IIAI Open Conference Publication Series
IIAI Letters on Business and Decision Science
Vol. 005, LBDS367
DOI: https://doi.org/10.52731/lbds.v005.367

A Study on a New Framework for the Influence of Time Constraints on Decision Making

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Abstract

This study examines a new analytical framework for the concept of time as it affects decision making. Here, we consider what generates time pressure to be time constraints and problem difficulty, and propose a framework for analyzing pressure situations based on a combination of these two factors. A preliminary small-scale experiment was conducted to test the validity of this framework.

Keywords: decision making, framework, time constraints, time pressure

1 Introduction

Decision-making is the act of selecting the best alternative from multiple alternatives for a certain objective. It is an indispensable act in our daily lives, and it would not be wrong to say that our daily lives are made up of a series of decisions.

The amount of time we can spend on a decision is finite. And it is not the case that the more time we spend on a decision, the better the result. Rather, it is possible to achieve satisfactory results even when decisions are made in a short amount of time. It is also possible that the more time one can spend on a decision, the more likely one is to postpone the decision. Conversely, a shorter time available for decision making may encourage the act of decision making. Thus, human decision making can be affected by time in various ways.

In this study, we discuss a new framework for analyzing how time constraints affect actual decision making. In particular, previous studies have assumed that it is simple time constraints that influence decision making. Here, however, we discuss a new framework in which not only simple time constraints but also the difficulty of the decision-making problem itself are considered to have a compound effect on decision makers.

2 Previous Studies

Decision-making is the act of selecting one of several alternatives, and the process is said to occur in the following order: setting objectives, enumerating alternatives, comparing alternatives, and making a decision. Therefore, a change in the decision-making outcome is considered to mean that some change in the decision-making process has occurred. Therefore, in

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studying the impact of time constraints on decision making, this paper will discuss how time affects the decision-making process itself. To this end, this section will address previous research on time constraints and the decision-making process. In addition, the concepts and definitions of time constraints that have been shown to influence decision making will be summarized.

2.1 Previous Studies on Time Constraints and Decision Making

Ando used time pressure as a concept of time that influences decision making, and divided the items to be considered when making a purchase into two categories: analytical items, which are analytical, controlled, rule-dominated, and labor-intensive, and sensory items, which are intuitive, associative, quick, automatic, and labor-saving [1]. The following nine hypotheses were developed by incorporating the level of information-processing intention as the level of motivation for information processing. Ando then conducted an Internet-based questionnaire survey of custom-built homebuyers and statistically analyzed the results to test the hypotheses.

H1: Consumers under time pressure spend less time processing information than consumers who are not under time pressure.

H2: Consumers under time pressure have a narrower range of information processing than consumers who are not under time pressure. In other words, they have fewer choices.

H3: Consumers under time pressure have less depth of information processing than consumers who are not under time pressure. In other words, they have fewer items to consider.

H4: Consumers under time pressure do not differ in the amount of analytical information they process compared to consumers who are not under time pressure. In other words, there is no difference in the number of analytical items.

H5: Consumers under time pressure process less sensory information than consumers who are not under time pressure. In other words, they process fewer sensory items.

H6: Consumers with low information-processing intention process and maintain the same amount of analytical information even when the level of time pressure increases.

H7: For consumers with low information-processing intention, the amount of sensory information processed increases as the level of time pressure increases.

H8: For consumers with high information processing intention, the amount of analytical information processed decreases as the level of time pressure increases.

H9: For consumers with high information-processing intention, the amount of sensory information processed remains unchanged and is maintained even as the level of time pressure increases.

For each of the hypotheses, statistical analysis using the questionnaire results supported Hypothesis 1, Hypothesis 3, Hypothesis 4, Hypothesis 5, Hypothesis 6, and Hypothesis 8. Hypothesis 2 and Hypothesis 7, on the other hand, were supported only in specific situations.

Edland with the Maximum rule, which chooses the alternative with the highest rated of all attributes, the Minimum rule, which does not choose the alternative with the lowest

rating, and the Majority of Confirming Dimensions, which chooses the alternative with the highest number of attributes that are better than the other alternatives, Max important rule, which chooses the most highly rated alternative with the most important attributes, were enumerated, and a study was conducted on the question of which decision rule tends to be used under time pressure. In the validation experiment, 80 subjects were randomly selected from college and high school students and divided into two groups [2].

Then, one group was given 15 seconds and the other 55 seconds to make a decision problem in which they had to choose one of the three candidates who would be able to go through the college process and graduate as a school clinical psychologist. There, the problem was set up in such a way that it would show the trend of what rules were used depending on the alternative chosen. The results showed that decision makers under time pressure tended to use Maximum rule and Max important rule associated with positive information more than those who were not under time pressure.

2.2 Previous Research on Time Constraints and Definitions of Time Pressure

Next, we will introduce how time constraints and time pressures that influence decision making are defined in prior studies.

Hwang states, “Although time pressure has been studied intensively by psychologists and behavioral scientists, a generally accepted definition does not exist. He also explains the difference between time pressure and time constraint, “Here, no distinction is made among time pressure, time constraint, and time limit.” [3].

Howard and Sheth considered time pressure to be the reciprocal of the amount of time available for consumers to perform the actions required for consumption-purchase behavior. They then stated that it is the amount of time required for a consumer to perform a consumption-purchasing behavior, which is related to the time the consumer allocates to himself to perform the consumption-purchasing behavior [4].

We consider that, unlike the definition by Howard and Sheth, the impact of available time on decision making in general is a concept that can occur in any decision, not just in purchasing behavior. We also believe that it does not arise simply from the constraints of available time, but that the constraints of time and the pressures on the decision maker arising from time are two different things, since the same time availability does not have the same impact on easy and difficult decision problems.

Contrary to Hwang's assertion, some prior studies consider time constraints and time pressure to be different. Ordòñez and Benson defined “Time constraint exists whenever there is a time deadline, even if the person is able to complete the task in less time.” and “Time pressure indicates that the time constraint induced some feeling of stress and created a need to cope with the limited time. Thus, it is possible to have time constraint but no time pressure.” [5]. Here, the time constraint is an externally observable variable, from which some factor is added that can affect the decision-making process, which is time pressure.

However, even if there is a time constraint in decision making, the impact of the time constraint on decision making may change between a case where an alternative that is superior in all aspects can be easily found and a case where the evaluation of alternatives is

competitive and one cannot easily select an alternative. In other words, the impact of time constraints on decision making should vary depending on the difficulty of the decision problem.

Both Howard 's and Ordòñez and Benson 's definitions consider that what influences decision-making is only an external factor, the time constraint. However, while the change in the outcome of a human decision is externally observable, the process by which that decision outcome is changed is internal and unobservable. Therefore, if the decision-making outcome is changed by the effect of time, then the effect of time on the decision-making process is considered to be acting on the decision-making process, and the effect of time constraints on decision-making is a variable acting on the internal human mind. In addition, since decision-making is solely internal to the individual and how it is affected can vary from individual to individual, the degree of time influence should be different for each decision-maker.

Hwang states that “The task characteristic that is likely to be changed through varying time pressure is task difficulty.” “The change in task difficulty is likely to cause performance differences, which then may be appropriately attributed to varying time constraints.” “ Task difficulty may be defined as the degree of cognitive load, or mental effort, required to identify a problem solution. [3]”

Since time pressure is considered here as the same thing as time constraints, when this is applied to decision making, it can be interpreted as a change in the difficulty of the problem and a change in the decision outcome due to a change in time constraints. Figure 1 below shows a conceptual model of this idea.

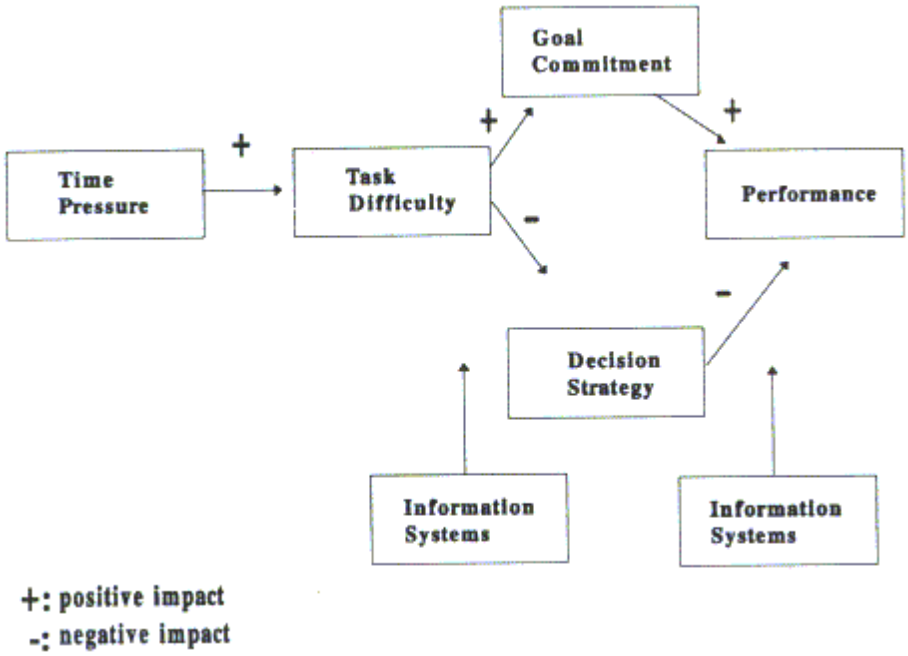

Figure 1: A model of decision making under time pressure. (Hwang, [3])

Here, Task difficulty is considered to be one that can vary with Time Pressure Here, we consider the difficulty of a decision problem to exist independently of the time constraint. Even when no time constraint is set, the difficulty of the problem exists and affects the decision outcome..

3 New Analytical Framework

In the previous section, we introduced definitions of time constraints and time pressure that affect decision making. In contrast to the definitions introduced here, we provide new definitions of time constraints and time pressure, and propose a new analytical framework for decision-making problems based on these definitions.

3.1 New Definitions of Time Constraints and Time Pressure for Analytical Frameworks

From what has been discussed above, we will redefine time pressure that affects the human decision-making process in a new way, distinguishing it from simple time constraints. The four requirements are as follows. The time pressures that influence human decision making are those that arise from

1 time constraints.

2 It results from the difficulty of the problem.

3 It is clearly distinct from time constraints.

4. they affect the inner life of the decision-maker.

In making definitions that meet these requirements, it is necessary to make new definitions of time constraints and problem difficulty.

First, we define time constraint as "the degree of constraint arising from the amount of time available to the decision maker. This is an objectively measurable variable.

Next, difficulty is defined as "the difficulty of the problem is the degree of difficulty in solving the decision-making problem. This is another variable that can be objectively estimated by a decision-making expert's judgment.

We will now consider where difficulty of the problem in decision-making arise. If we consider each stage of the decision-making process, we can start with the difficulty of goal setting. Second, an excessively large or small number of alternatives or attributes to consider can also make decision-making difficult. Other difficulties can be the difficulty of comparing alternatives.

Based on the above conceptual preparation, we define time pressure as a psychological feeling that influences decision making and is caused by time constraints and the difficulty of the problem. It is a subjective variable and difficult to measure objectively.

On top of that, the generation and influence process of time pressure is shown in Figure 2. This represents the fact that time constraints and the difficulty of the problem cause changes in the decision-making process, which in turn changes the observable behavior. The idea here is based on the idea that the occurrence of time pressure changes the decision-making process and, accordingly, the decision-making outcome. Based on this idea, it is conceivable that if time pressure causes a negative change in decision making, this can be ameliorated by taking action against time constraints and problem difficulties.

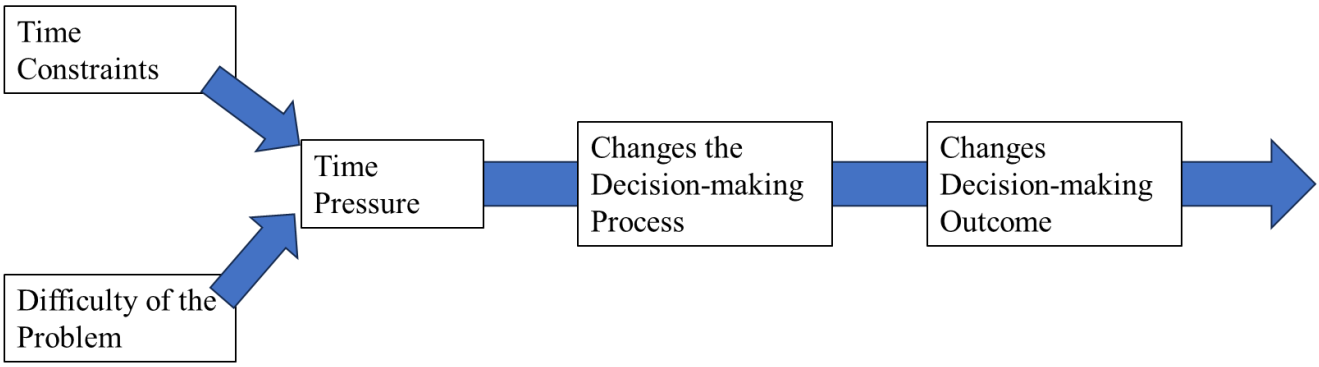

Figure 2: Time pressure generation and its influence process.

3.2 Suggestions for a Framework That Combines Problem Difficulty and Time Constraints

In this study, we redefined time pressure based on the idea that decision making is changed by time constraints and the magnitude of the difficulty of the problem. Therefore, in future research on how decision making is changed by time pressure, we will classify decision-making problems according to time constraints and the magnitude of problem difficulty. As a framework for classifying problems with this objective, we will create four areas with the difficulty of the problem on the vertical axis and the time constraint on the horizontal axis. Figure 3 illustrates what kind of decision-making situations can be assumed for each area.

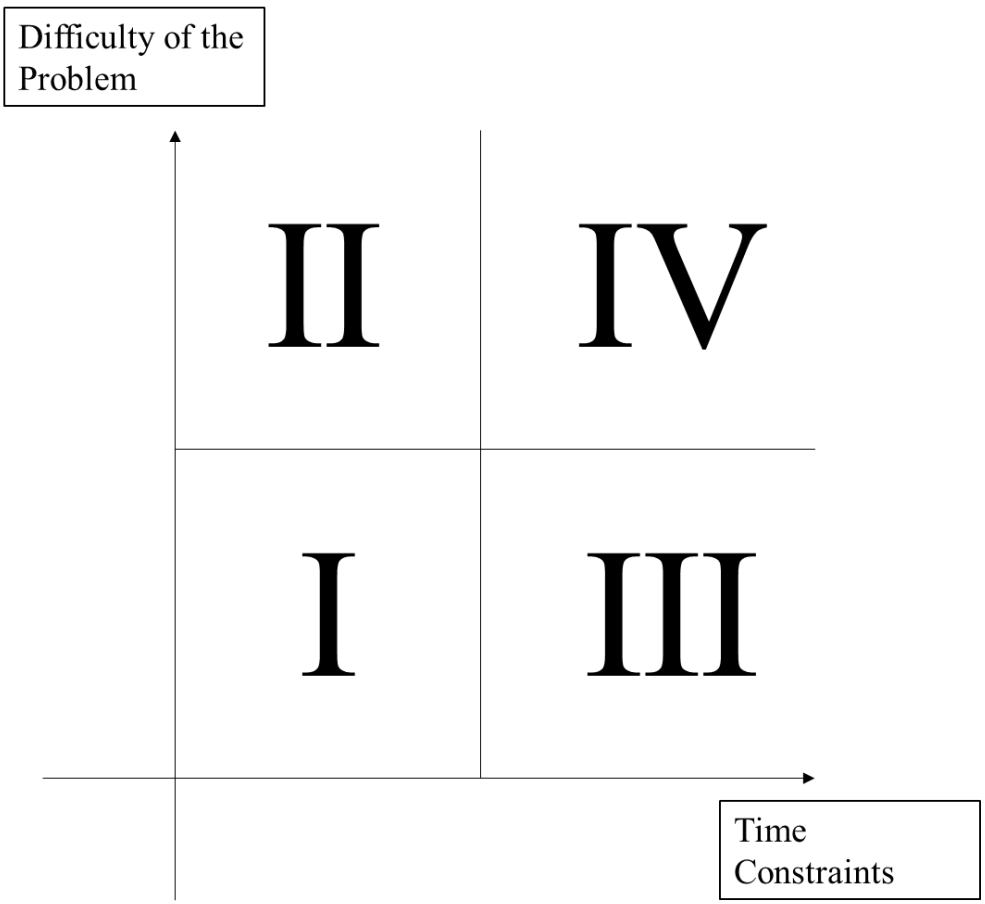

Figure 3: Decision-making situation due to time pressure

In this figure, area I shows a situation where the problem is easy and there is almost no time constraint, i.e., there is not much time pressure on the decision maker. Area II shows a situation where the problem is difficult and there is almost no time constraint, which means there is a moderate amount of time pressure on the decision maker. Area III represents a situation in which the problem is easy and the time constraint is large, and the decision maker is under a moderate amount of time pressure. Area IV represents a situation where the problem is difficult and the time constraint is large, which means that there is a very large amount of time pressure on the decision maker.

From this point, we will study how human decision making changes under time pressure.

4 Experiments

We have discussed the magnitude of time pressure by classifying decision-making situations into four areas based on time constraints and the magnitude of difficulty of the problem, as described above. The following hypotheses are then formulated regarding how the decision-making process changes depending on the time pressure situation.

"Decision makers' use of heuristic rules varies with the difficulty factor of the problem and the magnitude of the time constraint."

To test this hypothesis, an experiment will be conducted.

4.1 Experiment Summary

An experiment will be conducted to test what real-life human decision making under time pressure is like, and the experiment will be followed by an open-ended questionnaire asking what kind of decisions were actually made. To do so, we will develop decision-making questions under situations that fall within each of the areas of the proposed analytical framework that preceded the experiment.

First, we will consider the difficulties of the decision-making questions in the design of the experiment. Based on the analysis conducted in the previous chapter, the factors that increase the difficulty of the problem are considered to be the amount of information and the fact that the problem is ill-structured. In other words, decision problems in which it is impossible to enumerate alternatives and attributes due to insufficient information, decision problems in which it is difficult to select the optimal objective or compare alternatives due to excessive information, and decision problems in which objectives, alternatives, attributes, and constraints are not clear are considered difficult to decide. Therefore, in designing the experiment, two types of decision problems with high problem difficulty were created: decision problems that are ill structured and have excessive amounts of information, and decision problems that are ill structured and have low amounts of information. Similarly, one type of decision problem, well structured decision problem, was created as a decision problem with low problem difficulty.

Next, consider time constraints. The size of the time constraint depends on how the deadline is given. Therefore, when creating a decision problem with a large time constraint, we create a problem situation in which a decision must be made almost instantaneously by dividing the time by 30 seconds or 2 minutes. For decision-making problems with small time constraints, we create problem situations where decisions can be made slowly over the course of a week.

Based on these factors, a decision-making problem for the experiment is created for each area. First, for the decision-making problems in the first area, where the time constraint is small and the difficulty of the problem is small, we set well-structured decision-making problems that can be made over a week. Next, for the decision problems in the second area, where the time constraint is small and the difficulty of the problem is large, we set up ill structured and low information decision problems that can be made in one week. Next, for the third area, where the time constraint is large and the difficulty of the problem is small, we set a well-structured decision-making problem in which a decision is made in 30 seconds. Finally, for the fourth area of decision problems, where the time constraint is large and the difficulty of the problem is high, we created an ill structured and information overloaded decision problem in which a decision must be made in 2 minutes.

In conducting the experiment, participants in the decision-making seminar, who were mainly university students and had previous knowledge of decision-making, were used as

subjects. To conduct the experiment, we first distributed a request for cooperation and explained the flow of the experiment. Then, the participants were asked to solve a decision-making problem in the third area, followed by the distribution of a questionnaire with questions to be filled out. This process was repeated for the fourth area. Then, the questionnaires for the first and second areas were distributed to the participants, and they were asked to submit their answers one week later. In addition, they were asked to fill out a questionnaire after submitting their answers. The participants were given approximately 20 minutes to fill out the questionnaires for each question. The number of valid responses was different for each question in each area.

In addition, the questionnaire that the participants were asked to answer after the experiment consisted of the following five questions.

1. other than the one chosen, what other alternatives were there? Please answer by specifically naming the alternatives. (Not provided for questions that gave alternatives.)

2. What were your goals in making this decision? Please answer specifically the purpose/goal of the choice.

3. What aspects did you focus on in making your final decision? Please be specific about the attributes you focused on.

4. How much time did you spend on the entire decision-making process? Please answer how long it took you to make the final decision. (For the decision-making questions with smaller time constraints, we also asked the participants to verbally answer the date and time of their final decision in this section.

5. How did you narrow down the list of alternatives to the one that was finally chosen? Please describe in detail how you narrowed down the list of alternatives and the process you went through.

4.2 Experimental Results and Discussion

In the experiment conducted in the area , of the twelve subjects who gave valid responses, only three subjects comprehensively considered the presented attributes, indicating that most subjects made decisions in a way that was not a rule that comprehensively considered the utility of all attributes. When asked when and how much time they spent making decisions, most subjects indicated that they spent less than 30 minutes on the day of the deadline. This can be said to indicate that even if the time constraint is small and the difficulty of the problem is small for a decision-making problem, they do not make decisions until the time constraint is greater.

In the experiments conducted in the second area, it was found that all participants set their own constraints in some form. This indicates that the subjects set some conditions for information gathering in response to the bad structure and insufficient information, which were the factors contributing to the difficulty of this problem, i.e., they dealt with the unclear alternatives by setting constraints. When asked when and how much time they spent on the decision-making process, most subjects said that they spent less than 30 minutes on

the day of the deadline. This can be said to mean that even if the time constraint is small and the difficulty of the problem is large for a decision-making problem, they do not make a decision until the time constraint is large.

In the experiment conducted in the third area, when asked what process they used to make decisions on problems in this area, all respondents indicated that they used only one type of heuristic rule in their decision making.

In the experiment conducted in the fourth area, decision makers tended to make at-random choices called “intuition,” choices that relied on visually accessible information, such as “I decided on what I saw,” or choices based on prior knowledge, such as “I chose an alternative that I knew the characteristics of beforehand,” or They tended to make choices based on prior knowledge.

Thus, it became clear that there were specific trends in decision making in each of these areas. Therefore, we can confirm that this analytical framework has a certain validity. In addition, the new definition of time pressure is more in line with reality, since decisions are influenced by time constraints and the difficulty of the problem.

In addition, looking at the decision-making tendencies for each of these four areas as a whole, the following can be seen. That is, for decision-making problems in the second area, the difficulty of the problem is reduced and decisions are made after a certain time constraint is exceeded. In other words, we can say that decision makers tend to make decisions after the decision problem in the second area has been reworked to become a situation in the third area. Similarly, for the decision-making problems in the first area, decision-making is made after the time constraint exceeds a certain level. In other words, we can say that decision makers tend to make decisions for decision-making problems in the first area after they have reached the situation in the third area.

This is illustrated in Figure 4 below.

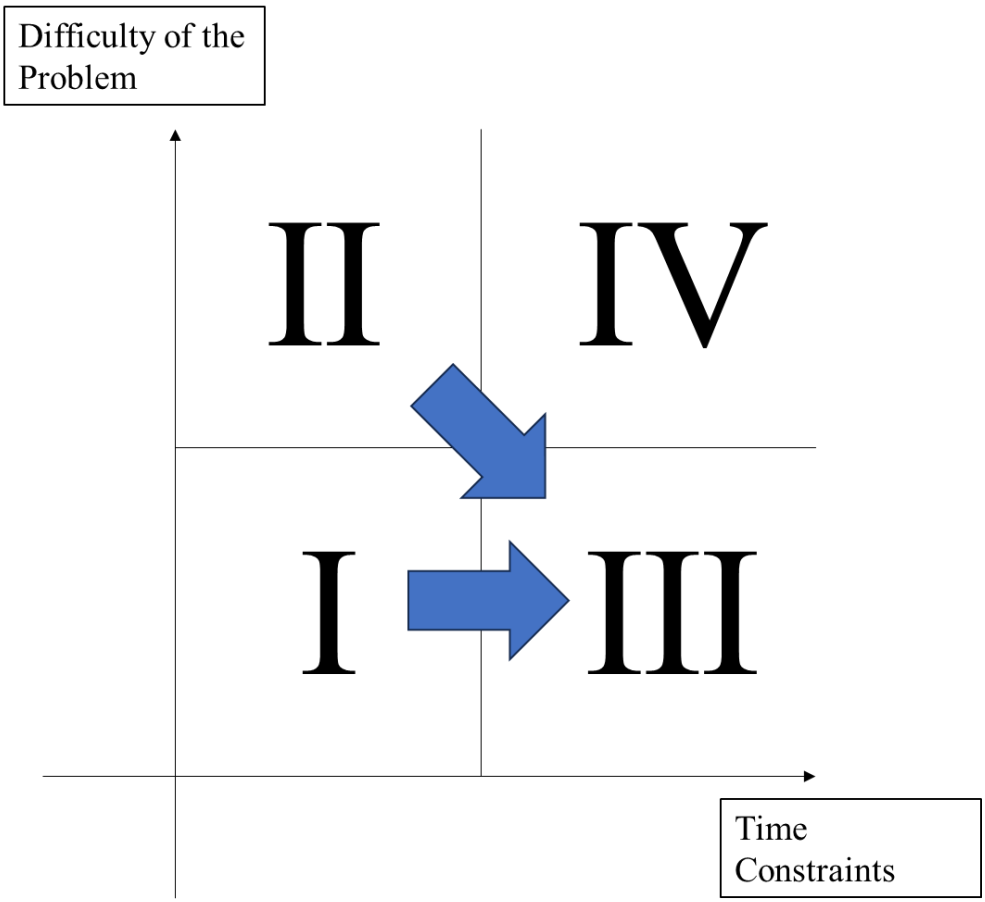

Figure 4: Remaking the decision-making situation

Thus, it was found that humans make decisions after remaking the decision problem and changing the situation in response to time constraints and the difficulty of the problem. From this, we can say that humans do not make decisions unless they are under some degree of time pressure. This is a convincing result in light of my own experience and the experiences of many of my friends. Therefore, this is another result of this study.

5 Future Issues

In line with the newly used analytical framework, a simple experiment was conducted in the present study, suggesting that there may be certain tendencies in human decision making under time pressure. Therefore, it can be said that this study has achieved certain results. We will now consider the issues that need to be addressed in order to further develop this research.

In this experiment, the number of responses to the questionnaire was small, and the open-ended response method made statistical processing difficult. Therefore, in the next

round, we would like to design an experiment aiming at statistical processing, and statistically investigate the impact of time constraints on decision making.

In this study, based on our own experience, we designed the experiment assuming that the difficulty of the problem is due to the ill-structured problem structure and the under- or over-information. In the future, it will be necessary to examine more concretely the factors of "ill structure" and "excessive or insufficient amount of information," which were considered at an abstract level, as factors of difficulty in decision-making problems, to conceptualize the difficulty in some form, and then to verify the conceptualization. In addition, since there may be other factors besides the ill structure and the excessive/excessive amount of information that may cause the difficulty, there is room to extract and verify these factors.

Finally, the present experiment suggests that there is a certain tendency to set constraints in dealing with the difficulty of the problem. Therefore, there is room to investigate what other ways of coping with difficulties exist besides those found in the present study.

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