

DESIGN OF A GAME TO MAKE DECISIONS UNDER PRESSURE

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ABSTRACT

Given the competitive nature of their jobs, it is not surprising that the majority of managers actively seek ways to strengthen its administrative capacity and ability to achieve effective performance. There are different reasons why there is so much interest in improving decision making at management levels, some relevant reasons are the quality and acceptability of decisions that could influence some aspects of career and personal satisfaction on managers. In this paper, we examine the influence of time pressure and time-dependent incentive schemes on the quality of decision-making in an experimental contest game.

INTRODUCTION

“High-velocity” environments are characterized by rapid changes in technology, demand, competitors, or regulatory rules (Eisenhardt, 1989) and often involve stress due to the need to make decision under time sensitive. As Eisenhardt notes, “the decision-making dilemma in such environments come from the fact that it is easy to make mistakes by deciding too soon and equally ineffective to delay choices or to imitate others”.

The goal of any decision maker is to make the most optimal decisions possible with a minimal amount of cognitive strain or effort. This may not be a very frightening task when given unlimited time to assess the decision problem, but many situations exist that require individuals to make decisions under deadlines. What happens to decision making in the presence of either potential gains or losses when we are under time pressure? (Maule, Hockey, & Bdzola, 2000).

Research suggests three major ways in which people respond to decision problems under time pressure. First people accelerate their processing (i.e., spend less time processing each item of information) (Huber & Kun, 2007). Second, processing tends to be more selective under time stress, focusing on the more important and/or negative information about alternatives (Ben Zur & Breznitz, 1981). Third, decision strategies may shift

as a function of increased time pressure (Payne, Bettman, & Johnson, 1988) (Svenson, Edland, & Slovic, 1990).

We investigate decision making under situations where there is time pressure. We are interested in how people adapt their decision when faced with possible limits of time. Then we summarize an accuracy-effort framework for adaptive decision behavior and purpose a game to report a study of decision strategies based on that framework. Finally, we discuss the implications of the results for adaptive decision making under time pressure.

Our study explicitly aims to investigate these issues. In particular, we will address two research questions: (1) is there a tradeoff between the quality of decision-making and time pressure and (2) how do time-dependent incentive schemes affect the (possible) tradeoff between the quality of decision-making and time pressure?

DECISIONS

Decision means taking a position. It involves two or more alternatives under consideration and the person who decides will have to choose between them (Kast & Rosenzweig, 1980). It is an action that needs to be taken when there is no more time to collect information (Moody, 1983). How man behaves and acts to maximize or optimize a certain result; decisions are made in response to a problem. A problem is a discrepancy between the current state of things and the desired state which requires consideration of alternative courses of action (Robbins & Coulter, 2005).

Decision making is the process of analysis and choice between alternatives, to determine a course of action (Chiavenato, 2002). Decision making is critical to the body and behavior of the organization, it provides the ways to control and enables coherence within systems (Kast & Rosenzweig, 1980). The decision making is the process of identifying and selecting a course of action, it is focused on the parameters of game theory and chaos (Moody, 1983). Under these definitions made by the authors it can be concluded that decision-making is a

process in which alternatives are defined for the solution of a problem, then they are analyzed and finally a decision is made.

The decision making process consists of 8 steps according Robbins (Robbins & Coulter, 2005):

This process leads to a final and optimal decision when the problem is well identified and the goals are well defined. If these two statements lack of a good definition and understanding, the whole process may result in a complete waste of time and decision making leads to disturbing and non-beneficial consequences.

Freman and Gilbert (Stoner, Freeman, & Jr., 1986) also define the rational decision making process in four stages:

- Stage 1: Investigate the situation.
- Stage 2: Develop alternatives.
- Stage 3: Evaluate the alternatives and choose the best among those available.
- Stage 4: Implement the decision and monitor it.

This model is basic and similar to the one proposed by Robbins, but in a summarized way, so application of either is valid for making a decision.

DECISION MAKING UNDER PRESSURE

Many decisions in economics and finance have to be made under severe time pressure. Furthermore, payoffs frequently depend on the speed of decision-making, as for instance, when buying and selling stocks. We find that convergence to equilibrium is faster and payoffs are higher under low time pressure than under high time pressure. Interestingly, time-dependent payoffs under high time pressure lead to significantly quicker decision-making without reducing the quality of decisions. (Kocher & Sutter, 2006).

Even though many decisions in economics and finance have to be made under severe time pressure, the effects of time pressure are a largely unexplored territory in these fields.

One of the key sources of the presumed speed/accuracy tradeoff is that time pressure prevents a thorough and in-depth processing of information. This effect of time pressure can result in the so-called 'closing of the mind' (Kruglanski &

Freund, 1983) meaning that people seek cognitive closure and stop considering important aspects of multiple alternatives. (Kocher & Sutter, 2006).

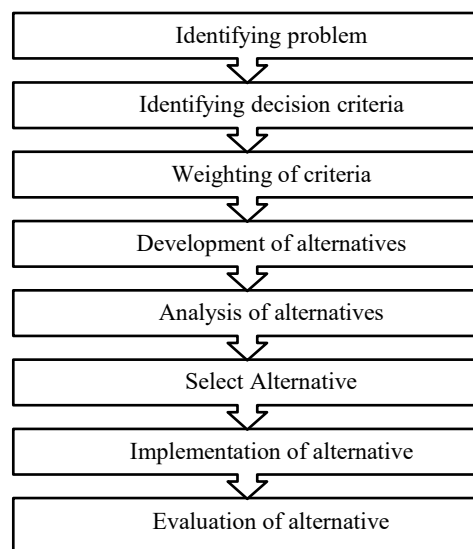
Evidence from psychological research on individual decision-making tasks suggests that a tight time constraint for decisions may impair the capacity for information processing or the consistency of decision-making, thus reducing decision-making quality. It has been the purpose of several papers to investigate (1) whether time pressure has a negative effect on the quality of decision-making in an interactive context and, given an affirmative answer to the first question, (2) whether time-dependent incentive schemes have an effect on decision-making under time pressure (Kocher & Sutter, 2006).

We have chosen a simple beauty contest game as our vehicle of re-search since it resembles very closely decision-making on financial markets where time pressure is a common phenomenon.

Several experimental studies have pointed out that decision making under time pressure can reduce the accuracy of a decision, which is known as the speed-accuracy-tradeoff, (Hockey, Maule, Clough, & Bdzola, 2000), produce extreme judgements and reduce the propensity to take risks (Kocher & Sutter, 2006). Time pressure also seems to induce a more frequent use of heuristics in decision making (Payne, Bettman, & Johnson, 1988). Whether time pressure influences search behavior has not been studied thoroughly, though. Based on the results of previous research we expect that time pressure will influence search behavior in a way that decisions become less optimal (Ibanez, Czermak, & Sutter, 2009).

Setting a tighter time limit for making decisions has been found to influence search behavior in initial rounds, i.e. when subjects are still inexperienced. This impact of time pressure in the early phase of the experiment is an important finding since it indicates that searching may be particularly suboptimal when subjects face a situation for the first time (think of an employee who suddenly loses his job and urgently needs to find a new source of income, which might induce him to accept the first opportunity of a new occupation, even if it is not an optimal one). The effects of tighter time restrictions on search behavior vanish quickly as subjects gain experience with the task, though. More experience leads in general also to quicker decisions (Ibanez, Czermak, & Sutter, 2009).

EXHIBIT 1 DECISION MAKING PROCESS



An experiment is reported that investigated the extent to which affective state, information processing strategy and task structure determine the effects of time- pressure on decision making. Research participants were presented with risk scenarios involving a choice between safe and risky actions. The scenarios were systematically varied in terms of out-come valence (positive or negative) and effort associated with taking the safe action (high or low). Half the participants were given unlimited time to make their decision, the other half were required to choose within a deadline. The findings showed that time- pressured participants were more anxious and energetic and used a number of different strategies to cope with the deadline.

These effects, as well as changes in risk- taking, were shown to vary systematically with task structure, particularly the effort manipulation. The findings are discussed in terms of how they contribute to theories of time-pressure and the methodological implications they have for future research in this area.

Reviews of research on time-pressure have identified a number of ways in which the outcomes and processes underlying judgment and decision-making change when the time available is limited (Hockey, Maule, Clough, & Bdzola, 2000). For instance, time-pressure has been shown to reduce the quality of decision making (Payne, Bettman, & Johnson, 1988) induce less extreme judgements (Kaplan, Wanshula, & Zanna, 1983) and reduce the propensity to take risks (Maule, Hockey, & Bdzola, 2000).

Maule and Hockey (Maule, Hockey, & Bdzola, 2000) argued that the imposition of a deadline, the usual way of generating time pressure, may induce a number of different affective states depending, in part, upon the importance of the decision, and the extent to which individuals appraise how they can adapt in ways that allow them to maintain their task goals at an acceptable level.

Second, Maule and Edland (Maule & Edland, 1997) argued that the effects of time-pressure may also vary with the mode of adapting used by individuals. They reviewed evidence indicating that time-pressured decision- makers may adapt in terms of relatively small scale or micro-changes in strategy. Examples of these include acceleration (increasing the speed or tempo or information processing) and filtration (increased

selectivity of processing). (Maule, Hockey, & Bdzola, 2000).

As mentioned above, Busemeyer (Busemeyer & Townsend, 1993) demonstrated that the effects of time-pressure on risk-taking in a gambling task depend crucially upon the variance of probabilities and the positivity/negativity of the expected values of outcomes.

Our findings showed, as predicted, that in addition to feeling time-pressured participants choosing within a deadline were more anxious and more energetic. This provides strong evidence that deadlines induce not only feelings of time-pressure, but also broader changes in affective state. As indicated earlier, we believe that the increase in anxiety rejects an increased awareness of the need to work harder that occurs when the amount of time to make the decision is less than would normally be taken (Maule, Hockey, & Bdzola, 2000).

Our analysis of the effects of time-pressure on information-processing strategy revealed that, as predicted, participants used both filtration and acceleration to adapt to the imposition of the deadline. Un-like previous studies, we investigated the relations between the use of these different modes, and showed that these may be seen as, to some extent, complementary strategies for participant’s strong use of one is associated with less use of the other.

GAME DESIGN

For game design it was used the methodology described by (Gómez, 2010). This methodology consists of ten steps:

Below are detailed each one of the steps in the game design.

1. **Identify the theme of the game:** Decision making under pressure environments.
2. **Stablish the purpose of the game:**
 - α) Teaching: Understand the decision making as a rational process. Establish the basic conditions for decision making. Establish differences between programmed and non-programmed decisions.
 - β) Check: The cost-type time pressures have been shown to reduce the quality of decision making (Payne, Bettman, & Johnson, 1988), induces less extreme

EXHIBIT 2 METHODOLOGY USED FOR THE GAME DESIGN.

STEP	DESCRIPTION
1	Identify the theme
2	Establish the purpose
3	Identify the instructional objectives
4	Identify and define general concepts of the theme
5	Select candidate techniques
6	Select the appropriate technique(s) according to characterization
7	Incorporation of specific knowledge
8	Development of initial tests (Pilot Sessions)
9	Consolidation of the final version
10	Elaborate an evaluation survey

judgments (Kaplan, Wanshula, & Zanna, 1983) and reduces the risk acquisition (Ben Zur & Breznitz, 1981). The preference of an individual to take a risk is inversely proportional to the magnitude of the undertaking, involving the decision.

χ) Measure: Quantify the effectiveness of decision making under different environments at different pressure and risk.

3. Identify the instructional objectives of the game:

- Identify the participant's performance in situations of tension.
- Develop the participant's ability to encode information quickly and timely.
- Measure the quality and acceptability of decisions at different pressure environments (Time pressure).

4. Identify and define general concepts of the theme: General concepts of decision making explained above in previous paragraphs.

5. Select candidate techniques: Based on key words within the game theme, Instructional objectives and basic concepts and definitions. Candidate Techniques are picked by the keywords are: Monopoly, Roleplaying and Ladder.

6. Select appropriate technique or techniques according to characterization: The evaluation of proposed techniques was based on the model proposed by Gomez (Gómez, 2010). In this model, several questions were raised for further techniques characterization (Techniques Knowledge Base available in Gomez (Gómez, 2010) and Duque (Duque, 2011)). These questions can be differentiated or standard and both are scored weighted. The maximum score for each technique is calculated. Next step is evaluating each of the candidate techniques; their respective scores obtained are evaluated under the model criteria. (Gómez, 2010).

The results indicate that none of the techniques are

within the range defined in the proposed evaluation criteria, meaning that those techniques do not fix with game proposal. A new technique needs to be arranged to meet the objectives of the game.

7. Incorporate specific knowledge to the game: In the previous step the techniques evaluated did not match to an existing technique template to modify it with specific knowledge of the game. For this we propose a new game technique.

8. Development of initial tests of the game (pilot sessions): Three pilot sessions were executed for game testing. First session was applied to four players. The time fixed to each situation was one minute. For the second session the number of players was two and time remains the same. For third session the participants were 2 and time was reduced to half a minute. Exhibit 3 shows some pictures of that tests.

From pilot sessions some enhancements were suggested for functionality of game:

- The game should be played in different groups considering the time limit.
- The way in which the alternatives are placed for election should be modified to avoid influence over decisions of co-players.
- Some situations need to be time particularized, so it will be defining a time limit for each situation.
- Other suggested changes were made about cards, boards, and game pieces, in order to improve fun factors.
- Due to the different time players took to make decisions on pilot sessions it was proposed to include a time benefit in final score to those ones that make the decision first.

9. Consolidation of the final version of the game: From

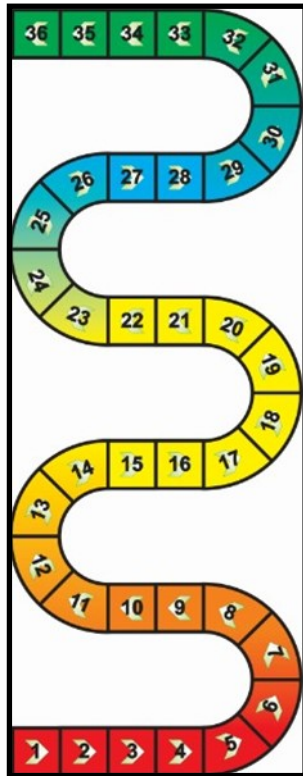
EXHIBIT 3 INITIAL TESTS OF THE GAME



key point suggested in pilot sessions, there were some changes applied to game template and parts and materials of the game. Some mayor changes are listed below:

- Game Board: the shape of the board was modified, avoiding confusion on chips or figure movements
- Game Template: Some changes like time limit and time measure were added like chronometers.
- Game Cards: New game cards were designed trying to accomplish some recommendations made on pilot sessions.

**EXHIBIT 4
GAME BOARD**



It is shown the final board design of the game with the respective modifications

Each number represents a box in which participants will advance in the game. The game starts in box number 1 and finishes in box number 32, colors of the board do not have any specific meaning. In this step the game in consolidated with all the suggestions of the pilot sessions.

10. **Elaborate an evaluation survey:** Some questions were made to participants, with the objective of collect primary information of their experiences, the reality and the fun factor of the game.

RESULTS

The main result of this paper is the completely design of the game Decisions, based on the 10 steps proposed by (Gómez, 2010). and focus on decision making under pressure. The materials for the game are shown in Exhibit 5.

To start the game each board must be assembled with all the material and the coordinator of each group must ensure that participant understand the game. The principal characteristics and instructions of the game are:

1. Each player has to read a case of study, before the beginning of the game and before making moves on the board.
2. Each player positions his chip in the starting box.
3. The board coordinator will deliver a situation to each player.
4. Situations cannot be read until the board coordinator points it out.
5. Given the signal, players have thirty (30) seconds to read the situation and then select a card with the chosen response alternative. Players of other boards, will not have time constraints, in order to compare results.
6. The selected card indicates the number of positions that the player must move on the board.
7. 12 rounds of situations are performed during the game, for which steps 3-5 must be repeated.
8. The game will be won by the participant who reaches the

**EXHIBIT 5
GAME MATERIALS**

MATERIAL	AMOUNT	DESCRIPTION
Board	1	Board with 36 boxes.
Game tokens	2 - 4	Game tokens of different colors to show the progress of each player on the board.
Game Cards	12	Cards with 12 different situations and their respective decision alternatives. One package for each player.
Score Cards	36	Cards with the scores or advance on the game board. One package for each player.
Guide to coordinate the game	1	Guide that contains all the steps to follow during the game.
Card holder	2 - 4	Card holder with 3 positions per situation, where the score cards are located. One for each player.
Format for data	1	Format for data tabulation of the game (scores by situation and times).
Chronometer	1	Countdown clock to regulate response times.

highest possible position on the game board, when the 12 rounds are completed.

9. The total time for the game is approximately of 1 hour to 1 hour and 30 minutes.

As an initial test of the game and with the objective of obtain primary results, the game was applied to 17 players distributed in four game boards as it follows:

- Game Board 1: Four players.
- Game Board 2: Four players.
- Game Board 3: Four players.
- Game Board 4: Five players.

The boards 1 and 2 had time constrains; for game boards 3 and 4 there were no constrains of any kind. The obtained results show that better scores occur in those game boards where there is not time pressure and consequently best decisions were made. Although there was no major difference between higher results this information is relevant to support what the objectives of the game are.

As a consequence of game application some values were tabulated in order to summarize the principal results.

As shown in Exhibit 6, player number 5 of game board 4 (No constrains game) is the higher score (34 points), 2 points before from the possible max point (36 points). The player with lower score (25 points) was the player 4 of game board 1 (constrains game), and the average score for all players including restricted and no restricted boards was of 30 points.

In addition, for those game boards with time constrains the response time by alternative and player were measured. The time limit for each alternative as stated in the games was of 30 seconds, but in some cases players an-answered more quickly than the expected time limit possibly due to the complexity of situations of the game and individual decision making process applied in the game.

Below is shown the average time response of players by situation:

CONCLUSIONS

As findings of the process of design of the game “Decisions”, it shows that the methodology of ten steps proposed by (Gómez, 2010) to design games is clear, easy to apply and continuously leads to improve the designed game.

Referring to changes made on materials of the game (Board and cards), the modifications enhanced the experience of the game and were very helpful but there is the need to review again the organization of the cards in order to ensure a game environment that lacks of any type of constraints, focusing only on constrains of time pressure.

The first application of the game show differences between making decisions with time constrains and without that constrains. As seen in exhibit 7, time pressure influences the decisions made on boards 1 and 2 and can lead to take non-optimal or least favorable decisions. This could be seen on the left side of the graphic. In the opposite case where no time constrains were applied the results are better than those within time constrains.

A second conclusion that could be made is the time taken to answer the situations on the game; as seen in table 2 the lower and higher average time response could lead to a particular characterization of each alternative time limit, thus making the environment and conditions of the game more restrictive.

Regarding the survey of the game, most of the people enjoyed the game and they think that it would be better to improve the cards where the sceneries are shown. They suggested the software design to play this game it would be the best way to enjoy this kind challenger.

For future work based on results and conclusions, the goal is to develop a computational game that could refine the behavior and performance of the game allowing a better achievement of instructional games objectives.

EXHIBIT 6
TOTAL POINTS OF GAME. FINAL SESSION

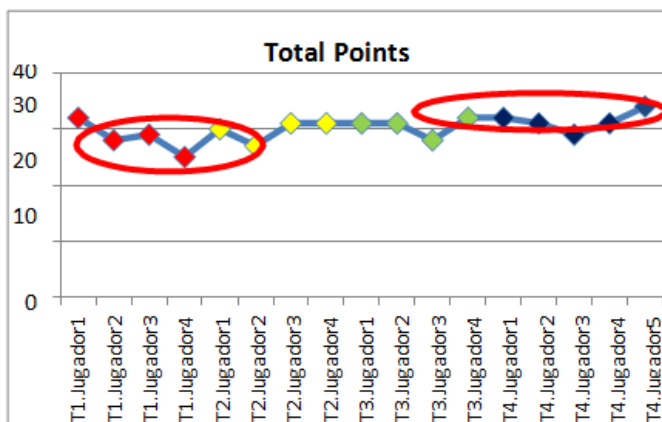


EXHIBIT 7
AVERAGE TIME RESPONSE BY ALTERNATIVE

Alternatives	Average Response time
1	18,68
2	18,19
3	19,63
4	14,79
5	16,29
6	20,77
7	15,03
8	16,52
9	23,51
10	20,20
11	21,90
12	24,76

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