

BUSINESS DECISION MAKING: STUDYING THE COMPETENCE OF LEADERS

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INTRODUCTION

As Smith, Wang and Leung (1997) point out being an effective leader requires the ability to handle a stream of challenges and threats to the organization's optimal performance. Many of the decisions business leaders face are intricate to an extent that can put the future of a company at stake. Our rationality limitations, which hinder and restrict our ability to make optimal decisions (Bavolar, 2013; Einhorn, 1970; Hunt, Krzystofiak, Meindl and Yousry, 1989) plus the innumerable variables, inaccurate information, difficulties to envision alternatives, constraints of time and costs can lead to highly undesirable results (Bazerman and Moore, 2012; Simon, 1955). Even under these scenarios, executives tend to be overconfident (Camarero and Lovallo, 1999) or present different behavioral responses depending on certain circumstances such as their physiological state, time pressure, cognitive load and social context (Appelt, Milch, Handgraaf and Weber, 2011; McElroy, Dickinson and Stroh, 2014), which raises the question: how good are the leaders decisions in businesses environments?

The main objective of this study was to evaluate the decision-making competence of leaders working on different business sectors and to investigate some of the psychological limitations involved in this process. In a broader way, this study may help establish the basis for other researchers who wish to evaluate the decision-making competence of executives bringing out an understanding of the individuals differences. This is an area of knowledge that has not yet been well investigated by other researchers (Armstrong, Cools and Sadler-Smith, 2012).

DECISION-MAKING FRAMEWORK

An important point in the decision-making research is to understand how the judgments and decisions are influenced by the individual differences. These are defined by Appelt et al. (2011, p. 253) as: "[...] a broad term, covering any variable that differs between people, ranging from decision styles to cognitive abilities and personality."

Most of the research on decision making of leaders focuses on the style and not on the competence. Some authors have conducted research on military leaders using instruments like Movement Pattern Analysis to assess their decision-making style and underlying motivational propensities (see Connors, Rende and Colton, 2013, 2014, 2015) or even by observing video images of heads of states (Connors, 2006).

Self-report measures, such as the General Decision-Making Style (GDMS from Scott and Bruce, 1995), have been extensively used, for instance, to assess correlations between decision-making style of Swedish military officers and mental abilities necessary on battlefield situations (Thunholm, 2004) or to investigate differences in decision making style between army captains acting as leaders and followers (Thunholm, 2009) .

Outside of the military world, Russ, McNeilly and Comer (1996) investigated links between decision making style, leadership style and performance of first level sales managers and Erenda, Meško and Bukovec (2014) investigated the presence of the GDMS intuitive decision making style in top and middle managers of the Slovenian automotive industry.

In the realm of International Relations, there are studies on the processes that drive political leaders to take decisions associated with public affairs (Mintz, 2004), on the profile and decision style of terrorist leaders (Chatagnier, Mintz and Samban, 2012) and on the fear of losing status and the escalation of commitment bias in political and military leaders (Renshon, 2015). However, these were not focused on the decision-making competence itself.

Armstrong et al. (2012) conducted a review of 40 years of research on the role of cognitive styles in business and management and found out a focus on decision-making style versus strategic decisions, presence of biases, risk perception, escalation of commitment and framing effects, but not on decision-making competence specifically. For this reason, we believe this article adds to the research in leadership and decision making on the business environment, an area not yet thoroughly explored.

In this field of measuring the decision making competence, the test A-DMC (Adult Decision Making Competence) brings a correlation between individual competences and a questionnaire that assesses experiences with life events influenced by adults' decisions (DOI – Decision Outcomes Inventory) (both developed by Bruine de Bruin, Parker and Fischhoff, 2007). More specifically, higher A-DMC scores were correlated with higher DOI scores and, in general, most of the negative decision outcomes were associated with lower A-DMC, as well as younger and poorer people (Parker, Bruine de Bruin and Fischhoff, 2015).

The A-DMC and DOI are considered promising by Appelt et al. (2011), since they can predict the performance of people in real life decisions and there is evidence showing a relationship between cognitive functions of the brain and dimensions of competence in decision-making (del Missier, Mäntylä and Bruine de Bruin, 2012). The A-DMC research also found significant predictive validity when controlling for individual difference variables such as demographic characteristics, cognitive ability, and constructive decision-making styles (Bruine de Bruin et al, 2007). Dewberry, Juanchich, and Narendran (2013) also utilized the DOI to investigate the relationship between personality aspects and decision-making competence since they considered the DOI as “the only measure of everyday decision-making competence currently available”, therefore reinforcing its importance.

In addition to the original application in the United States (Bruine de Bruin et al., 2007), the same method or components have been also translated and applied in Slovakia (Bavolar, 2013), Italy (del Missier et al., 2010) and Sweden (Marklund, 2008 as cited in del Missier et al., 2010), which reflects a potential application in non-English native speaking countries. The A-DMC was also utilized by Carnevale, Inbar and Lerner (2011) on a population of senior leaders visiting the Harvard Kennedy School of Government.

For the reasons explained above, the A-DMC method was selected for this study to evaluate the decision-making competence.

MATERIALS AND METHODS

The A-DMC components chosen were the same used by Carnevale et al. (2011) in previous studies with leaders (Resistance to Framing, Consistency in Risk Perception, Resistance to Sunk Costs and Under/overconfidence).

Resistance to Framing (RF) evaluates how decision making is affected by irrelevant variations in the problem description, since studies show that the same problem framed in different ways can influence its solution, although, normatively, the same decision should be made (Mc Elroy and Seta, 2003; Druckman, 2001; Tversky and Kahneman, 1981). In addition, most prescriptive decision making processes consider the formulation of the problem as the first step to get good results (Bazerman and Moore, 2012; Clemen and Reilly, 2001; Yu, 2001; Hammond, Keeney and Raiffa, 1999).

The Under / OverConfidence (UOC) item measures how people recognize the extent of their own knowledge (metacognition) or, in other words, how confident they are and to what extent that trust corresponds to the reality of decision-making. In general, though, the majority of individuals tend to be overconfident (Griffin and Brenner, 2004) and the executives too (Camarero and Lovallo, 1999; Doukas and Petmezas, 2007).

Consistency in Risk Perception (CRP) assesses the ability to follow probability rules including the susceptibility to the conjunction fallacy (Tversky and Kahneman, 1983). It requires the participant to flexibly switch between different event descriptions and time frames and judge the chance of an event to happen.

Resistance to Sunk Costs (RSC) refers to the propensity to continue an endeavor once an investment in money, effort, or time has been made. This can be one of the causes for an irrational escalation of commitment when taking decisions (Bazerman and Moore, 2012), since, normatively, unrecoverable past expenditures should be ignored and only future consequences be considered (Bazerman and Moore, 2012; Bruine de Bruin et al., 2007; Hammond et al., 1999; Kahneman, Lovallo and Sibony, 2011). However, there are evidences that the desire not to appear wasteful is a possible psychological justification for this behavior (Arkes and Blumer, 1985) and also that this behavior can affect both decisions of everyday life as more complex / strategic decisions (van Putten, Zeelenberg and van Dijk, 2010).

Participants

In this article, we draw results from a sample of experienced team and business leaders instead of a typical undergraduate student sample. We would like to emphasize this point because we believe this provides a better replication of actual decision making in business settings for college sophomores may differ from adult samples in many senses (Sears, 1986). Authors have also observed differences in susceptibility to decision biases between military leaders and Pittsburgh residents (Carnevale et al., 2011), on decisions made by undergraduate political science students and military elite decision makers (Mintz, Redd and Vedlitz, 2006) and in political elite decision making where power, age and experience play a significant role in the decision making process (Renshon, 2015).

Participants were recruited through a Master of Business Administration (MBA) course (41%) and others directly in the business market (59%). Leadership experience was a criteria for the admission process for all participants on the MBA course (mainly first level managers) and the other participants were asked to report on the number of years of leadership experience resulting in an average of 8.2 years ($SD = 6.8$ years).

The questionnaire was addressed to 66 people and we obtained 49 responses (74%). The sample was composed of 41 men and 7 women aged between 27 and 58 ($M = 35.80$ and $SD = 6.82$).

No monetary incentive was offered to participants, only one feedback report with results and tips for improving their decision-making skills.

The sample size is compatible to ensure the objectives of this sociological research. First, we opted for a number of cases considered statistically sufficient to form a sample that allows the application of multivariate statistical analysis, given the high difficulty of obtaining a sample with the peculiar characteristics required in this study. Following the perspective from Kazmier (1982, p. 126-128), a sample with size n greater than or equal to 30 allows the use of the normal probability distribution associated with the standard error of the mean, following the Central Limit Theorem (CLT).

Procedure

Before the A-DMC was applied, it was translated from English to Portuguese by the authors with minor modifications. Application of the test was made either via a printed copy of the test (53%) or digitally (47%). Participants took around 45 to 80 minutes to complete it, which they considered very time consuming.

Everybody invited for the research had privacy, anonymity and total liberty to not participate at any time guaranteed. Participants were given a brief explanation about the research and provided consent in written or electronic form before filling the questionnaire.

Methodological Limitations

We would like to highlight two limitations of the present study. Firstly, the current study utilized an intentional sample of leaders, which may not be representative of the general Brazilian population in terms of age, education, social background and other aspects. Future studies should expand the application of the A-DMC to a heterogeneous sample in Brazil to verify its applicability to the broader population. A wider application can also consider the use of all six components as utilized in the original study (Bruine de Bruin et al., 2007), although many participants voiced their dissatisfaction with the duration of the reduced questionnaire. A second limitation is associated with the comparison of studies from different cultures and samples (in terms of size and composition). Here we have utilized other studies in the literature as a reference without trying to definitively infer on the causes of their differences. We understand these cultural differences could be the object of further studies using the A-DMC in order to better understand its effects over the results.

RESULTS AND DISCUSSION

A score was calculated for each one of the 49 participants in each of the A-DMC components following the criteria established by Bruine de Bruin et al. (2007). The scoring key was available in Society for Judgment and Decision Making (2007). Appendix A brings the individual results.

The first result was that all participants presented some susceptibility to the known biases and judgment errors associated with decision making. While there has been three participants with a top score in RF (participants #7, #42 and #45), other three with maximum score in UOC (participants #28, #33, #37) and again participant #42 in RSC, nobody achieved complete immunity to the effects already reported in the literature. No single participant achieved top

scores in all components. These results suggests susceptibility to the judgment errors typically reported in the literature, with different degrees of influence for each one of the participants.

Analysis of individual differences

A point to highlight in Appendix A is the variation in performance between participants and within components for a given participant. Taking as an example participant #7, who had the best result in RF (5.00), we verified that the same person had a less expressive result in UOC (0.86). Another example is participant #13, who had the worst result for CRP (0.50), but achieved a very good result in UOC (0.98). The relationship between A-DMC components allows these individuals to observe these areas of deficiencies, in which there is an individual field to improve decision making.

In order to provide a relative comparison between participants, we calculated the quartiles for each one of the components (see Table 1).

Table 1 - Quartile calculations for A-DMC components

Component	minimum	quartile 1	quartile 2	quartile 3	maximum
RF	3,00	3,86	4,43	4,64	5,00
UOC	0,79	0,91	0,93	0,97	1,00
CRP	0,50	0,75	0,80	0,85	0,95
RSC	3,10	4,20	4,70	5,00	6,00

From the quartiles, we noticed that not a single participant had all grades into the 4th quartile, which would have indicated a distinctive performance in this dataset. Data showed, however, that participants #7, #10, #28, #37 and #46 had three components in the fourth quartile, therefore showing a better performance when compared to the group.

On the other hand, nobody had all grades in the 1st quartile, which would be an indicative of an overall poor performance. That said, participants #3, #9, #27, #39, #40, #44 and #48 had 03 components falling within the 1st quartile, therefore revealing a greater need for improvement.

We believe the use of quartiles provides a solid way of assessing each participant in comparison to the group. This reveals in which components they should focus their improvements efforts.

Correlations between components

Linear correlations were calculated between test components to analyze if the results would be inter related (see Table 2). From the results, there was a positive moderate correlation (indexes within 0.3 and 0.7) between RSC and RF. On the other hand, the other components presented a positive weak correlation (index below 0.3) with the exception of CRP and UOC, for which the index was negative.

From these data, we concluded that, in general terms, there was a weak linear correlation between these variables what indicates that the performance for each component is not strongly tied between themselves. In other words, an increase (or decrease) in the performance for a given component implies small increases (or small decreases) in the performance of other components.

On the other hand, as the majority of correlation indexes are positive, an overall good performance in each component indicates a tendency of a better global performance, or better decision-making competence. This result was also verified by Bruine de Bruin et al. (2007).

Table 2 – Pearson correlation between test components

Component	RF	UOC	CRP
RF	---	---	---
UOC	0.06	---	---
CRP	0.27	-0.05	---
RSC	0.37	0.04	0.23

Correlations with age

Similarly to other authors, we investigated linear correlations between the age of the participants and the performance on the A-DMC test (see Table 3).

Table 3 – Pearson correlation with age

Component	Pearson coefficient	Correlation
RF	-0.42	Moderate
UOC	-0.08	Weak
CRP	-0.10	Weak
RSC	0.08	Weak

From Table 3, there was only a moderate negative linear correlation between age and RF. The other components presented weak negative linear correlations, with the exception of RSC, which was positive. In this sample the performance in three of four components worsens with age.

Other authors have also not found indications of strong correlations with age. Bruine de Bruin et al. (2007) reported weak correlations for these components, but positive for RSC and UOC. Bavolar (2013) observed weak and positive correlations for all these components but the CRP, which had a moderate positive correlation (0.356). The results seem mixed in this aspect, but it

is important to highlight that they are difficult to compare given the differences in age and culture in the studies.

Comparative with other studies

Even though there are considerable differences between the current study and others in the literature with regards to the culture (country) and sample (size and composition), the results of this study were summarized in face of other researches. Due to these limitations, the data are presented for comparative terms, without trying to definitively infer on the possible causes of the differences of the results (see Table 4).

Table 4 – Comparison with other studies (sample characteristics)

Study	Country of application & origin of participants	Age	Main objective of research	A-DMC components
current	Brazil – Business leaders mainly from the private sector	27 - 58 (<i>M</i> = 35.80, <i>SD</i> = 6.82)	Evaluate the decision-making competence of leaders working on different business sectors	- RF - UOC - CRP - RSC
Bavolar (2013)	Slovakia - high school and university students	18 - 26 (<i>M</i> = 20.71; <i>SD</i> = 2.38)	Translation and validation of the A-DMC in Slovakia.	All except Path Independence
Carnevale et al. (2011)	United States – leaders visiting the Harvard Kennedy School of Government. Participants came mainly from US state, local, and federal government or the US military	n/a (<i>M</i> = 46 ; <i>SD</i> = 7.73)	Investigation of the relationship between A-DMC components and Need for Cognition. Investigation of decision making by leaders in comparison to the original A-DMC sample.	- RF - UOC - CRP - RSC
del Missier et al. (2010)	Italy - undergraduates	n/a (<i>M</i> = 23.45 ; <i>SD</i> = 5.04)	Investigation of the relationship between A-DMC components and executive functions of the brain	- CRP - Applying Decision Rules
Bruine de Bruin et al. (2007)	United States - people recruited through varied social service organizations and community groups in the greater Pittsburgh metropolitan area	18 - 88 (<i>M</i> = 47.7, <i>SD</i> = 17.0)	Construction and validation of the A-DMC in the USA	All

n/a: not available

The studies that dealt with the validation of the test in the United States (Bruine de Bruin et al., 2007) and Slovakia (Bavolar, 2013) utilized the larger samples between the studies presented. From Table 4, it is possible to note that the research with greater coverage in terms of age span was Bruine de Bruin et al. (2007) that involved people from 18 to 88 years old and was the original evaluation of the A-DMC. Bavolar (2013) utilized a sample of undergraduate students, which restricted the sample to younger people, even though the author demonstrated results comparable to the original study. Similarly, the study in Italy (del Messier et al., 2010) was drawn from a sample of undergraduate students and focused on investigating relationships between two A-DMC components and functions of the brain.

This current study included people from 27 to 58 years old comprised of leaders working mainly on the private sector, which is a distinction from previous studies. Even though Carnevale et al. (2011) also investigated the decision making competence of leaders, these were mainly working in government or military affairs.

Table 5 complements this comparative overview with the literature by bringing a compilation of the main descriptive statistical results.

A comparison of the mean results between the studies in Table 5 revealed that the performance of leaders in this study was better to what is reported in the literature for RF and UOC. On the other hand, the performance of the sample was less expressive for CRP and RSC. It is possible to notice, therefore, that, in mean terms, there is need for more development in these two specific components.

Table 5 – Comparison with other studies (descriptive statistics)

Component	Study	Observed range	Median (Mdn)	Mean (M)	Standard Deviation (SD)
	Current	3.00 - 5.00	4.43	4.25	0.53
RF	Bruine de Bruin et al. (2007)	1.00 - 4.92	3.83	3.72	0.61
	Carnevale et al. (2011)	n/a	n/a	4.03	0.59
	Bavolar (2013)	1.79 - 5.00	4.00	3.95	0.55
	Current	0.79 - 1.00	0.93	0.93	0.06
UOC	Bruine de Bruin et al. (2007)	0.50 - 1.00	0.93	0.91	0.08
	Carnevale et al. (2011)	n/a	n/a	0.92	0.07
	Bavolar (2013)	0.50 - 1.00	0.91	0.89	0.09
	Current	0.50 - 0.95	0.80	0.78	0.10
CRP	Bruine de Bruin et al. (2007)	0.20 - 1.00	0.70	0.70	0.16
	Carnevale et al. (2011)	n/a	n/a	0.84	0.10
	del Missier et al. (2010)	0.10 - 1.00	n/a	0.74	0.14

	Bavolar (2013)	0.25 - 1.00	0.80	0.79	0.16
	Current	3.10 - 6.00	4.70	4.62	0.63
RSC	Bruine de Bruin et al. (2007)	1.00 - 6.00	4.50	4.40	0.77
	Carnevale et al. (2011)	n/a	n/a	4.94	0.87
	Bavolar (2013)	1.00 - 6.00	4.30	4.25	0.84

n/a: not available

CONCLUSIONS

We believe this study brings several contributions to the decision making in the business environment. Firstly, we identified that the literature typically focused on the decision making style of leaders whereas we are bringing a different perspective by studying the competence. We see this as a key factor considering the importance of actual results in the business world. The application of the questionnaire revealed susceptibility to the judgment errors typically reported in the literature, with different degrees of influence for each one of the participants. Considering that one of the most important tasks of a business leader is to take decisions, having a systematic way of measuring this competence is relevant for the assessment of leaders. Also, increasing awareness about judgment biases, providing a feedback about people's performance and training executives to be capable of identifying these limitations can minimize decision making errors (Hammond et al, 1999; Keeney, 2004; Kahneman et al, 2011; Bazerman and Moore, 2012). Ultimately, one could infer that a higher competence on decision making would be associated with more effective leadership as a whole.

The current sample is comprised of business leaders from the private business and from different sectors, which adds diversity to other studies of styles and competence. Other studies focused on undergraduates (Bavolar, 2013; del Missier et al., 2010), a heterogeneous population sample (Bruine de Bruin et al., 2007), military leaders (Carnevale et al., 2011; Connors et al., 2013, 2014, 2015; Thunholm, 2004, 2009), political leaders (Connors, 2006; Mintz, 2004; Renshon, 2015), terrorist leaders (Chatagnier et al., 2012), sales managers (Russ et al., 1996) and managers from the automotive industry (Erenda et al., 2014). Also, by not using college sophomores, we do not need to rely on a possible relationship between the performance of an unexperienced sample and leaders, thus avoiding possible differences already reported in the literature (Mintz et al., 2006; Renshon, 2015; Sears, 1986). As noted by Carnevale et al (2011) and Sears (1986) using leaders as research participants may also affect how seriously these results are taken outside of the psychologist's world. As noted by these authors, studying leaders may strengthen their belief that the typical findings of decision-making research do apply to them, which would then make them more open to debiasing prescriptions and advice.

We believe there are practical implications from this research as the A-DMC could be applied in other business scenarios, such as recruitment processes and performance assessments. In this research, the application of the A-DMC allowed the assessment of the leaders with regards to an absolute criterion (A-DMC scale) or to a relative criterion (comparison with the group), which can be of interest to practitioners. These results provide insights for the individual development of business executives. This research expands the use of the A-DMC outside of the English-speaking world, by being, to the extent of our knowledge, the first attempt of a translation to the Portuguese language. This adds to the already published studies from Slovakia

(Bavolar, 2013), Italy (del Missier et al., 2010) and Sweden (Marklund, 2008 as cited in del Missier et al., 2010). The results observed fall within results from the other published studies with a closer proximity to those obtained by Carnevale et al. (2011) than to the original application of the questionnaire (Bruine de Bruin et al., 2007).

We believe that the choice of the samples (leaders) and the relationship between performance scores and education could be an influencing factor for the results to be closer to Carnevale et al. (2011). The age structure of the sample, while possibly a factor, has been seen as of lesser relevance since no significant correlation between A-DMC and age emerged in the original application (Bruine de Bruin et al., 2007). It is also possible that cultural aspects would be a contributing factor to some of these differences. The descriptive statistics observed are in line with those reported in the literature, thus providing indication that the A-DMC can be used to help business leaders identify key areas of improvement in decision-making competence.

Future research directions

The applicability of this method in the business environment is worth discussing. The A-DMC questionnaire has been developed and demonstrated to be correlated to real life decision making as measured by the Decision Outcomes Inventory (DOI), which is a self-report based on general aspects of life (e.g. being in a jail cell overnight for any reason; being in a public fight or screaming argument; declared bankruptcy). In some aspects, these scenarios do not directly relate to the business world, which could pose a question to its applicability to the businesspeople. We believe this is not the case, since the studies conducted by Bruine de Bruin et al. (2007) and further expanded by Carnevale et al. (2011) involved a very broad sample of American people in terms of social background, education, age, gender among other characteristics and the A-DMC skill set was demonstrated to be a unified construct central to decision making. That said, we consider there is room for future research that explores the relationship between A-DMC performance, DOI and actual decision making tasks in business scenarios.

Finally, we would like to point out other areas for the advancement of knowledge. We believe correlations between decision-making and age (like fine wine), the number of people led by the leader (i.e. a proxy for complexity) and salaries could be investigated. A comparison of the ability to make decisions between leaders and non-leaders would also be worthwhile to better understand the role of experience.

REFERENCES

- Appelt, K. C., Milch, K. F., Handgraaf, M. J. & Weber, E. U. (2011). The decision making individual differences inventory and guidelines for the study of individual differences in judgment and decision-making research. *Judgment and Decision Making*, 6(3), 252-262.
- Arkes, H. R. & Blumer, C. (1985). The psychology of sunk cost. *Organizational Behavior and Human Decision Processes*, 35(1), 124–140. doi: 10.1016/0749-5978(85)90049-4.

- Armstrong, S. J., Cools, E. & Sadler-Smith, E. (2012). Role of cognitive styles in business and management: Reviewing 40 years of research. *International Journal of Management Reviews*, 14(3), 238-262.
- Bavolar, J. (2013). Validation of the Adult Decision-Making Competence in Slovak students. *Judgment and Decision Making*, 8(3), 386–392.
- Bazerman, M. H. & Moore, D. A. (2012). *Judgment in Managerial Decision Making* (8th ed.). Hoboken, NJ: John Wiley & Sons.
- Bruine de Bruin, W., Parker, A. M. & Fischhoff, B. (2007). Individual differences in adult decision-making competence. *Journal of Personality and Social Psychology*, 92(5), 938–956. doi: 10.1037/0022-3514.92.5.938.
- Camarero, C. & Lovallo, D. (1999). Overconfidence and Excess Entry: An Experimental Approach. *The American Economic Review*, 89(1), 306–318. doi: 10.1257/aer.89.1.306
- Carnevale, J. J., Inbar, Y. & Lerner, J. S. (2011). Individual Differences in Need for Cognition and Decision-Making Competence among Leaders. *Personality and Individual Differences*, 51(3), 274-178. doi: 10.1016/j.paid.2010.07.002.
- Chatagnier, J. T., Mintz, A. & Samban, Y. (2012). The decision calculus of terrorist leaders. *Perspectives on Terrorism*, 6(4-5), 125-144.
- Clemen, R. & Reilly, T. (2001). *Making hard decisions with Decision Tools*. Pacific Grove, CA: Duxbury Thomson Learning.
- Connors, B. L. (2006). No leader is ever off stage: Behavioral analysis of leadership. *Joint Force Quarterly*, 43, 83-87.
- Connors, B. L., Rende, R. & Colton, T.J. (2013). Predicting individual differences in decision-making process from signature movement styles: an illustrative study of leaders. *Frontiers in Psychology*, 4(658), 1-9. doi: 10.3389/fpsyg.2013.00658.
- Connors, B. L., Rende, R. & Colton, T. J. (2014). Inter-rater reliability for movement pattern analysis (MPA): measuring patterning of behaviors versus discrete behavior counts as indicators of decision-making style. *Frontiers in Psychology*, 5(605), 1-6. doi: 10.3389/fpsyg.2014.00605
- Connors, B. L., Rende, R. & Colton, T. J. (2015). Decision-Making Style in Leaders: Uncovering Cognitive Motivation Using Signature Movement Patterns. *International Journal of Psychological Studies*, 7(2), 105-112. doi: 10.5539/ijps.v7n2p105.
- del Missier, F., Mäntylä, T. & Bruine de Bruin, W. (2012). Decision making competence, executive functioning, and general cognitive abilities. *Journal of Behavioral Decision Making*, 25(4), 331–351. doi: 10.1002/bdm.731
- Dewberry, C., Juanchich, M. & Narendran, S. (2013). Decision-making competence in everyday life: The roles of general cognitive styles, decision-making styles and

- personality. *Personality and Individual Differences*, 55(7), 783–788. doi: 10.1016/j.paid.2013.06.012.
- Doukas, J. & Petmezas, D. (2007). Acquisitions, overconfident managers and self-attribution bias. *European Financial Management*, 13(3), 531–577. doi: 10.1111/j.1468-036X.2007.00371.x.
- Druckman, J. N. (2001). Evaluating framing effects. *Journal of Economic Psychology*, 22(1), 91-101. doi: 10.1016/S0167-4870(00)00032-5.
- Einhorn, H. J. (1970). The use of nonlinear, noncompensatory models in decision making. *Psychological Bulletin*, 73(3), 221–230. doi: 10.1037/h0028695.
- Erenda, I., Meško, M. & Bukovec, B. (2014). Intuitive decision-making and leadership competencies of managers in Slovenian automotive industry. *Journal of Universal Excellence*, 3(2), 87-101.
- Griffin, D. & Brenner, L. (2004). Perspectives on probability judgment calibration, In D. J. Koehler & N. Harvey (Ed[s]). *Blackwell handbook of judgment and decision making* (pp. 177–199), Oxford: Blackwell.
- Kahneman, D., Lovallo, D. & Sibony, O. (2011). Before you make that big decision. *Harvard Business Review*, 89(6), 50-60.
- Keeney, R. L. (2004). Making better decision makers. *Decision Analysis*, 4(1), 193-204.
- Hammond, J. S., Keeney, R. L. & Raiffa, H. (1999). *Smart choices: A practical guide to making better decisions*. Boston, MA: Harvard Business Review Press.
- Hunt, R. G., Krzystofiak, F. J., Meindl, J. R. & Yousry, A. M. (1989). Cognitive style and decision making. *Organizational Behavior and Human Decision Processes*, 44(3), 436–453. doi: 10.1016/0749-5978(89)90018-6.
- Kazmier L. J. (2009). *Schaum's outline of theory and problems of business statistics*. McGraw Hill Companies.
- McElroy, T. & Seta, J. J. (2003). Framing effects: An analytic-holistic perspective. *Journal of Experimental Social Psychology*, 39(6), 610–617. doi: 10.1016/S0022-1031(03)00036-2.
- McElroy, T., Dickinson, D. L. & Stroh, N. (2014). Pour Some Sugar in Me: Does Glucose Enrichment Improve Decision Making? Bonn/Germany. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2543904.
- Mintz, A. (2004). How do leaders make decisions? A poliheuristic perspective. *Journal of conflict resolution*, 48(1), 3-13. doi: 0.1177/0022002703261056.
- Mintz, A., Redd, S. B. & Vedlitz, A. (2006). Can we generalize from student experiments to the real world in political science, military affairs, and international relations? *Journal of Conflict Resolution*, 50(5), 757-776. doi: 10.1177/0022002706291052.

- Parker, A. M., Bruine de Bruin, W. & Fischhoff, B. (2015). Negative decision outcomes are more common among people with lower decision-making competence: an item-level analysis of the Decision Outcome Inventory (DOI). *Frontiers in Psychology*, 6(363), 1-7. doi: 10.3389/fpsyg.2015.00363.
- Renshon, J. (2015). Losing face and sinking costs: experimental evidence on the judgment of political and military leaders. *International Organization*, 69(3), 659-695. doi: 10.1017/S0020818315000107.
- Russ, F. A., McNeilly, K. M. & Comer, J. M. (1996). Leadership, decision-making and performance of sales managers: a multi-level approach. *Journal of Personal Selling & Sales Management*, XVI(3), 1-15.
- Scott, S. G. & Bruce, R. A. (1995). Decision-making style: the development and assessment of a new measure. *Educational and Psychological Measurement*, 55(5), 818-831.
- Sears, D. O. (1986). College Sophomores in the Laboratory: Influences of a Narrow Data Base on Social Psychology's View of Human Nature. *Journal of Personality and Social Psychology*, 51(3), 515-530. doi:10.1037//0022-3514.51.3.515.
- Simon, H. A. (1955). A Behavioral Model of Rational Choice. *The Quarterly Journal of Economics*, 69(1), 99-118.
- Smith, P. B., Wang, Z. M. & Leung, K. (1997). Leadership, decision-making and cultural context: Event management within chinese joint ventures. *The Leadership Quarterly*, 8(4), 413-431. [http://doi.org/10.1016/S1048-9843\(97\)90022-9](http://doi.org/10.1016/S1048-9843(97)90022-9).
- Society for Judgment and Decision Making Website (2007), http://www.sjdm.org/dmidi/Adult_-_Decision_Making_Competence.html (accessed 02 November 2014).
- Thunholm, P. (2004). Decision making style: Habit, style, or both? *Personality and Individual Differences*, 36(4), 931-944. doi: 10.1016/S0191-8869(03)00162-4.
- Thunholm, P. (2009). Military leaders and followers – do they have different decision styles? *Scand. J. Psychol.* 50(4), 317-324. doi: 10.1111/j.1467-9450.2009.00714.x.
- Tversky, A. & Kahneman, D. (1981). The Framing of Decisions and the Psychology of Choice. *Science*, 211(4481), 453-458.
- Tversky, A. & Kahneman, D. (1983). Extensional versus intuitive reasoning: the conjunction fallacy in probability judgement. *Psychological Review*, 90(4), 293-315.
- van Putten, M., Zeelenberg, M, van Dijk, E. (2010). Who throws good money after bad? Action vs. state orientation moderates the sunk cost fallacy. *Judgment and Decision Making*, 5(1), 33-36.
- Yu, A. S. O. (Ed[s]). *Tomada de decisão nas organizações: uma visão multidisciplinar* [Decision making in organizations: a multidisciplinary view], São Paulo: Saraiva, 2011.

APPENDIX A

Individual results of the A-DMC test application (N=49)

Table A.1 – Individual results				
Component				
Participant	RF	UOC	CRP	RSC
	obs: the closer to 5 the better.	obs: the closer to 1 the better.	obs: the closer to 1 the better.	obs: the closer to 6 the better.
#1	3,21	0,84	0,85	4,90
#2	4,50	0,97	0,65	5,00
#3	3,57	0,81	0,75	4,70
#4	4,79	0,92	0,65	3,30
#5	4,71	0,92	0,90	4,10
#6	3,50	0,91	0,75	4,70
#7	5,00	0,86	0,95	5,30
#8	3,79	0,96	0,75	4,50
#9	4,00	0,91	0,65	3,70
#10	4,93	0,95	0,95	5,50
#11	4,57	0,98	0,75	5,60
#12	4,21	0,96	0,75	4,80
#13	4,57	0,98	0,50	4,80
#14	4,43	0,84	0,60	5,20
#15	4,79	0,93	0,85	4,90
#16	4,43	0,97	0,80	4,30
#17	4,21	0,99	0,75	5,00
#18	4,50	0,93	0,70	4,20
#19	4,36	0,99	0,75	4,90
#20	3,93	0,97	0,75	5,70
#21	4,29	0,99	0,80	4,60
#22	4,64	0,95	0,90	5,00
#23	3,86	0,96	0,90	5,50
#24	3,07	0,91	0,80	4,20
#25	4,64	0,97	0,95	5,00
#26	4,50	0,93	0,65	4,80
#27	3,50	0,93	0,75	4,20
#28	4,71	1,00	0,80	5,10
#29	4,14	0,96	0,75	4,60
#30	4,43	0,79	0,85	4,80
#31	3,86	0,90	0,80	4,70
#32	4,36	0,98	0,85	4,70
#33	4,57	1,00	0,85	5,20

#34	4,79	0,80	0,85	4,20
#35	3,79	0,93	0,80	4,10
36	4,79	0,95	0,75	4,00
#37	4,71	1,00	0,90	3,90
#38	4,21	0,99	0,85	3,60
#39	3,57	0,92	0,75	4,00
#40	3,00	0,98	0,55	3,10
#41	4,43	0,90	0,90	4,50
#42	5,00	0,92	0,80	6,00
#43	4,00	0,94	0,85	4,20
#44	3,57	0,91	0,70	3,50
#45	5,00	0,86	0,65	5,50
#46	4,50	0,98	0,90	5,10
#47	4,57	0,86	0,85	4,60
#48	3,36	0,90	0,70	4,30
#49	4,57	0,84	0,90	4,20
