processes; it can also improve decision quality by motivating the decision maker to put effort into his process of choosing and searching for information (Mann and Tan, 1993).

On the other hand, in particular, under moderate time pressure and in the presence of a useful and balanced information load, it is suspected that, in this scenario, the individual finds favorable conditions to improve the quality and performance of his decision, given that, in addition to the

moderate level of time pressure, motivating the decision maker to make an effort in his choice process (Hahn et al., 1992) and leading to a more focused and committed collection of information (Payne et al ., 1996), the provision of additional relevant information provides an opportunity for "informed decision-making" (Heinrich & Schwabe, 2018; Wilson et al., 2014), culminating in the reduction of uncertainty and empowering the decision maker in his choice process, favoring individual decision (Letmathe & Noll, 2021; Luft et al., 2016). In view of this, it is reflected that an individual operating from a high cognitive reflection processing (Type 2) will obtain a superior performance than one who operates through a low cognitive reflection processing (Type 1).

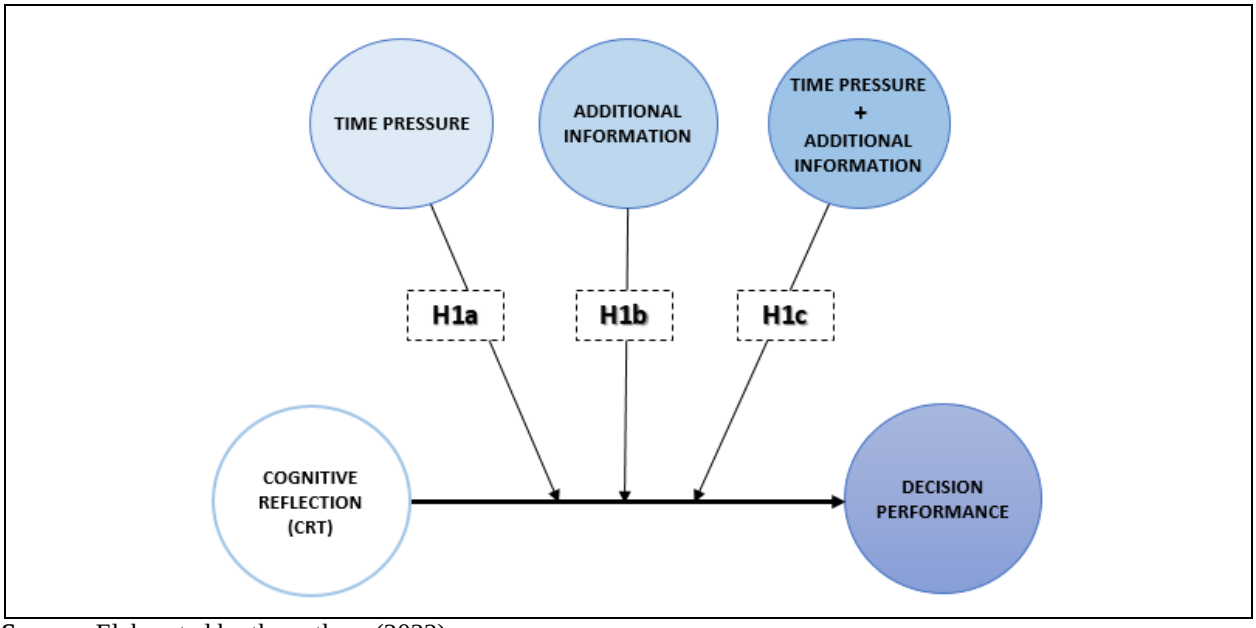
That said, it follows that it is only under conditions of no time pressure, or pressure at moderate levels, that decision makers will be able to continue to make good use of the additional information, at least within the limits of their bounded rationality (Hahn et al., 1992; Simon, 1955, 1987). In this scenario, therefore, of simultaneous interaction between time and information, it is conjectured that predominantly more reflective individuals will seek to maintain an analytically oriented and committed behavior in their decisions, given the time available, generating positive performance results, since who, when presenting a high level of cognitive reflection, are more likely to employ strategies and processes that generate normatively correct responses, that is, through Type 2 processes, especially in contexts involving numerical and financial variables (Moreira Costa et al., 2021).

As for less reflective individuals, lower performance results are expected, given the recognized absence or low systematic use of information made available to the decision-making process, due to the reduced cognitive effort employed (Kahneman, 2011); or even because they usually speed up reasoning during the course of deliberation, culminating in seeking and using less available data, focusing only on the characteristics that they deem to be most relevant (Rieskamp & Hoffrage, 2008). Therefore, the third and final secondary hypothesis of the research is proposed:

H1c. *Cognitively more reflective individuals, when simultaneously affected by time pressure and in the presence of additional information, tend to have a better decision-making performance when compared to cognitively less reflective individuals.*

After the aforementioned discussion, it is understood that the articulated literature provides conceptual justification for the proposition of the respective theoretical model (Figure 1), below:

Figure 1 - Research model and theoretical hypotheses



Source: Elaborated by the authors (2022).

3. METHOD

3.1 Participants

Initially, 532 participants were part of the total study sample. However, as it was necessary to separate the database from the cognitive profile presented by the individuals, 222 subjects classified as more reflective and 210 as less reflective were obtained, distributed in four experimental groups - in the following subtopics the statistical calculation that provided the basis for the definition of this categorization. At the end - after processing the data - the sample consisted of 521 participants, who were undergraduate university students, members of a public university community in southeastern Brazil (covering all courses, shifts, periods and *campuses* of the institution), that responded to a decision-making scenario built especially to meet the research objectives. The choice to study university students is justified by the fact that it is during the period of Higher Education that individuals begin their professional life through studies, experiences with professional colleagues, practical activities and work experiences.

3.2 Materials

The experiment was built, programmed and executed on the *LimeSurvey* ® research platform (Schmitz & Nagel, 2020) - a program based on a programming language, used in its free version , which currently allows the construction of surveys and research forms -, being presented only in online/digital mode, and can be accessed via mobile phone, tablet, computer, notebook, or other device with internet access and support.

The decision-making scenario on which the manipulation focused was built and validated from five distinct pre-test stages (including qualitative and quantitative phases), until reaching the current version used in the study. The decision-making task was designed for individuals to choose the most appropriate decision in order to ensure good operational management of the sandwich sales business. Thus, regardless of which criteria/strategies were used by the participants to make their decisions, they were expected to identify the best option among the alternatives offered; which would only be possible through the articulation, albeit minimal, but necessary, of a logical-mathematical reasoning of the variables inherent to the problem.

An answer was scored as "normatively correct" when the participants marked the option that referred to the only decision - among the others - that constituted the most adequate and satisfactory for the presented scenario; and scored as "normatively incorrect", when they marked any of the options that generated a decision that was harmful and inefficient to the management of the business. Thus, the respondent's final performance was conditioned to the total hits and errors obtained by him/her when submitted to the experimental groups. After the decision was made, all respondents had to justify their choices, because it was necessary to capture, to some extent, the cognitive processing and reasoning developed by them during the resolution of the decision-making problem. In total, 1,042 justifications (521x2) were analyzed.

3.3 Data Collection and Analysis Procedures

Participants received the survey via a *link* sent to their personal e-mails registered in the polling system of the public educational institution where the study was conducted. Each participant answered the same groups of questions, differing only in the experimental group in which they were randomly assigned (between-subjects design). The instrument took an average of 44.6 minutes to be completely answered. Initially, a Free and Informed Consent Term (FICT) was made available to the research subjects, if it was marked as accepted, the instrument was automatically released for completion. Following, a set of general instructions was exposed to guide the proper participation of the target audience. Subsequently, the groups of questions appeared on the monitor, one at a time, in an ordered sequence. In the end, a *debriefing* containing the real objective of the research was revealed.

In reference of the manipulation related to the time restriction, applied to the sandwich sales scenario, with a view to pressuring the individual to increase their attention and effort in decision making, within a limited time, was inspired by previous studies, especially in the proposed operationalization by Corso (2009). Considering that the time was timed, the count started when the individual started to read the decision scenario and ended when the participant clicked on the button to move to the next step; or when the time has ended (respecting the maximum limit set for the time restriction, visible on the screen). This allowed no extrapolation of the maximum time defined for the subjects assigned to this experimental condition, which was essential to be guaranteed in this experimental design. Regarding the handling of additional information, it was based on the Operations Management and Management Accounting literature (Dornier et al., 2000; Fitzsimmons & Fitzsimmons, 2010; Krajewski & Ritzman, 2004; Martins, 2018; Peinado & Graeml , 2007; Slack et al., 2009; Vasconcellos, 2011; Vasconcellos & Garcia, 2008), especially the one related to the discussion of production costs (eg, fixed cost, variable cost and total production cost), from which theoretical instructions of a financial nature were selected and

inserted at the end of the presentation of the main data of the scenario, in order to better direct and instruct the individual's decision-making process.

The sample, in turn, with a non-probabilistic characteristic, involved undergraduate students, being collected based on the criterion of convenience (Cozby, 2003). All data collection was processed and analyzed using the respective statistical packages: 1) Electronic Spreadsheet *(Microsoft Excel®)*, 2) *RStudio* (*Software R*®), version 1.4.1106; and 3) JAMOVI®, version 1.6.23.

4. PRESENTATION AND DISCUSSION OF RESULTS

4.1 Sample Characterization

The sample consisted of 521 undergraduate students from different courses and linked to an HEI located in one of the states of southeastern Brazil. On average, students were 26.3 years old (Minimum = 16; Maximum = 64), 57.2% (N=298) were female and 42.8% (N=223) were male. When asked if they had previous academic/professional training (e.g. technical course, technologist, undergraduate, graduate, various courses, etc.), about 58.2% (N=303) of the students said they did not, and 41.8% (N=218) indicated yes. In relation to the main shifts studied, 36.7% (N=191) indicated the full-time shift, 18.2% (N=95) the night shift, and 14.4% (N=75) the day shift. As for the semester attended at the researched HEI, on average, students indicated being between the 3rd and 4th academic semester (Q1 = 1.0; Q2 = 3.0; Q3 = 6.0). Of the total number of students interviewed, 361 (69.3%) said they currently have some experience in professional and/or academic activities, with an average experience of approximately 4 years (Q1 = 0.0; Q2 = 1.0; Q3 = 5.0). Finally, it was identified that the courses involved in the research belonged to the following Knowledge Areas: Applied Social Sciences (N=128; 24.6%), Human Sciences (N=85; 16.3%), Exact and Earth Sciences (N=79; 15.2%), Health Sciences (N=78; 15%), Engineering (N=61; 11.7%), Biological Sciences (N=26; 5%), and Agricultural Sciences (N=14; 2.7%).

4.2 Manipulation-Check

Table 1 – Manipulation-check TP, AI and TP+IA (group: “more reflective” vs. “less reflective”)

MANIPUPATION-CHECKS	N	Mean	Median	SD	SE	*P-value*
# TIME PRESSURE (GROUP 1)						
P1: More reflective (Stimulus: TP)	41	6.02	7.00	3.23	0.504	0.337
P1: Less reflective (Stimulus: TP)	62	5.50	6.00	2.99	0.380	
# ADDITIONAL INFORMATION (GROUP 4)						
P2: More reflective (Stimulus: AI - presence)	65	7.88	9.00	2.76	0.342	0.136
P2: Less reflective (Stimulus: AI - presence)	52	7.37	7.00	2.57	0.357	
P3: More reflective (Stimulus: AI - absence)	65	3.23	2.00	2.75	0.341	**< .001**
P3: Less reflective (Stimulus: AI - absence)	52	5.87	6.50	2.90	0.402	

MANIPUPATION-CHECKS	N	Mean	Median	SD	SE	*P-value*
# TIME PRESSURE + ADDITIONAL INFORMATION (GROUP 2)						
P1: More reflective (Stimulus: TP)	55	5.35	5.00	2.72	0.367	0.138
P1: Less reflective (Stimulus: TP)	46	6.22	6.00	2.99	0.441	
P2: More reflective (Stimulus: AI - presence)	55	6.84	7.00	2.75	0.370	0.388
P2: Less reflective (Stimulus: AI - presence)	46	7.43	7.00	2.43	0.358	
P3: More reflective (Stimulus: AI - absence)	55	3.93	3.00	2.83	0.381	0.065
P3: Less reflective (Stimulus: AI - absence)	46	4.93	5.00	2.62	0.386	

Source: Elaborated by the authors based on the research data (2022).

Based on Table 1, it can be seen that only the P3 *manipulation-check* for the G4 experimental group (IA) showed a statistically significant difference between the two cognitive profiles (*p-value* < .001), indicating that the "more reflective" subjects considered that, practically, they did not perceive the absence/lack of other more relevant information to decide, regarding the problems reported in the decision-making scenario. While the "less reflective" subjects reported a moderate perception (tending to high) about the feeling of absence of other more relevant information to decide. As for the other results, they did not reveal statistically significant differences in the applied stimuli (TP, IA and TP+IA) between the two cognitive profiles groups studied, which, in turn, is a good finding for the experiment, as it indicates the correct functioning of the manipulations that were applied in the treatment groups, since they were justly perceived in a similar way by the participants - whether they are more or less reflexive -, when exposed to the stimuli.

4.3 Hypothesis Test

First, to enable the execution of the hypothesis tests, it was necessary to divide the database cognitive profile between "more reflective" and "less reflective" individuals. Therefore, to define such extremes, the Kruskal-Wallis One-Way ANOVA test *(non* -parametric test) was performed. In view of this, the results obtained reveal that the relationship between CRT and the performance of subjects in the experimental groups is statistically significant ($\chi^2(3) = 83.1$, *p-value* <.001), with only pairs scoring 2-3 are equal, indicating that there is no statistical difference between the performance of respondents who obtained 2 and 3 points in the cognitive reflection test.

Therefore, it was defined as extreme values for the classification of the cognitive profile, the score: 0 for the "least reflective", and the scores 2 and 3 for the "more reflective", excluding from the experiment the data of the respondents who achieved 1 point on the CRT Test. Therefore, 222 subjects were categorized as more reflective and 210 subjects as less reflective, randomly distributed among the four experimental groups. After this step, the hypotheses were tested using another non-parametric test of significance, that is, using the statistical technique called the Mann-Whitney U Test (*sample independence* test). The results can be seen in Table 2.

Table 2 - Hypothesis Test: H1a, H1b and H1c (group: more reflective *vs.* less reflective)

A) Mann - *Whitney U* test (p-*value* <0.05):

- Group Description - Stimulus: Time Pressure (TP)

	Group	N	Mean	Median	SD	SE
Decision Performance	**More Reflective** (presence of TP)	41	1.17	1.00	0.667	0.104
	Less Reflective (presence of TP)	62	0.790	1.00	0.656	0.0833

Note: Test Statistics [U= 900, n 1 ≠ n 2**, *p-value* =0.006**]

B) *Mann-Whitney U* - Test (p-*value* <0.05):

- Group Description - Stimulus: Additional Information (AI)

	Group	N	Mean	Median	SD	SE
Decision Performance	**More Reflective** (presence of AI)	65	1.57	2.00	0.661	0.0820
	Less Reflective (presence of AI)	52	0.769	1.00	0.731	0.101

Note: Test Statistics [U= 763, n 1 ≠ n 2, ***p-value* <.001**]

C) Mann - *Whitney U* test (p-*value* <0.05):

- Group Descriptions - Stimuli: Time Pressure (TP) + Additional Information (AI)

	Group	N	Mean	Median	SD	SE
Decision Performance	**More Reflective** (presence of TP+AI)	55	1.31	1.00	0.742	0.100
	Less Reflective (presence of TP+AI)	46	0.761	1.00	0.736	0.109

Note: Test Statistics [U= 783, n 1 ≠ n 2, ***p-value* <.001**]

Source: Elaborated by the authors based on the research data (2022).

When looking at Table 2, which contains a summary table with the results of the hypothesis tests performed for the participants categorized as "more reflective" vs. "less reflexive", considering the stimuli applied, it appears, initially, that the decision-making performance of cognitively more reflexive individuals ($\mu_{MoreReflexive} = 1.17$; $M_d = 1.0$) and cognitively less reflexive individuals ($\mu_{LessReflexive} = 0.790$; $M_d = 1.0$) are considered statistically different ($U = 900$, $n_1 \neq n_2$, *p-value* = 0.006), when affected by the same temporal pressure (6 minutes). That said, it appears that cognitively more reflexive individuals, when affected by time pressure, tend to have a better decision-making performance (that is, superior) when compared to less cognitively reflexive

individuals, also affected by the same time pressure. With this, it is possible to confirm the first secondary hypothesis (H1a) outlined for the research.

Regarding the decision-making performance achieved by the two cognitive profiles studied when affected by the stimulus of financial instruction information, it appears that the difference between them is statistically significant (U = 763, $n_1 \neq n_2$, *p-value* <.001). Thus, it was identified that subjects classified as more reflective have a much better performance ($\mu_{MoreReflexive}$ = 1.57; M_d = 2.0) than individuals classified as less reflective ($\mu_{Less\ Reflexive}$ = 0.769; M_d = 1.0), when stimulated by the additional information available in the decision scenario. Therefore, it is inferred that cognitively more reflective individuals, in the presence of additional information, tend to have a better decision-making performance when compared to cognitively less reflective individuals, also exposed to the same additional information. Therefore, it can be said that the second secondary hypothesis (H1b) articulated in the research was confirmed within the statistical parameters recommended by the literature.

Finally, from the findings obtained with the last stimulus applied, it is possible to confirm the theoretical proposition for the existence of a statistically significant difference between the performance of cognitively more reflective individuals ($\mu_{MoreReflective}$ = 1.31; M_d = 1.0) and cognitively less reflective individuals ($\mu_{LessReflective}$ = 0.761; M_d = 1.0) –, based on the respective test statistic: U = 783, $n_1 \neq n_2$, *p-value* <.001. Thus, when accepting the H1c hypothesis, it is noted that cognitively more reflective individuals, when simultaneously affected by time pressure and in the presence of additional information, tend to have a better decision-making performance when compared to cognitively less reflective individuals, also simultaneously affected by same time pressure and the same additional information.

From the statistical results from the hypothesis tests for the experiment carried out, it appears that all the manipulated variables (TP, IA and TP+IA) had an effect on the response variable, relative to the performance in managing a sales business of sandwiches during the pandemic period. Such findings are corroborated by the statistical data set presented in Table 2, providing support to confirm the respective hypotheses: **H1a** (U = 900, $n_1 \neq n_2$, *p-value* =.006), **H1b** (U = 763, $n_1 \neq n_2$, *p-value* <0.001), and **H1c** (U = 783, $n_1 \neq n_2$, *p-value* <.001).

The reason for these three hypothesized relationships to have been confirmed (H1a, H1b and H1c) stems from the comparison made between the statistical results obtained through the two samples with different cognitive profiles (more reflective *versus* less reflective). Thus, as the performance of cognitively more reflective individuals was superior (better) and statistically significant than the performance of less reflective subjects, in all experimental conditions, it can, therefore, be concluded that the three secondary propositions outlined for the study were considered accepted and valid for the experiment performed. Which, in turn, also allows to highlight and confirm the main hypothesis (H1) made for the study, which deals with more and less reflective individuals being affected in different ways by time pressure and additional information in the decision-making process.

4.4 General Discussion

Consistent with the Theory of Bounded Rationality, with the Theory of Dual Process and with the theoretical approaches of Time Pressure and Financial Instructional Information, the main discussions are:

From the experimental design of the work, it was possible to establish a clear relationship between the cognitive profile of the decision maker and his performance in a decision-making task in the management area, influenced by the restriction of time and the availability of information. Although previous work has already tested the relationship between the cognitive ability of individuals and their performance on different cognitive tasks (Alós-Ferrer et al., 2016; Ball et al., 2018; Cresswell & Speelman, 2020; Pennycook et al., 2016; ; Pennycook & Ross, 2016; Thompson & Markovits, 2021; Thomson & Oppenheimer, 2016); and a lot of scientific investigations have already explored the effect of time pressure and the presence of information on the decision-making process (Buckert et al., 2017; Crescenzi et al., 2021; Gawad et al., 2021; Gazdag et al., 2018; Lallement, 2010; Letmathe & Noll, 2021), this work, in turn, in a peculiar way, articulated evidence that the individual's level of cognitive reflexivity (Frederick, 2005) could be the key to explain one of the reasons for the differences in performance verified between individuals who decide under pressure for time and/or in the presence of additional information, under the conceptual lens of the Dual-Process Theory.

The data from the experiment sheds light on the question of whether or not the level of cognitive reflection is a useful measure for explaining the way in which the individual decides during his reasoning and judgment process, that is, resorting to Type 1 (intuitive) thoughts, or Type 2 (analytical) as a basis for processing your choices (Kahneman, 2011). In this study, it seems so, since: **(i)** individuals who were categorized as cognitively more reflective were those who obtained better performance results in decision making; **(ii)** that despite having been supposedly negatively influenced by time pressure, they demonstrated to have employed some type of strategy to deal with the stressor effect caused by time; **(iii)** who most appropriated the instructional information available to direct, or even confirm, the logical way in which the decision-making problem should be faced/treated; and **(iv)** much of the analysis performed by these participants appeared to be guided by the rules of logic and quantitative/mathematical principles (despite having been explicitly instructed to do so). Such findings, in addition to being evidenced through quantitative data, also received qualitative support from the analysis of the justifications presented by the participants for the decisions taken. Thus, providing robust evidence that they were cognitively guided by Type 2 – that is, analytical – thought processes, likely blocking and overriding in the course of their reasoning, personal impressions and intuitive judgments.

As for the cognitively less reflexive subjects, characteristically, they were those who: **(i)** showed significantly lower levels of performance when assuming the fictitious role of entrepreneurs; **(ii)** had the impulsiveness of thought reinforced when pressed for time, possibly not being negatively stimulated by its stressor effect, since one of the most striking characteristics of this cognitive profile is precisely to process information almost automatically, quickly and without effort, often based on affective and emotional aspects; **(iii)** little use of the information provided, indicating the limited propensity, motivation and/or preparation of these individuals to use the information resource that was available; **(iv)** predominance of Type 1 thinking in decision-making, given that the choices indicated that they were based on rooted beliefs and intuitive perceptions, based on the use of cognitive shortcuts (via heuristics and biases) to facilitate the decision-making process

decision making, 'ignoring' logical choices based on cost and financial perspective. In addition to the statistical analyses, the aforementioned findings were achieved through the complementary support provided by the content of the justifications presented by the less reflective individuals, in the decisions taken.

Part of the explanation for obtaining these results may lie in Dual Process Theories, which assume that fast Type 1 processing generates intuitive default responses, which can be replaced by subsequent Type 2 reflective and analytical processing (Evans & Stanovich, 2013; Hodgkinson & Sadler-Smith, 2018) – which did not occur in the decision-making of the cognitively less reflective group, in which analytical thinking did not seem to have interfered to change the initial intuitive response produced. In this group, heuristic and apparently correct judgments emanate quickly and effortlessly through Type 1 processing. As a result, errors and biases accumulate within the reasoning and decision-making processes. Thus, the judgments eventually expressed are called intuitive as they "maintain the initial hypothetical proposal without much modification" (Kahneman & Frederick, 2002, p. 51). On the other hand, the more reflective individuals identified by this study engaged in slower and more laborious analytical reasoning processes, that is, through Type 2 thinking, which possibly intervened to endorse or correct the logical and quantitative reasoning developed during the execution of the decision task (Evans, 2007; Kahneman & Frederick, 2002).

The Dual Process Theory, within this approach, would supposedly have the ability to explain when Type 2 processes interfere, why they interfere, and what would lead them to interfere (Kahneman, 2011). In this perspective, intuition and analysis "do not compete as parallel processes" (Evans, 2006, p. 328); rather, a behavioral response will be "controlled either heuristically or analytically" (Evans, 2007, p. 322). According to Hodgkinson & Sadler-Smith (2018), this view was reinforced by Evans and Stanovich (2013, who stated, based on evidence accumulated over decades of research, that human beings are, by nature, 'cognitive misers'. ', heavily reliant on rules of thumb and prone to replacing attributes that are more difficult to assess (e.g., logical, probabilistic, and mathematical variables) with practices that are easier to use - via cognitive shortcuts -, concluding that most decision-making behaviors "agrees with (heuristic) standards" (Evans & Stanovich, 2013, p. 237).

Therefore, although it is clear that there are two qualitative different forms of processing in decision-making, activated when an individual solves a problem and, which may or may not interact cognitively to produce an observed behavior, we have in the cognitive capacity - understood by the level of reflexivity or impulsivity of reasoning – one of the explanatory keys to understand why cognitively more reflexive individuals, even when negatively pressured by time and positively supported by information, adopt more Type 2 processes and, consequently, achieve better decision-making performance than theirs less reflective counterpart – this one, in turn, which is often supported in Type 1 processes and presents inferior results.

Oechssler, Roider and Schmitz (2009), for example, found that individuals with high CRT scores exhibited a lower incidence of bias and made better probability judgments. Cesarini, Johannesson and Wallace (2012), in turn, identified that individuals with high CRT scores are less likely to make representation errors or not consider the sample size. Likewise, Toplak, West and Stanovich (2011) found that performance on the CRT is specifically correlated with "reflective mind" and disjunctive

reasoning, avoiding responses based on inappropriate heuristics. It is important to point out that both types of thinking are important for human decision making (Alves et al., 2021). In many cases, there is no time to evaluate different options and decisions have to be made based on general rules. Its use is not limited to naive decision makers or beginners, but is also frequently used by experts such as chess masters, poker players and firefighters. However, relying only on Type 1 cognitive processes can lead to individuals making poor judgments, achieving poor performance results in different dimensions and domains.

Overall, the classic studies by Kahneman and Tversky (1974) – which remain important in cognitive and behavioral science studies – provide a wealth of evidence that relying solely on Type 1 reasoning results in heuristics, systematic errors, and biases. However, it seems that people use it more often, as it is cognitively easier and more comfortable, and can be performed in parallel with other thoughts and behaviors (Kahneman, 2003).

5. CONCLUSIONS AND LIMITATIONS

In general, when basing the main argument defended in the present study and, when answering the invoked problem, if *"there is a difference in the influence of time and information on the performance of individuals, when comparing the decision-making process of those who are more cognitively reflective in relation to those who are less cognitively reflective",* this research provided important insights for understanding the decision-making behavior of cognitively more and less reflective individuals.

This is because, when considering the set of results obtained with the experiment, mainly referring to the findings that address the difference between the two cognitive profiles investigated, preliminarily, it is possible to affirm that the cognitive reflection of the individual considered as a psychological characteristic about how the individual conducts his information processing during episodes that involve choices and decisions, directly influences the way the subject deals with his analytical and intuitive load within the decision-making process, in addition to constituting an important predictor of performance.

Finally, it is believed that, through the answer given to the research problem, as well as the general (quantitative and qualitative) results evidenced throughout the study, it was possible to support the main argument of the study, by investigating whether there would be a difference in the influence of the time and information in the decision-making process of cognitively more reflective individuals, in relation to cognitively less reflective individuals – in behavioral terms. Thus, the effect of time pressure, in turn, was proven through hypothesis testing, as well as additional information with a financial instruction function in the researched subjects, pointing to an important avenue of research that deserves further empirical investigations in the future.

Finally, it should be noted that although the study has its limitations (eg, difficulty in reproducing, scientifically, to the satisfaction, real-life situations without involving any kind of bias or noise; and lack of triangulation of the results with other types and nature of data), the proposal to carry out a study with an experimental approach was met within the statistical criteria, as well as the validation of the proposed manipulations for the performed experiment and, the veracity of the

hypothesized relationships. Therefore, the development of this work followed the recommendations of the consulted literature, aiming to rigorously comply with the methodological steps, answer the research problem, as well as meet the proposed objectives, in order to adequately support the main argument of the study.

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