Effects of Time Pressure on the Amount of Information Acquired

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Abstract

We tested the influence of time pressure and to what extent time pressure interacts with the contextual factors ('payoff scheme' and 'level of costs for information that can be acquired') in three laboratory experiments. Participants had to decide how many pieces of information they wanted to purchase non-sequentially in order to make a decision under uncertainty. Our findings indicate that under time pressure, individuals acquire less information. Moreover, while we found no effect of time pressure with a negative payoff scheme, higher levels of information costs suppress the willingness to acquire information.

Keywords: information acquisition, decision-making, amount of information, time pressure, payoff scheme, information costs

1. INTRODUCTION

Many economic decisions are accompanied by time restrictions (e.g., Kocher et al., 2019), such as trading, purchasing and sales, or production decisions. Particularly in the times of digital media, more information is available for decision-making and needs immediate processing (e.g., Gawryluk and Krawczyk, 2017). In organizational contexts, where time plays a crucial role, questions about the behavioral control of how much information should be acquired and used in decision-making processes are highly relevant. Even though prior research has already investigated the role of time pressure for sequential information acquisition behavior (Mann & Tan, 1993), research on information acquisition has not yet examined its influence when information acquisition is non-sequential. The examination of non-sequential information acquisition under time pressure is highly relevant, since the argument that the given time frame hinders the decision maker from inspecting all the information is most important for many work situations. Further, through digitization, more and more information is becoming available and can be used as a basis for decision-making (Saxena & Lamest, 2018). Therefore, it is often unrealistic to inspect all the information available so that the decision about the amount of information to be inspected (and acquired) is often made at the beginning of the decision-making process. Up to now, most studies have manipulated time as the only variable across treatments even though it is possible that this variable interacts with other contextual factors (Spiliopoulos and Ortmann, 2018). Hence, the present study aims to identify how time pressure by itself and in conjunction with further contextual factors affects the amount of information acquired in a decision-making process.

For three reasons, the factor of primary interest in this paper is that of time pressure: First, time pressure is an important topic in everyday work life (Lallement, 2010). Second, time pressure is often strongly related to decision-making processes due to the sheer amount of decisions that have to be made on a regular basis and that are often accompanied by strict deadlines (Geisler and Allwood, 2018). Third, time pressure is not only a natural factor within organizations, it is also a factor that can be artificially invoked by managers and it can therefore be used as a control instrument. For these reasons, we investigate the following research questions: (1) What is the effect of time pressure on the amount of information acquired by individual decision makers? (2) Does the effect of time pressure on the amount of information acquired depend on different payoff schemes in a decision-making task? (3) Is the effect of time pressure on the amount of information acquired different for various levels of information acquisition costs? To answer these research questions, we conducted laboratory experiments and employed multivariate analyses.

The paper is structured as follows: In the next section, we summarize existing research on information acquisition in decision-making. We review related research on time pressure effects in the decision-making literature, as well as on payoff schemes and information costs. Then, we explain the protocols of the experiments we conducted, the measures used, and the methodology of the analysis. Subsequently, we present and then discuss the results of the three experiments. Finally, we summarize the theoretical and practical implications as well as the limitation of our research and we outline future research implications.

2. THEORY AND HYPOTHESES

2.1 Information acquisition research

Prior literature on the amount of information acquired for decision-making (e.g., San Miguel, 1976; Mann and Tan, 1993; Kerstholt, 1996) can be divided into two parts: the acquisition of sequential and of non-sequential information. The former investigates pieces of information that are acquired one after another. The latter deals with the process of obtaining varying amounts of information at only one point in time and is the underlying form of information acquisition in the present study. Studies in this field deal with a broad range of topics: San Miguel (1976) examined, among other things, the effect of psychological traits on the amount of information purchased before decision-making. This study shows that the mean amount of information purchased is higher for individuals low in flexibility (also described as being intolerant of ambiguity) and is very similar between different levels of intellectual efficiency, which describes how efficiently an individual uses her / his intellectual resources (Gough, 2000). In the experimental task by Fischer, Schulz-Hardt, and Frey (2008) participants made a decision on a legal case and each participant was requested to choose one piece of information that was consistent or inconsistent with her or his prior decision between a set of two or ten pieces of information (half of the set of two and half of the set of ten pieces of information was consistent and the other half was inconsistent). The results show a preference for inconsistent information when participants were faced with two pieces of information and for consistent information when they were faced with ten. In the experiment by Uecker (1978), participants had to choose an amount of

information in the form of a random sample size to be drawn from an urn containing a total of 100 marbles, some of them black and some of them white (as information systems). The urn was selectable from a set of 10 urns and the ratio of black to white marbles in the selected urn was unknown to the participants. They only knew that out of the 10 urns, 2 of them contained 90 black and 10 white marbles, 4 urns contained 70 black and 30 white marbles, 3 urns contained 50 black and 50 white marbles, and 1 urn contained 30 black and 70 white marbles. After specifying a random sample size, the marbles were shown to a simulated decision maker, executed through a computer, and programmed with either a Bayesian or a conservative decision model. Based on the sample results and its prior probability assessments, the simulated decision maker estimated the ratio of black to white marbles in that urn. The optimal information system for the Bayesian model comprised 16 marbles and, for the conservative model, the sample size was 24 marbles. The participants were provided with a budget of $3.00, and the cost for sampling a marble was $0.01. In the case of a decision maker making a correct decision, each participant received $0.50 less the cost for the marbles in the specified sample. In the case of a decision maker making an incorrect decision, each participant lost $0.50 plus the cost of the marbles in the specified sample. However, this study was not primarily interested in the amount of information acquired. It was more interested in discovering whether the participants were able to choose an optimal information system for the decision maker, i.e. if he / she specified the sample size in accordance with the normative theory of information evaluation. Overall, there was no significant convergence on the optimal number of marbles with the decision models. Moreover, participants specified smaller sample sizes than optimal for the conservative model. In the present study, we aim to identify contextual factors that influence acquisition behavior rather than the way in which people deviate from an optimal information level.

2.2 Time pressure and its effects on decision-making

Time pressure plays a crucial role in information acquisition and decision-making (e.g., Payne et al., 1988) and is often induced through the imposition of severe time restrictions within the decision-making process. Overall, much of the previous research explored the effects of time pressure on information processing (for a review, see Lallement, 2010). In particular, the following phenomena play a role when processing information under time pressure: individuals accelerate the decision process, pay more attention to negative information, and may selectively screen information since they are focusing on aspects they regard as being important (Ben Zur and Breznitz, 1981; Wright, 1974). For example, in the experiment by Mann and Tan (1993), participants were confronted with a decision dilemma. Before making a choice between two options, they had the possibility to inspect information sequentially in an information booklet. Results show that participants who were pressed for time read less information in the booklet because they focused on information that they perceived as being important.

Apart from the effects of time pressure on information processing in general, studies highlight its negative effects, the fact that it influences individuals differently and they outline its positive effects as well. Time restrictions leading to time pressure are often seen as factors that increase task complexity or difficulty (e.g., Chernev et al., 2015). Furthermore, it is assumed that individuals under time pressure tend to disregard relevant aspects and to use heuristic methods (e.g., Kruglanski and Freund, 1983). Besides these assumptions, time pressure may lead to disruptions because the remaining time is inspected visually (Mann and Tan, 1993) and has been found to lead to lower decision performance (e.g., De Paola and Gioia, 2016). In addition to this, it is common sense that perceived time pressure induces stress (e.g., Keinan et al., 1987). Importantly, Conte et al. (2015) argue that when time pressure is present, the performance of the majority of individuals may be negatively affected but not of all of them. This finding is also supported by the study results of Kocher et al. (2019), who, in risky decision-making tasks, found that individuals with the ability to cope with time restrictions perform differently when perceiving time pressure from those individuals without this ability. Apart from these negative time pressure effects dependent on individual traits, Lindner and Rose (2017) found that time pressure leads to less present-bias, which means that individuals pay more attention to the amount of payment instead of the immediateness of the decision. Additionally, Ordóñez et al. (2015) infer from the literature that people work more smartly when a deadline is in place, thereby increasing efficiency.

The dual-system approach (Kahneman and Frederick, 2002; Stanovich and West, 2000) can help us to understand how time pressure impacts decision-making. It assumes that two systems of information processing and decision-making exist. These are defined, in particular, due to their characteristics of rapidity and controllability (Kahneman and Frederick, 2002). System 1 is described by traits such as automatic, intuitive, or fast. In contrast, System 2 is characterized by traits such as controlled, deliberative, or slow. The interaction of the two systems is described in the literature as follows: System 1 suggests intuitive solutions immediately, while System 2 monitors and, if necessary,

remediates these. Responses of an individual evolve either through automatic (System 1) or controlled (System 2) cognitive processes (e.g., Kahneman and Frederick, 2002). The operations of System 2 can be disrupted by external factors, such as time pressure, since there is less time for thinking deliberately and the remaining time needs to be monitored. Thus, the function of System 2 is weakened through the presence of time pressure and leads individuals to filter for only those aspects that appear to be most striking (Maule et al., 2000). As a result, judgement biases, which are not necessarily remediated by System 2, can occur and can interrupt decision-making. Importantly, Glöckner and Betsch (2008) note that even if the presence of time pressure inhibits deliberate considerations, this does not need to impact automatic processes negatively. In the same vein, Kahneman (2003) argues that automated decisions often lead to good results and can even be superior to System 2 thinking.

Derived from these theoretical lines or argumentation (e.g., Lallement, 2010; Glöckner and Betsch, 2008), we assumed that participants under time pressure decided quickly, without thinking deliberately about how much information to purchase. Based on prior literature in this research field (e.g., Mann and Tan, 1993), we argue that fewer pieces of information are selected non-sequentially under time pressure, and we therefore tested the following hypothesis:

H1: Participants under time pressure acquire less information than participants without time restrictions.

Kahneman (2003) regards the accessibility of information, which he describes as "the ease (or effort) with which particular mental contents come to mind" (Kahneman, 2003: 699), to be dependent on properties of the cognitive constitution and the context. Therefore, we explore not only the influence of *time pressure* but also the influence of its interactions with the following contextual factors: *payoff scheme* and *information costs* on the *amount of information acquired*.

2.3 Payoff schemes in decision-making under time pressure

In general, payoff schemes describe the decision-based and environmentally condition-based payments for the decision maker and they therefore consist of various outcome options. These outcomes are often based on the information used to make decisions and can include positive information on potential positive outcomes (gains) and negative information on potential losses.

The literature has revealed that a negativity bias exists i.e., negative information, also labeled as entity, event, stimuli, or aspect of an object, has a greater effect than positive information (Kanouse and Hanson, 1987; Baumeister et al., 2001; Rozin and Royzman, 2001; Peeters and Czapinski, 1990). Negative information comprises, for example, information about potentially losing money, or being criticized, whereas positive information, for example, refers to winning money or receiving acknowledgments (Baumeister et al., 2001). The literature also links the negativity bias to cognitive processes and states that negative information involves more (thorough and conscious) processing than positive information does, so that an individual's definite impression builds more strongly on negative information (Baumeister et al., 2001; Ito and Cacioppo, 2000; Peeters and Czapinski, 1990). Although many studies provide evidence for a negativity bias, the strength of the evidence depends on various issues (Baumeister et al., 2001) and it is therefore not a generic bias (Rozin and Royzman, 2001).

Payoff schemes in conjunction with time pressure have mainly been researched in the context of risky gambles. For example, Ben Zur and Breznitz (1981) found that participants under time pressure paid more attention to possible losses compared to gains and Gawryluk and Krawczyk (2017) found that more deliberation time leads to a more accurate weighting of the options in risky gambles. Moreover, studies have examined risk preferences under time pressure (e.g., Kirchler et al., 2017). Even though risk preferences for lotteries do not play a role in the context of the present study, the important take away is that time pressure affects lottery choices where payoff schemes play an important role. The study by Haesevoets et al. (2019) supports this notion, since they found that the payoff structure (i.e. endowment size) significantly influences choice behavior. This leads to the assumption that different payoff schemes invoke different information acquisition behaviors.

Whereas some studies have already shown that under time pressure individuals give more weight to negative outcomes (Ben Zur and Breznitz, 1981; Wright, 1974; Huber and Kunz, 2007), prior research studies have not yet investigated the effects of different payoff schemes, i.e. with either negative or positive expected values, in conjunction with time pressure on information acquisition behavior. When participants faced a positive payoff scheme, we assumed that participants under time pressure would make use of System 1 thinking and that they would acquire significantly less information. Based on previous studies in this research field (e.g., Haesevoets et al., 2019; Ben Zur and Breznitz, 1981), we expected that a higher negative payment in possible negative outcomes would lead to a focus on this negative information and to a shift away from intuitive processes (induced by time pressure) towards more deliberate cognitive processes. In particular, we hypothesized the following:

H2: Participants confronted with a negative payoff scheme and who are placed under time pressure acquire more information than participants confronted with a positive payoff scheme and who are placed under time pressure.

2.4 Information costs in decision-making under time pressure

Information costs describe the (monetary) value relevant to acquiring information and this is very often linked to a certain amount of costs to be paid. From the rational perspective, the cost for information must be compared with the benefit of its diagnostic value (Connolly and Thorn, 1987) and higher costs should lead people to purchase only the amount of information that has a higher or equal utility than related costs (Kraemer et al., 2006).

When sequential information is considered, only the study of Kerstholt (1996), at least to our knowledge, has investigated the effect of different levels of information costs under time pressure in a dynamic task. The study has shown that under time pressure, relatively low information costs lead people to acquire more information compared to relatively high information costs. Importantly, this result was found when it would have been better (because of a higher expected outcome) to apply an action immediately instead of requesting any (further) information. They inferred that people tend to decide based on a direct comparison of the costs for information and action and that further factors are not considered. Additionally, they concluded that relatively low information costs lead people to acquire information sooner in that task.

The role of information costs was also the subject of the following studies which did not consider the influence time pressure: The experimental study by Baethge and Fiedler (2016), where participants were involved in an investment task with either free or costly information, has shown that when confronted with information costs, significantly less information was acquired. The researchers also concluded that information costs lead people to spend more time on analyzing a certain piece of information. The study by Ambuehl et al. (2018) investigated the information acquisition behavior when information costs are non-monetary and are measured through experimental variation in the amount of calculations to be checked and participants' psychological costs, such as cognitive ability. They showed that higher non-monetary information costs lead people to acquire less information before making a decision. Kraemer, Nöth, and Weber (2006) experimentally examined the information acquisition and Bayesian updating behavior of individuals. Participants were shown decisions by their predecessors and were allowed to acquire further information at a certain cost (without manipulating its level). The results of this study revealed that half of the participants did not decide rationally and purchased too much further information.

Nonetheless, we are not interested in the deviations from an optimal amount of information. Rather, we want to know in what way costs influence non-sequential individual acquisition behavior when time pressure is present. Based on theory and prior studies in this field (e.g., Kerstholt, 1996; Kraemer et al., 2006), we assumed that costs would be an important factor for determining the amount of information acquired and that they would lead participants to neglect other aspects of the choice context, such as time pressure. Moreover, when information costs are low, it is reasonable to assume that the cost factor would override time pressure effects. Accordingly, we hypothesized the following:

H3: Participants facing relatively low information costs and who are placed under time pressure acquire more information than participants facing relatively high information costs and who are placed under time pressure.

3. EXPERIMENTAL PROTOCOLS

3.1 Procedure and task structure

We tested the influence of *time pressure* and its interactions with the contextual factors *payoff scheme* and *information costs* on the *amount of information acquired* non-sequentially in a decision-making task. Therefore, we conducted three laboratory experiments. Experiment 1 served as the basis and comprised a so-called positive payoff scheme and relatively high information costs. Compared to Experiment 1, we altered the choice context in Experiment 2 due to the payoff scheme (a so-called negative payoff scheme was presented) and in Experiment 3 due to the level of information costs (participants faced relatively low information costs). In each experiment, we varied the presence of *time pressure* (present, not present). Altogether, we had 6 treatments. Table 1 gives an overview of the factors considered in every experiment.

Table 1. Overview of experiments

Experiment	Treatment	Time pressure	Payoff scheme	Information costs
1	1	yes	positive	relatively high
	2	no		
2	3	yes	negative	relatively high
	4	no		
3	5	yes	positive	relatively low
	6	no		

The use of experiments is most reasonable because we can implement manipulations of the explanatory factors directly, which, in turn, minimizes problems with reverse inference (Croson and Gächter, 2010). The experiments were programmed in z-Tree (Fischbacher, 2007) and were conducted at a large German university. All participants were students and were assigned randomly to the different treatments. All experiments consisted of the same procedure and the same task structure, which was divided into four parts. Appendix A displays the full experimental instructions.

In the introduction, participants learned about the main task and about the payment modalities. The main task was a decision task under uncertainty, inspired by Connolly and Thorn (1987). In our study, participants were told that they would be the production manager in a cake factory and would have to decide about whether an unused machine should be operated again. Re-operating made sense in case of a high future demand. As long as the test persons had no further information about the future demand, there was an equal likelihood of a high or a low demand. Pieces of information about the future demand trend for cakes were purchasable from eleven distribution centers, each providing exactly one piece of information, which was drawn at random. If at least six distribution centers forecasted a high demand, the demand was then considered to be high, otherwise to be low. We chose to provide eleven pieces of information in order to have a complex task regarding the calculations of conditional expectations so that an optimal amount of information was not obvious. After one practice round, the task was repeated for twenty independent rounds. To perform the task, each participant received a budget of 15,000 Experimental Currency Units (ECU) in every round. From this budget, a participant was able to buy information non sequentially from the distribution centers at a certain cost. From the remaining budget, an additional payment was added or deducted. This additional payment, which was shown in the form of a payoff matrix, was based on a participant's decision to operate the machine (yes, no) and the overall future demand. The level of the task-based payment was dependent on the experimental condition. Similarly to prior studies, we implemented time pressure by restricting the time available for each round. If participants needed more than 13 seconds for a round, the system made a random decision. The level of time pressure was chosen based on prior literature in this research field (e.g., Kerstholt, 1996) and on the pre-tests conducted. After the main task, participants had to fill out a questionnaire. Afterwards, participants had to perform as many calculations as possible in an arithmetic problem task (Ekstrom et al., 1976) for 5 minutes. After completing the experiment, participants received their individual payment, consisting of their performance in the decision task (one round was selected by lottery) and in the arithmetic problem task (depending on the correctly answered arithmetical operations) at an exchange rate of 2,000 ECU = 1 Euro. 219 students took part in the experiments (88 females, 131 males). The average age of the participants was 23.44 years (SD = 3), ranging from 19 to 37 years. 155 participants were enrolled in different engineering disciplines and 64 students were studying economics, business administration, or political science. On average, the experimental sessions lasted for 47.58 minutes and the average payment was 9.46 Euros.

3.1.1 Experiment 1

The aim of Experiment 1 was to test the influence of *time pressure* on the *amount of information acquired* in order to test Hypothesis 1. Consequently, one half of the participants was randomly assigned to the time pressure treatment (Treatment 1), whereas the other half was not (Treatment 2). Based on the procedure and the task described above, participants in Experiment 1 were incentivized by the payoff scheme depicted in table 2. This payoff scheme describes the additional payment that was added to the budget of 15,000 ECU less information costs for the acquired information. In the case of the decision to operate the machine, the additional payment was 10,000 ECU for a high future demand, and -8,000 ECU for a low future demand, i.e. 8,000 ECU would be subtracted from their remaining budget. Since the probabilities for both conditions were 0.5 when deciding to operate the machine without further information, the expected value was 1,000 ECU, which is why we term this payoff

scheme 'positive'. If the participants decided that the machine should not be operated, the additional payment was 0 ECU.

Table 2. Positive payoff scheme

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000	-8,000
	Machine will not operate	0	0

The direct costs for an additional piece of information increased with every piece of information by 68 ECU. To acquire a certain amount of information, the direct costs were added together. For example, to acquire two pieces of information the total costs were 204 (= 68 + 136) ECU. We chose these values so that the total costs for eleven pieces of information, which were 4,488 ECU, would be slightly under the expected value for the additional payoff if participants acquired all the information. This expected additional payoff was 5,000 ECU, since the reasonable outcomes in the payoff matrix for participants with complete information about the future demand were either 10,000 ECU (the decision to operate the machine and a high future demand with a probability of 50 percent) or 0 ECU (the decision that the machine should not be operated).

3.1.2 Experiment 2

We altered the task conducted in Experiment 1 by varying the *payoff scheme* due to the negative possible outcome option in Experiment 2: If participants decided to operate the machine and the overall future demand was low, their additional payment was -12,000 ECU instead of -8,000 ECU. This variation led to a negative expected value of -1,000 ECU (0.5*10,000 ECU - 0.5*12,000 ECU) when no information was acquired, i.e. leading to a *negative payoff scheme*. In Experiment 2, participants performed the same procedure and tasks as in Experiment 1. Again, in one treatment, students were placed under time pressure (Treatment 3) and in the other one they had no time restrictions (Treatment 4). In contrast to the positive payoff scheme before, participants were paid according to the negative payoff scheme, as illustrated in table 3. This means that if they decided to operate the machine and the overall future demand was low, their additional payment would be -12,000 ECU. All other values in the payoff scheme remained unchanged.

By taking the data of Experiment 1 and 2 together, we were able to test the influence of the interaction effect of time pressure and a negative payoff scheme on the amount of information acquired and to investigate Hypothesis 2.

Table 3. Negative payoff scheme

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000	-12,000
	Machine will not operate	0	0

3.1.3 Experiment 3

In Experiment 3, we altered the task conducted in Experiment 1 by varying the level of *information costs* for acquiring information. They were reduced by fifty percent compared to Experiment 1. Participants in Experiment 3 had to perform the same procedure and tasks as in the previous Experiments. Again, one treatment was pressed for time (Treatment 5), whereas the other was not (Treatment 6). In order to test the influence of time pressure in conjunction with relatively low information costs on the amount of information acquired within regression analyses and to investigate Hypothesis 3, we took the data of Experiment 1 and 3 together.

3.2 Measures

The dependent variable in the present paper is the *amount of information acquired*, ranging from 0 to 11. The independent variable of main interest in this study is *time pressure*, measured binarily (1 if present, 0 otherwise). In Experiment 2, we additionally included the variable *negative payoff scheme* (1 if confronted with a *negative payoff* scheme, 0 otherwise). Only in Experiment 3 did we add the

variable *low costs* (1 for *low information costs*, 0 otherwise). To control whether the acquisition decisions are influenced by an individual's general risk preference, we included the construct *general risk aversion* (Mandrik and Bao, 2005). The items were measured using a Likert scale, ranging from 1 to 7. A confirmatory factor analysis revealed factor loadings ranging from .4602 to .7284. The Cronbach's alpha coefficient was .7668. We included the variable *round*, with values ranging from 1 to 20, to account for learning effects. To test whether 'smart-decisions' influence the *amount of information acquired*, we generated two variables: *decision rule* and *uneven number*. *Decision rule* describes the application of a decision rule that would maximize the expected payoff, which means that the participant decided to operate the machine when more information forecasted a high rather than a low demand. If an equal amount of information indicated a high or low demand, participants confronted with a *positive payoff* scheme would maximize their expected payoff if they decided to operate the machine. In contrast, participants confronted with a *negative payoff* scheme would then decide against operating the machine. The control variable *uneven number* indicates whether the test person acquired one, three, five, seven, nine, or eleven pieces of information. This selection is 'smart' because the actual information value is higher when a majority of positive or negative information exists. *Decision rule* and *uneven number* are measured binarily (1 if the *decision rule* was applied / an *uneven number* was acquired, 0 otherwise). Further, we included the control variables *score*, *age*, and *field of study*. *Score* is the sum of all points (measured in ECU) achieved in the arithmetic problem task. This variable was included to test whether quick calculation abilities play a role. As the literature assumes that differences due to time pressure perceptions exist between older and younger decision makers (Ordóñez et al., 2015), we controlled for *age* (measured in years) in our analyses. The *field of study* of the participants was (reflecting the nature of the university in question) either engineering or other fields of studies (measured binarily).

3.3 Analysis Methodology

For each experiment, we started with a descriptive data analysis and used two-sample t-tests for independent samples to test whether the average *amount of information acquired* was different between the treatments. Because the experimental tasks include repeated measures, we applied the Generalized Estimating Equations (GEE) method. We specified the 'identity' link function, which is applied for data that are normally distributed (Ballinger, 2004). We also employed an autoregressive correlation structure, which is applicable for time-dependent correlations (Ballinger, 2004). We performed supplementary analyses, where we excluded subjects who acquired zero information over twenty rounds. In doing so, we checked for the robustness of the results because we cannot rule out the possibility that selecting zero information means that some of the individuals did not participate in the task seriously.

4. RESULTS

4.1 Results of Experiment 1

73 students participated in Experiment 1. Of these, 35 students (16 female, 19 male) were in the *time pressure* treatment and 38 students (11 female, 27 male) were in the *no time pressure* treatment. The participants were 19 to 37 years old (M = 24.27, SD = 3.13). 51 participants were enrolled in different engineering disciplines and 22 students studied economics, business administration, or political science.

In the *time pressure* treatment, the mean *amount of information acquired* was 5.39 (SD = 3.22). In contrast, the amount was 6.18 (SD = 2.75) in the *no time pressure* treatment. To test whether the mean *amount of information acquired* is different between the *time pressure* and the *no time pressure* treatment, we executed a two-sample t-test for independent samples, which indicates a statistically highly significant difference ($p < .001$). Accordingly, participants in the *time pressure* treatment acquired significantly less information.

Descriptive statistics of the *decision rule* and *uneven number* variables are reported in the respective columns in Appendix B. The results show that participants without *time pressure* in Experiment 1 made use of the *decision rule* and selected an *uneven number* more frequently. The average time per round the participants needed to select information and to make the decision was 5.81 seconds in the *time pressure* treatment and 8.33 seconds in the *no time pressure* treatment. Only in five out of 700 rounds did participants fail to make a decision within the given time frame (only relevant for the *time pressure* treatment).

The results of the GEE regressions used to examine the influence of the independent variables, specifically of *time pressure*, on the *amount of acquired information* are presented for models 1 and 2 in the 'all subjects' column of table 4. When investigating the effect of *time pressure* only (model 1),

the results reveal that significantly less information is acquired ($p < .1$). When including control variables additionally in the regression analysis (model 2), the results show that *time pressure* still significantly decreases the *amount of information acquired* ($p < .05$). Accordingly, we find support for Hypothesis 1. Interestingly, neither the *general risk aversion* construct nor the interaction with *time pressure* is significant. The *round* variable also shows no significant influence. Applying the *decision rule* and selecting an *uneven number* both influence significantly and positively the *amount of information acquired* ($p < .001$; $p < .001$). Furthermore, *score* has no effect, *age* has a significant positive effect ($p < .01$), and *engineering studies* shows no effect on the *amount of information acquired*.

We report the results of the supplementary analyses for models 3 and 4 in the 'without subjects that acquired zero information over twenty rounds' column of table 4. Altogether, the results show identical patterns. However, the *time pressure* effect is insignificant when regressed solely on the *amount of information acquired* (model 3) but remains significant when other variables are included in the regression analysis (model 4), even though the significance level becomes weaker ($p < .1$). Thus, these results support Hypothesis 1 only to a limited extent. In addition to this, the effect of *age* remains at the significance level of 5%.

Table 4. GEE regression analyses on the amount of information acquired – Experiment 1

	Hypotheses		All subjects		Without subjects who acquired 0 information over 20 rounds		
	Prediction	Finding	Model 1	Model 2	Finding	Model 3	Model 4
Time pressure	H1 (-)	✓	-0.767 (0.0587)	-0.896 (0.0137)	(✓)	-0.432 (0.1712)	-0.575 (0.0588)
General risk aversion				-0.0739 (0.8072)			-0.140 (0.5701)
Time pressure * general risk aversion				0.363 (0.3757)			0.463 (0.1721)
Round				-0.0109 (0.6237)			-0.0111 (0.5849)
Decision rule				0.627 (0.0000)			0.632 (0.0000)
Uneven number				1.136 (0.0000)			1.074 (0.0000)
Score				0.000190 (0.1011)			0.000102 (0.2871)
Age				0.173 (0.0028)			0.113 (0.0178)
Engineering studies				0.143 (0.7201)			0.234 (0.4818)
Constant			6.105 (0.0000)	0.325 (0.8190)		6.469 (0.0000)	2.294 (0.0518)
N			1460	1460		1340	1340

Note. The first observation in each cell is the estimate and the second observation (in parentheses) is the two-sided p-value.

4.2 Results of Experiment 2 (in combination with Experiment 1)

70 students took part in the second experiment. 35 students were assigned to the *time pressure* treatment (11 female, 24 male) and 35 students were assigned to the *no time pressure* treatment (18 female, 17 male). Participants ranged in age from 19 to 32 years (M = 23.41, SD = 2.98). 49 students were enrolled in different engineering disciplines, 21 students reported that they were studying economics or business administration.

Descriptive statistics according to the *amount of information acquired* reveal the following: The mean amount is 5.52 pieces (SD = 3.01) for the *time pressure* treatment (Treatment 3) and 5.85 (SD = 2.73) for the *no time pressure* treatment (Treatment 4). We also employed a two-sample t-test, which shows a significant difference between these two treatments ($p < .05$), with the *time pressure treatment* stimulating the participants to buy significantly less information. Taking the treatments of Experiment 1 and 2 together, we again performed two-sample t-tests. The test for differences in the *amount of information acquired* between the *time pressure* treatments (Treatments 1 and 3) and the *no time pressure* treatments (Treatments 2 and 4) again indicates that the *time pressured* participants bought significantly less information ($p < .001$). In addition to this, we executed a two-sample t-test based on the *time pressure* treatments (Treatments 1 and 3) only. The test for differences in the *amount of information acquired* between time pressured participants confronted with the *positive payoff* scheme (Treatment 1) versus *negative payoff* scheme (Treatment 3) indicates no significant difference.

Descriptive statistics of the *decision rule* and *uneven number* variables in the treatments of Experiment 2 are reported in Appendix B. As in Experiment 1, participants in the *no time pressure* treatment decided in line with the *decision rule* and chose an *uneven number* of pieces of information more frequently. The average time participants needed for every round was 6.1 seconds for the *time pressure* treatment and 8.21 seconds for the *no time pressure* treatment. Only in eight out of 700 rounds did participants fail to make a decision within the given time frame (only relevant for the *time pressure* treatment).

To examine the effects of the independent variables, specifically of *time pressure* in conjunction with a *negative payoff scheme*, we based the GEE regression analyses on the data from Experiments 1 and 2 together. The results are provided for models 5 and 6 in the 'all subjects' column of table 5. Model 5 covers the *time pressure*, *negative payoff scheme,* and the interaction of *time pressure* and *negative payoff scheme* variables. In model 6, control variables were additionally included. The effect of *time pressure* on the *amount of information acquired* is significantly negative in model 5 and 6 ($p < .1$; $p < .05$). The results show no significance for the effect of a *negative payoff scheme* alone in either model. The effect of the interaction of *time pressure* and *negative payoff scheme* is also not significant in models 5 and 6. Hence, Hypothesis 2 is not supported. An examination of the control variables allows us to draw the following conclusions: As in Experiment 1 alone, *general risk aversion* as well as the interaction with *time pressure* indicate no significant effects. *Round* has no significant effect again, but the *decision rule* and *uneven number* variables significantly increase the *amount of information acquired* ($p < .001$; $p < .001$). *Score* shows a significantly positive effect ($p < .05$), *age* indicates no effect, and *engineering studies* indicates a significantly positive effect ($p < .05$) as well.

Table 5. Regression analyses on the amount of information acquired – Experiment 2

	Hypotheses		All subjects		Without subjects who acquired 0 information over 20 rounds		
	Prediction	Finding	Model 5	Model 6	Finding	Model 7	Model 8
Time pressure			-0.764 (0.0718)	-0.777 (0.0490)		-0.418 (0.2645)	-0.472 (0.1919)
Negative payoff scheme			-0.218 (0.6072)	-0.154 (0.6944)		-0.403 (0.2705)	-0.416 (0.2371)
Time pressure * negative payoff scheme	H2 (+)	✗	0.480 (0.4287)	0.461 (0.4116)	✗	-0.0478 (0.9276)	0.101 (0.8412)
General risk aversion				-0.0504 (0.8357)			0.0161 (0.9408)
Time pressure * general risk aversion				0.134 (0.6867)			0.0969 (0.7435)
Round				-0.00531 (0.7459)			-0.00484 (0.7569)
Decision rule				0.424 (0.0000)			0.429 (0.0000)
Uneven				0.906			0.888

number		(0.0000)		(0.0000)
Score		0.000203 (0.0442)		0.000140 (0.1191)
Age		0.0539 (0.2596)		0.00553 (0.8970)
Engineering studies		0.714 (0.0232)		0.712 (0.0118)
Constant	6.093 (0.0000)	2.925 (0.0114)	6.447 (0.0000)	4.604 (0.0000)
N	2860	2860	2720	2720

Note. The first observation in each cell is the estimate and the second observation (in parentheses) is the two-sided p-value.

We also ran regressions with the data from Experiment 2 only and can report significant differences compared to the regressions based on Experiments 1 and 2 together. However, we do not report these results in detail due to space limitations. An important difference in the regression results based on data from Experiment 2 only is that the effect of *time pressure* is not significant any more. This is reasonable, since the effect of the *negative payoff scheme* as well as its interaction with *time pressure* were already identified as being insignificant.

Models 7 and 8 in the 'without subjects who acquired zero information over twenty rounds' column in table 5 report the results of the supplementary analyses. Differences compared to models 5 and 6 are that *time pressure* is not significant any more in models 7 and 8. Apart from this, the effect of *score* diminishes and the effect of *engineering studies* remains at the significance level of 5%.

4.3 Results of Experiment 3 (in combination with Experiment 1)

76 students participated in Experiment 3. Of these, 37 students were randomly assigned to the *time pressure* treatment (10 female, 27 male) and 39 students to the *no time pressure* treatment (22 female, 17 male). The age of the students ranged from 19 to 33 years (M = 22.67, SD = 2.65). 55 students indicated that they were studying an engineering discipline, 21 students indicated that they were studying economics or business administration.

Descriptive statistics for the *amount of information acquired* indicate the following: The mean number of acquired pieces of information is 6.7 (SD = 2.74) for the *time pressure* treatment (Treatment 5) and 6.34 (SD = 3.35) for the *no time pressure* treatment (Treatment 6). We performed a two-sample t-test. This shows, in contrast to the prior experiments, that the *no time pressure* treatment acquired significantly less information ($p < .05$). Taking the data of Experiment 1 and 3 together, the test for differences in the *amount of information acquired* between the *time pressure* treatments (Treatments 1 and 5) and the *no time pressure* treatments (Treatments 2 and 6) indicates that participants in the *time pressure* treatments acquired significantly less information ($p < .05$). For the *time pressure* treatments (Treatments 1 and 5) only, the t-test for differences in the *amount of information acquired* between the treatments with relatively *high information costs* (Treatment 1) and relatively *low information costs* (Treatment 5) reveals that participants facing relatively *low information costs* acquired significantly more information ($p < .001$).

As in the previous studies, descriptive statistics of the *decision rule* and *uneven number* variables for the treatments of Experiment 3 are reported in Appendix B. Unlike before, the participants of Treatments 5 and 6 used the *decision rule* almost equally frequently and participants under *time pressure* (Treatment 5) selected an *uneven number* more frequently. On average, participants under *time pressure* needed 6.69 seconds and those under *no time pressure* 9.36 seconds for every round in the decision task. In seven out of 740 rounds, individuals did not decide within the given time frame (again, only relevant for the *time pressure* treatment).

To identify the effects of *time pressure* in conjunction with *relatively low information costs*, we took the data of Experiments 1 and 3 together to calculate the respective GEE regressions. The results are displayed for models 9 and 10 in the 'all subjects' column of table 6. Model 9 comprises the variables *time pressure*, *low costs* as well as its interaction term with *time pressure*. Control variables were included additionally in model 10. We found a significantly negative *time pressure* effect on the *amount of information acquired* in models 9 and 10 ($p < .1$; $p < .05$). Although no effect of *low costs* can be found in either model, we can find a significantly positive effect of the interaction term of *time pressure* and *low costs* in models 9 and 10 ($p < .05$; $p < .05$), i.e. the combination of *time pressure* and

low costs leads to more information acquisition. Hypothesis 3 is thus supported. Examining the influence of the control variables reveals the following: As in both previous experiments, *general risk aversion* by itself and in conjunction with *time pressure*, as well as *round,* are insignificant. Again, the *decision rule* and *uneven number* variables significantly increase *the amount of information acquired* ($p < .001$; $p < .001$). *Score* has a significantly positive effect ($p < .01$) and *age* and *engineering studies* both have no significant influence.

Again, we also ran regressions with data from Experiment 3 only and report conspicuous changes compared to the results obtained from the data of Experiments 1 and 3 together: The effect of *time pressure* is not significant any more. This is likely to be caused by the low information costs, which were halved, i.e. information costs were so low that the effect of time pressure faded in Experiment 3.

The supplementary analyses, depicted for models 11 and 12 in the 'without subjects who acquired zero information over twenty rounds' column of table 6, show that the effects of *time pressure* become insignificant in both models. Further, the influences of time pressure in interaction with *low costs* are not significant in models 11 and 12, so that Hypothesis 3 is not supported any more. The effect of *score* remains significant at the 1% level.

Table 6. Regression analyses on the amount of information acquired – Experiment 3

	Hypotheses		All subjects		Without subjects who acquired 0 information over 20 rounds		
	Prediction	Finding	Model 9	Model 10	Finding	Model 11	Model 12
Time pressure			-0.768 (0.0559)	-0.866 (0.0198)		-0.423 (0.2045)	-0.512 (0.1145)
Low costs			0.177 (0.6513)	0.302 (0.4056)		0.174 (0.5849)	0.260 (0.4025)
Time pressure * low costs	H3 (+)	✓	1.122 (0.0460)	1.066 (0.0399)	✗	0.621 (0.1779)	0.532 (0.2324)
General risk aversion				0.183 (0.3822)			0.149 (0.3988)
Time pressure * general risk aversion				0.229 (0.4349)			0.0942 (0.7110)
Round				0.00738 (0.6512)			0.00759 (0.6147)
Decision rule				0.559 (0.0000)			0.584 (0.0000)
Uneven number				1.098 (0.0000)			1.041 (0.0000)
Score				0.000204 (0.0062)			0.000206 (0.0055)
Age				0.0547 (0.2275)			0.00414 (0.9157)
Engineering studies				-0.0445 (0.8795)			0.210 (0.4043)
Constant			6.109 (0.0000)	3.000 (0.0072)		6.467 (0.0000)	4.445 (0.0000)
N			2980	2980		2800	2800

Note. The first observation in each cell is the estimate and the second observation (in parentheses) is the two-sided p-value.

5. DISCUSSION OF RESULTS

The results of the regression analyses of the experiments show that *time pressure*, when considered alone, reduces the *amount of information* acquired. Based on the literature, we assume that participants under time pressure perceived stress, decided quickly, had no time to process information deliberately, and thus relied on System 1 processes. The fact that people under time pressure needed on average less time to make the decisions supports these conclusions.

No significant effect was found for participants who were placed under *time pressure* and who were influenced by a *negative payoff scheme*. The findings also reveal that being confronted with a *negative payoff scheme* instead of a *positive payoff scheme* has no effect on the *amount of information acquired*. These results suggest that the previous empirical findings from the literature that have supported this effect should be treated with caution.

Apart from this, the findings imply that being confronted with relatively *low information costs* under time pressure increases the *amount of information acquired*. Since the *low information costs* variable alone has no significant effect on the *amount of information acquired*, we infer that the weighting of *low information costs* has a significant effect only if *time pressure* is present. Under *time pressure*, i.e. when people do not think deliberately, relatively *low information costs* might appear to be so cheap that people will purchase more information (than is reasonable). Moreover, we conclude that the effect of time pressure, which leads people to acquire less information, is diminished through relatively low information costs.

In addition to this, in Experiments 1 and 2, subjects who were not pressed for time (Treatments 2 and 4) made use of the *decision rule* and selected an *uneven number* more frequently than subjects with a time budget, suggesting that the former thought more consciously about a strategy for making a sound decision. In contrast to this, in Experiment 3, participants under *time pressure* (Treatment 5) made use of the *decision rule* equally often and selected an *uneven number* more often than participants without *time pressure* (Treatment 6). The cost factor might have been so strong that it led participants in both treatments (Treatments 5 and 6) to use different acquisition patterns or that it outweighed the effect of *time pressure*.

With regard to the control variables, we can conclude that these do play a role in the present context, at least to some extent. People with calculation skills, older participants, or students of engineering studies might have thought more deliberately before making a decision, e.g. by trying to compute an economically reasonable solution.

6. CONCLUSIONS AND IMPLICATIONS

We examined the effects of time pressure on the amount of information acquired non-sequentially in a decision-making process. Experiment 1 served as the basis and the results show that under time pressure, less information is acquired. We altered the choice context in Experiment 2 due to the payoff scheme, which yields a higher negative payment for the experiments' negative outcome (low demand) compared to Experiment 1. As a result, we found no significant effect of time pressure in conjunction with a negative payoff scheme on the amount of information acquired. In Experiment 3, we halved the information costs compared to Experiment 1. We found that being pressed for time and faced with relatively low information costs simultaneously leads people to purchase more pieces of information that can be used for decision-making.

The present study contributes to theory and practice in several ways. First, it provides further insights into the psychological processes of individuals during the decision-making processes which are often accompanied by time limits (Geisler and Allwood, 2018): We discovered in the regression analyses that under time pressure by itself, less information is acquired non-sequentially and that participants under time pressure needed on average less time per round to select information and to make the decision. Due to our results and previous results from the literature, we assume System 1 thinking to be the underlying psychological process.

Second, while many studies have examined contradictory performance effects of time pressure (e.g., De Paola and Gioia, 2016; Glöckner and Betsch, 2008), we did not focus on an optimal amount of information. Rather, we identified how to control the amount of information acquired non-sequentially in decision-making processes under time pressure. Additionally, we investigated interaction effects of time pressure with contextual factors. We found, in fact, that the effects of time pressure are influenced by these contextual factors and that it cannot be concluded that time pressure always reduces the number of pieces of information acquired. In this vein, we found time pressure effects to be conditional on the level of information costs. Under time pressure, individuals confronted with relatively low information costs acquired more pieces of information than participants facing relatively high information costs. With this, prior studies on information costs are supported (Ambuehl et al., 2018;

Baethge and Fiedler 2016; Kerstholt, 1996) and we expanded research by investigating information costs in conjunction with time pressure when information is acquired non-sequentially. Under time pressure, people seem to set another focus or to weight contextual factors differently, leading to different cognitive processes. Particularly, information costs seem to be such an important factor that they might reverse the primary time pressure effect.

Third, the result that less information is acquired under time pressure has been based on sequential information acquisition only (Mann and Tan, 1993). With the present study, we have transferred this conclusion to the non-sequential domain. The important difference between the two domains is that the argument that fewer pieces of information are purchased because participants are not able to inspect all the information and they need a fast closure cannot be raised in our non-sequential acquisition context.

Fourth, for the first time we investigated the effects of a payoff scheme with negative versus positive expected values in conjunction with time pressure on information acquisition behavior. Previously, payoff schemes have mainly been researched in the context of risky gambles (e.g., Gawryluk and Krawczyk, 2017). While previous research has already shown that the payoff structure (i.e. endowment size) significantly influences choice behavior (Haesevoets et al., 2019), our contribution to research is that we introduce payoff schemes as influencing factors to information acquisition research and that we uncover the need for research in this domain.

Fifth, we found that individual factors of the decision maker also influence acquisition behavior. Thus, research should pay attention to these when further studying information acquisition behavior.

In addition, our study has several practical implications. In a setting in which a superior wants a subordinate to acquire just a few pieces of information before decision-making, the superior can control this requested behavior by influencing the information costs or the time frame within which a decision has to be made. Importantly, the superior should pay attention to the contextual as well as the individual factors of the subordinate in order to influence acquisition behavior in a certain direction. In particular, information costs can influence the amount of information fundamentally acquired under time pressure.

However, our paper has some limitations. The experiments were conducted with a student sample in a laboratory setting and the task is hypothetical. In line with previous works (Peterson, 2001), we believe that students and decision makers at the workplace are highly comparable with regard to their information acquisition patterns since they have gone through a similar education - specifically in Germany where the dual education system is established (BMBF, 2015). In addition to this, a field experiment with employees would reduce some of the experiment's internal validity through difficulties in the controllability of job-specific experiences. It was these arguments especially that convinced us to use a student sample for the experiment. Nonetheless, we recognize that the use of an employee sample in a field experiment would have the potential to further increase the validity of the study's results and to test the replicability of the results in a natural environment. Besides this, our sample is relatively well educated. Since cognitive abilities, i.e. how sophisticated information can be processed, have been found to determine how people cope with time pressure (Kocher et al., 2019), a sample composition with different characteristics might lead to different results. However, the educational background of people making economic decisions should be comparable to the students who took part in the experiments. In the present study, we found neither an effect of the interaction of time pressure with a negative payoff scheme nor an effect of a negative compared to a positive payoff scheme. Perhaps the difference between the two schemes was not distinct enough to yield significant effects. Future research should use payoff schemes that are more different in order to make inferences about a shift towards negative factors under time pressure. Future studies could investigate the effect of experience with time pressure and clarify its influence on acquisition behavior. Moreover, this could also be examined in longitudinal studies. Other contextual factors could be taken into account in future investigations as well, for example the amount of available information or the working environment.

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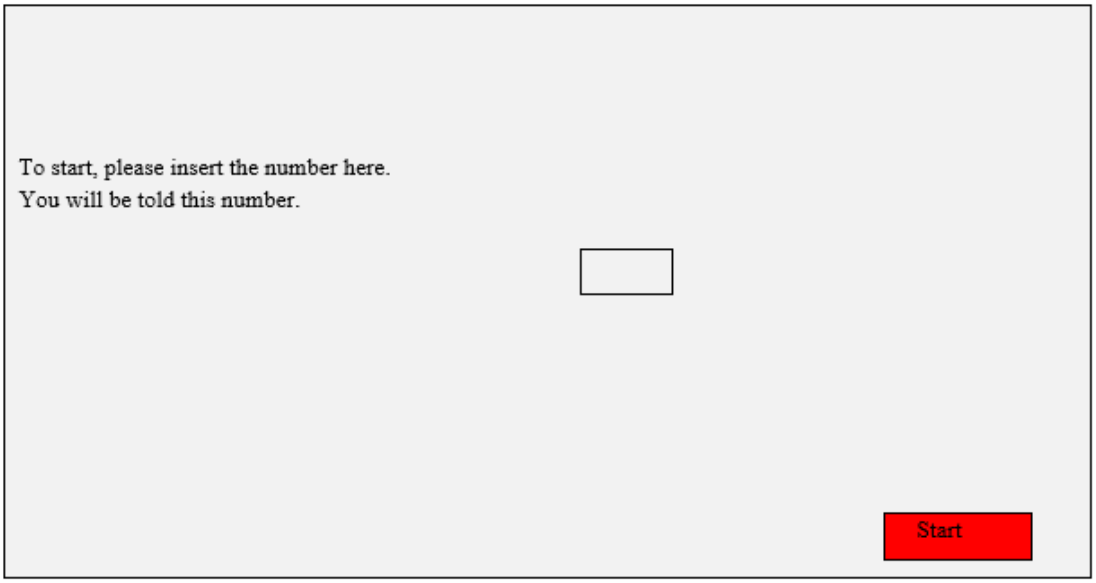
APPENDIX A: Experimental Instructions

Abbreviations for the six experimental treatments:

TP-POS-HCOSTS:	Time pressure was present, participants were facing a 'positive payoff scheme', and information costs were relatively high
NOTP-POS-HCOSTS:	Time pressure was not present, participants were facing a 'positive payoff scheme', and information costs were relatively high
TP-NEG-HCOSTS:	Time pressure was present, participants were facing a 'negative payoff scheme', and information costs were relatively high
NOTP-NEG-HCOSTS:	Time pressure was not present, participants were facing a 'negative payoff scheme', and information costs were relatively high
TP-POS-LCOSTS:	Time pressure was present, participants were facing a 'positive payoff scheme', and information costs were relatively low
NOTP-POS-LCOSTS:	Time pressure was not present, participants were facing a 'positive payoff scheme', and information costs were relatively low

Notes:
The instructions have been translated from the German; the original instructions are available upon request.
Text in red lettering displays differences between the TP and NOTP treatments.
Text in blue lettering displays differences between the POS and NEG treatments.
Text in green lettering displays differences between the HCOSTS and LCOSTS treatments.


To start, please insert the number here.
You will be told this number.
Start


Welcome.
Start

The objective of this experiment is to identify how people make decisions in the workplace. The experiment consists of several parts:

A section containing information about today's task.

A section where you will learn about the composition of your payment.

A section where you can try out today's task in a practice round.

A section containing today's task where you can acquire pieces of information and make decisions based on these pieces of information.

A section containing a questionnaire.

A section where you will solve arithmetic problems.

A section where you will be informed of your payment.

Continue

INFORMATION ON: Your task for today

Imagine that you work as a production manager in a cake factory called TOKU which specializes in producing cakes. TOKU sells its cakes to 11 independent distribution centers.

The demand for cakes has been fluctuating over the last few quarters, so one machine has not been used for producing cakes during the last few weeks. Currently, TOKU has no information (yet) about future demand trends.

Continue

INFORMATION ON: Your task for today

In today's task you, in your role of production manager, will decide whether TOKU will start operating the machine again that has not been used in the past few weeks. Re-operating the machine makes sense if future demand is going to be high.

You will play 20 rounds of this decision task. Your goal is to maximize your profits.

For each round, you will receive from TOKU a budget of 15,000 ECU (= Experimental Currency Units). Out of this budget you will be able to buy information from the 11 distribution centers to which TOKU sells the cakes it produces. This information can aid your decision-making. You can buy exactly one piece of information from each distribution center. The respective information will describe that particular distribution center's future demand for cakes. Correspondingly, 11 pieces of information will be available to you.

If at least 6 of the 11 distribution centers forecast a high demand, the demand is then considered to be high.
If at least 6 of the 11 distribution centers forecast a low demand, the demand is then considered to be low.

There is—without any further information—an equal likelihood of a high or a low demand actually occurring. The likelihood of either occurring is, then, 50% respectively—without any further information.

Continue

INFORMATION ON: Your task for today

In each round you will have 13 seconds in which to buy information, to make a decision, and to confirm your entry. The remaining time will be shown at the top right of the screen.

If you have not made your decision and confirmed it within the allotted time (13 seconds), 3,000 ECU will be deducted from your budget of 15,000 ECU and for this round the system will make a random decision about whether the machine should operate or not. Thus, it is always to your benefit to make your own decision about the amount of information that you need and whether the machine should operate or not.

Before you play the 20 rounds of the decision task, you will play one practice round which will not be relevant for your payment.

After you have played the 20 rounds of the payment-relevant decision task and have answered a questionnaire, you will then solve some arithmetic problems. This arithmetic problem task will also be payment-relevant.

Continue

For participants in the NOTP treatments, the sentences written in red were lacking.

Participants in the HCOSTS treatments were shown the following screen:

PAYMENT: Composition of your payment

Your payment will consist of three parts:
You will receive:
your budget of 15,000 ECU,
minus the costs for the acquired information,
plus an additional payment based on your decision

→ The direct costs for an additional piece of information will increase by 68 ECU for every further piece of information bought. This means that the first piece of information will cost 68 ECU. The second piece of information will cost 136 (= 68 + 68) ECU. The third piece of information will cost 204 (= 136 + 68) ECU, and so on.

The total costs for the acquisition of, for example, 3 pieces of information would be 408 ECU (= 68 ECU for the first piece of information + 136 ECU for the second piece of information + 204 ECU for the third piece of information).

→ The additional payment will be
10,000 ECU if you make a decision in favor of the machine operating and an overall high demand.
-8,000 ECU if you make a decision in favor of the machine operating and an overall low demand (8,000 ECU will then be deducted from your budget of 15,000 ECU)
0 ECU if you make a decision that the machine will not operate.

The following payoff matrix describes the decision options and the related payments in the case of a high or a low demand (independent of your budget and the costs for acquiring information):

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

At the end of the experiment, one out of the 20 rounds will be selected by lottery and based on this, your payment will be calculated. ECU will be converted into Euro at an exchange rate of 2,000 ECU = 1 Euro and will be rounded up or down to the first decimal place. Additionally, you will receive a payment based on your results in the arithmetic problem task. The composition of the arithmetic problem task will be explained to you later. At the end of the experiment you will receive a payment that is based on the 20 rounds of the decision task (by lottery) and on the arithmetic problem task.

Continue

For participants in the NEG treatments, the numbers in blue were replaced by 12,000.

Participants in the POS-LCOSTS treatments were shown the following screen:

PAYMENT: Composition of your payment

Your payment will consist of three parts:
You will receive:
your budget of 15,000 ECU,
minus the costs for the acquired information,
plus an additional payment based on your decision

→ The direct costs for an additional piece of information will increase by 34 ECU for every further piece of information bought. This means that the first piece of information will cost 34 ECU. The second piece of information will cost 68 (= 34 + 34) ECU. The third piece of information will cost 102 (= 68 + 34) ECU, and so on.

The total costs for the acquisition of, for example, 3 pieces of information would be 204 ECU (= 34 ECU for the first piece of information + 68 ECU for the second piece of information + 102 ECU for the third piece of information).

→ The additional payment will be
10,000 ECU if you make a decision in favor of the machine operating and an overall high demand.
-8,000 ECU if you make a decision in favor of the machine operating and an overall low demand (8,000 ECU will then be deducted from your budget of 15,000 ECU)
0 ECU if you make a decision that the machine will not operate.

The following payoff matrix describes the decision options and the related payments in the case of a high or a low demand (independent of your budget and the costs for acquiring information):

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

At the end of the experiment, one out of the 20 rounds will be selected by lottery and based on this, your payment will be calculated. ECU will be converted into Euro at an exchange rate of 2,000 ECU = 1 Euro and will be rounded up or down to the first decimal place. Additionally, you will receive a payment based on your results in the arithmetic problem task. The composition of the arithmetic problem task will be explained to you later. At the end of the experiment you will receive a payment that is based on the 20 rounds of the decision task (by lottery) and on the arithmetic problem task.

Continue

LEARNING PROCESS: Summary of your task for today

For cake production you will decide whether an unused machine should operate again or not. In order to make your decision, you will proceed as follows:

You will decide about the amount of information that you want to buy from the distribution centers. Each piece of information will reveal the future demand for cakes in one particular distribution center.

As soon as you have decided about the amount of information that you want to buy, you will be shown the result of the acquired information.

You will decide about whether the unused machine should operate again or not. To do so, you can make use of the acquired information.

You will play 20 rounds of this task.

The decision task will be finished as soon as you have decided about the amount of information to buy and, based on this, have made your decision in each of the 20 rounds about whether the unused machine should operate again or not.

At the end of the experiment one round will be selected by lottery (random sampling). Your decision about the amount of information to buy and about whether the unused machine should operate again or not will determine the amount of your payment.

Continue

Participants in the HCOSTS treatments were shown the following screen:

Please answer the following questions and click on "Continue" afterwards. You can only continue to the next screen when you have answered all questions correctly.

You work as a production manager in the TOKU cake factory and have to decide whether a machine that has been unused recently should operate again.	Yes No
Altogether, you will make 20 decisions about whether the unused machine should operate again or not.	Yes No
You already know the future demand trend for cakes without any information from the distribution centers.	Yes No
TOKU sells the produced cakes to 8 independent distribution centers.	Yes No
To help you make your decision, you can buy information from the 11 distribution centers about the future demand trend for cakes.	Yes No
Each piece of information costs 68 ECU.	Yes No
The direct costs for an additional piece of information increase with each further acquired piece of information by 68 ECU. The direct costs for the second piece of information acquired are 136 (= 68 + 68) ECU, and so on.	Yes No
Information costs are added together. For example, if you buy two pieces of information, you will have to pay 204 ECU (= 68 ECU for the first piece of information + 136 ECU for the second piece of information).	Yes No
You have to buy the information from all the distribution centers.	Yes No
Your payment depends on your decision and the amount of information you have bought from the distribution centers in order to make that decision.	Yes No

Continue

Please turn over the sheet of paper in front of you and take a look at it. Please wait until you have received further instructions.

Participants in the HCOSTS treatments were provided with the following sheet of paper:

Payoff matrix:

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Overview of direct and total costs:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information												
0	0	0												= 0
1	68	0	+68											= 68
2	136	0	+68	+136										= 204
3	204	0	+68	+136	+204									= 408
4	272	0	+68	+136	+204	+272								= 680
5	340	0	+68	+136	+204	+272	+340							= 1,020
6	408	0	+68	+136	+204	+272	+340	+408						= 1,428
7	476	0	+68	+136	+204	+272	+340	+408	+476					= 1,904
8	544	0	+68	+136	+204	+272	+340	+408	+476	+544				= 2,448
9	612	0	+68	+136	+204	+272	+340	+408	+476	+544	+612			= 3,060
10	680	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680		= 3,740
11	748	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680	+748	= 4,488

For participants in the NEG treatments, this number in blue was replaced by -12,000.

Participants in the POS-LCOSTS treatments were provided with the following sheet of paper:

Payoff matrix:

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Overview of direct and total costs:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information												
0	0	0												= 0
1	34	0	+34											= 34
2	68	0	+34	+68										= 102
3	102	0	+34	+68	+102									= 204
4	136	0	+34	+68	+102	+136								= 340
5	170	0	+34	+68	+102	+136	+170							= 510
6	204	0	+34	+68	+102	+136	+170	+204						= 714
7	238	0	+34	+68	+102	+136	+170	+204	+238					= 952
8	272	0	+34	+68	+102	+136	+170	+204	+238	+272				= 1,224
9	306	0	+34	+68	+102	+136	+170	+204	+238	+272	+306			= 1,530
10	340	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340		= 1,870
11	374	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340	+374	= 2,244

After 30 seconds have passed, the participants were shown the following screen:

To proceed, please click on "Continue".

Continue

PRACTICE ROUND:

In preparation for the decision task you will be playing one practice round of the task. The result of this practice round will have no effect on your payment.

Please commence now with the practice round.

Start practice round

Participants in the HCOSTS treatments were shown the following screen:

PRACTICE ROUND

remaining time (secs): 10

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high

If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Please select the amount of information you want to buy by clicking on one of the options:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information													
0	0	0												= 0	Buy 0 pieces of information for 0 ECU in total
1	68	0	+68											= 68	Buy 1 piece of information for 68 ECU in total
2	136	0	+68	+136										= 204	Buy 2 pieces of information for 204 ECU in total
3	204	0	+68	+136	+204									= 408	Buy 3 pieces of information for 408 ECU in total
4	272	0	+68	+136	+204	+272								= 680	Buy 4 pieces of information for 680 ECU in total
5	340	0	+68	+136	+204	+272	+340							= 1,020	Buy 5 pieces of information for 1,020 ECU in total
6	408	0	+68	+136	+204	+272	+340	+408						= 1,428	Buy 6 pieces of information for 1,428 ECU in total
7	476	0	+68	+136	+204	+272	+340	+408	+476					= 1,904	Buy 7 pieces of information for 1,904 ECU in total
8	544	0	+68	+136	+204	+272	+340	+408	+476	+544				= 2,448	Buy 8 pieces of information for 2,448 ECU in total
9	612	0	+68	+136	+204	+272	+340	+408	+476	+544	+612			= 3,060	Buy 9 pieces of information for 3,060 ECU in total
10	680	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680		= 3,740	Buy 10 pieces of information for 3,740 ECU in total
11	748	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680	+748	= 4,488	Buy 11 pieces of information for 4,488 ECU in total

For participants in the NOTP treatments, the text written in red was lacking.

For participants in the NEG treatments, this number in blue was replaced by -12,000.

Participants in the POS-LCOSTS treatments were shown the following screen:

PRACTICE ROUND

remaining time (secs): 10

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Please select the amount of information you want to buy by clicking on one of the options:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information													
0	0	0												= 0	Buy 0 pieces of information for 0 ECU in total
1	34	0	+34											= 34	Buy 1 piece of information for 68 ECU in total
2	68	0	+34	+68										= 102	Buy 2 pieces of information for 204 ECU in total
3	102	0	+34	+68	+102									= 204	Buy 3 pieces of information for 408 ECU in total
4	136	0	+34	+68	+102	+136								= 340	Buy 4 pieces of information for 680 ECU in total
5	170	0	+34	+68	+102	+136	+170							= 510	Buy 5 pieces of information for 1,020 ECU in total
6	204	0	+34	+68	+102	+136	+170	+204						= 714	Buy 6 pieces of information for 1,428 ECU in total
7	238	0	+34	+68	+102	+136	+170	+204	+238					= 952	Buy 7 pieces of information for 1,904 ECU in total
8	272	0	+34	+68	+102	+136	+170	+204	+238	+272				= 1,224	Buy 8 pieces of information for 2,448 ECU in total
9	306	0	+34	+68	+102	+136	+170	+204	+238	+272	+306			= 1,530	Buy 9 pieces of information for 3,060 ECU in total
10	340	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340		= 1,870	Buy 10 pieces of information for 3,740 ECU in total
11	374	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340	+374	= 2,244	Buy 11 pieces of information for 4,488 ECU in total

For participants in the NOTP-POS-LCOSTS treatment, the text written in red was lacking.

PRACTICE ROUND

remaining time (secs): 4

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Summary of the forecasts made by the distribution centers:

Number of pieces of information that forecast a high demand:	Number of pieces of information that forecast a low demand:
2	1

Please decide whether you want the unused machine to operate again or not by clicking on one of the two options:

The machine should operate again
The machine should not operate again

For participants in the NOTP treatments, the text written in red was lacking.
For participants in the NEG treatments, this number in blue was replaced by -12,000.

PRACTICE ROUND remaining time (secs.): 2

Please confirm your entry:

Do not submit entry

Submit entry

For participants in the NOTP treatments, the text written in red was lacking.

In the case that the participant purchased 3 pieces of information and that the participant decided that the machine should operate again and an overall low future demand, the following screen was shown:

Summary of the practice round:

You bought 3 pieces of information for 408 ECU.

You decided that the machine should operate again.

Overall, there is a low demand in this round.

For this reason, your payment for this round would be (please note that this practice round will not be payment-relevant):

15,000 ECU - 408 ECU + -8,000 ECU = 6,592 ECU

Continue

For participants in the NEG treatments, this number in blue was replaced by -12,000 and therefore, the payment for this round was 2,592 ECU.
For participants in the POS-LCOSTS treatments, these numbers in green were replaced by 204 ECU and therefore, the payment for this round was 6,796 ECU.

Your TASK for today:

In the following 20 rounds you will make a decision about the amount of information to be acquired and about whether the machine should operate or not on the basis of this information. Your decisions in each of the 20 rounds will be independent of each other.

Please click on "Continue".

Continue

Please start now with round 1 of the decision task.

Start round 1

Participants in the HCOSTS treatments were shown the following screen:

ROUND 1 of 20

remaining time (secs): 11

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high

If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Please select the amount of information you want to buy by clicking on one of the options:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information													
0	0	0												= 0	Buy 0 pieces of information for 0 ECU in total
1	68	0	+68											= 68	Buy 1 piece of information for 68 ECU in total
2	136	0	+68	+136										= 204	Buy 2 pieces of information for 204 ECU in total
3	204	0	+68	+136	+204									= 408	Buy 3 pieces of information for 408 ECU in total
4	272	0	+68	+136	+204	+272								= 680	Buy 4 pieces of information for 680 ECU in total
5	340	0	+68	+136	+204	+272	+340							= 1.020	Buy 5 pieces of information for 1,020 ECU in total
6	408	0	+68	+136	+204	+272	+340	+408						= 1,428	Buy 6 pieces of information for 1,428 ECU in total
7	476	0	+68	+136	+204	+272	+340	+408	+476					= 1,904	Buy 7 pieces of information for 1,904 ECU in total
8	544	0	+68	+136	+204	+272	+340	+408	+476	+544				= 2,448	Buy 8 pieces of information for 2,448 ECU in total
9	612	0	+68	+136	+204	+272	+340	+408	+476	+544	+612			= 3,060	Buy 9 pieces of information for 3,060 ECU in total
10	680	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680		= 3,740	Buy 10 pieces of information for 3,740 ECU in total
11	748	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680	+748	= 4,488	Buy 11 pieces of information for 4,488 ECU in total

For participants in the NOTP treatments, the text written in red was lacking.

For participants in the NEG treatments, this number in blue was replaced by -12,000

Participants in the POS-LCOSTS treatments were shown the following screen:

ROUND 1 of 20

remaining time (secs): 11

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Please select the amount of information you want to buy by clicking on one of the options:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information													
0	0	0												= 0	Buy 0 pieces of information for 0 ECU in total
1	34	0	+34											= 34	Buy 1 piece of information for 68 ECU in total
2	68	0	+34	+68										= 102	Buy 2 pieces of information for 204 ECU in total
3	102	0	+34	+68	+102									= 204	Buy 3 pieces of information for 408 ECU in total
4	136	0	+34	+68	+102	+136								= 340	Buy 4 pieces of information for 680 ECU in total
5	170	0	+34	+68	+102	+136	+170							= 510	Buy 5 pieces of information for 1,020 ECU in total
6	204	0	+34	+68	+102	+136	+170	+204						= 714	Buy 6 pieces of information for 1,428 ECU in total
7	238	0	+34	+68	+102	+136	+170	+204	+238					= 952	Buy 7 pieces of information for 1,904 ECU in total
8	272	0	+34	+68	+102	+136	+170	+204	+238	+272				= 1,224	Buy 8 pieces of information for 2,448 ECU in total
9	306	0	+34	+68	+102	+136	+170	+204	+238	+272	+306			= 1,530	Buy 9 pieces of information for 3,060 ECU in total
10	340	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340		= 1,870	Buy 10 pieces of information for 3,740 ECU in total
11	374	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340	+374	= 2,244	Buy 11 pieces of information for 4,488 ECU in total

For participants in the NOTP-POS-LCOSTS treatment, the text written in red was lacking.

ROUND 1 of 20

remaining time (secs): 2

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Summary of the forecasts made by the distribution centers:

Number of pieces of information that forecast a high demand:	Number of pieces of information that forecast a low demand:
2	4

Please decide whether you want the unused machine to operate again or not by clicking on one of the two options:

The machine should operate again
The machine should not operate again

For participants in the NOTP treatments, the text written in red was lacking.
For participants in the NEG treatments, this number in blue was replaced by -12,000.

Participants in the TP treatments were provided with the following screen if they did not make a decision within the allotted time (participants in the NOTP treatments were never provided with this screen since they were not restricted in the time available):

You have not made your decision within the allotted time. The system has decided for you. The result of this decision will be shown on the next screen.

Continue

Participants in the TP treatments were provided with the following screen if they did not make a decision within the allotted time (participants in the NOTP treatments were never provided with this screen since they were not restricted in the time available):

Summary of round 1:

The system decided that the machine should operate again.

Overall, there is a high demand in this round.

For that reason and because you did not make your decision within the allotted time, your payment for this round will be (if this round is selected by lottery at the end):

15,000 ECU – 3,000 ECU + 10,000 ECU = 22,000 ECU

Round 1 is finished. Please work on round 2 now.

Start next round

Participants repeated this task for 20 rounds.

Participants in the HCOSTS treatments were shown the following screen:

ROUND 20 of 20

remaining time (secs): 12

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Please select the amount of information you want to buy by clicking on one of the options:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information													
0	0	0												= 0	Buy 0 pieces of information for 0 ECU in total
1	68	0	+68											= 68	Buy 1 piece of information for 68 ECU in total
2	136	0	+68	+136										= 204	Buy 2 pieces of information for 204 ECU in total
3	204	0	+68	+136	+204									= 408	Buy 3 pieces of information for 408 ECU in total
4	272	0	+68	+136	+204	+272								= 680	Buy 4 pieces of information for 680 ECU in total
5	340	0	+68	+136	+204	+272	+340							= 1.020	Buy 5 pieces of information for 1,020 ECU in total
6	408	0	+68	+136	+204	+272	+340	+408						= 1,428	Buy 6 pieces of information for 1,428 ECU in total
7	476	0	+68	+136	+204	+272	+340	+408	+476					= 1,904	Buy 7 pieces of information for 1,904 ECU in total
8	544	0	+68	+136	+204	+272	+340	+408	+476	+544				= 2,448	Buy 8 pieces of information for 2.448 ECU in total
9	612	0	+68	+136	+204	+272	+340	+408	+476	+544	+612			= 3,060	Buy 9 pieces of information for 3.060 ECU in total
10	680	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680		= 3,740	Buy 10 pieces of information for 3,740 ECU in total
11	748	0	+68	+136	+204	+272	+340	+408	+476	+544	+612	+680	+748	= 4,488	Buy 11 pieces of information for 4,488 ECU in total

For participants in the NOTP treatments, the text written in red was lacking.
For participants in the NEG treatments, this number in blue was replaced by -12,000.

Participants in the POS-LCOSTS treatments were shown the following screen:

ROUND 20 of 20

remaining time (secs): 12

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Please select the amount of information you want to buy by clicking on one of the options:

Infor-mation	Direct costs (in ECU) of a particular piece of information	Total costs (in ECU) for the acquisition of an amount of information													
0	0	0												= 0	Buy 0 pieces of information for 0 ECU in total
1	34	0	+34											= 34	Buy 1 piece of information for 68 ECU in total
2	68	0	+34	+68										= 102	Buy 2 pieces of information for 204 ECU in total
3	102	0	+34	+68	+102									= 204	Buy 3 pieces of information for 408 ECU in total
4	136	0	+34	+68	+102	+136								= 340	Buy 4 pieces of information for 680 ECU in total
5	170	0	+34	+68	+102	+136	+170							= 510	Buy 5 pieces of information for 1,020 ECU in total
6	204	0	+34	+68	+102	+136	+170	+204						= 714	Buy 6 pieces of information for 1,428 ECU in total
7	238	0	+34	+68	+102	+136	+170	+204	+238					= 952	Buy 7 pieces of information for 1,904 ECU in total
8	272	0	+34	+68	+102	+136	+170	+204	+238	+272				= 1,224	Buy 8 pieces of information for 2,448 ECU in total
9	306	0	+34	+68	+102	+136	+170	+204	+238	+272	+306			= 1,530	Buy 9 pieces of information for 3,060 ECU in total
10	340	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340		= 1,870	Buy 10 pieces of information for 3,740 ECU in total
11	374	0	+34	+68	+102	+136	+170	+204	+238	+272	+306	+340	+374	= 2,244	Buy 11 pieces of information for 4,488 ECU in total

For participants in the NOTP-POS-LCOSTS treatment, the text written in red was lacking.

ROUND 20 of 20

remaining time (secs): 8

		your additional payment in the case of a	
		high demand	low demand
your decision:	Machine will operate	10,000 ECU	-8,000 ECU
	Machine will not operate	0 ECU	0 ECU

If at least 6 pieces of information forecast "high demand" → future demand is then considered to be high
If at least 6 pieces of information forecast "low demand" → future demand is then considered to be low

Summary of the forecasts made by the distribution centers:

Number of pieces of information that forecast a high demand:	Number of pieces of information that forecast a low demand:
5	4

Please decide whether you want the unused machine to operate again or not by clicking on one of the two options:

The machine should operate again
The machine should not operate again

For participants in the NOTP treatments, the text written in red was lacking.
For participants in the NEG treatments, this number in blue was replaced by -12,000.

Round 20 of 20 remaining time (secs.): 3

Please confirm your entry:

Do not submit entry
Submit entry

For participants in the NOTP treatments, the text written in red was lacking.

In the case that the participant purchased 9 pieces of information and that the participant decided that the machine should not operate again and an overall low future demand, the following screen was shown:

Summary of round 20:

You bought 9 pieces of information for 3,060 ECU.

You decided that the machine should not operate again.

Overall, there is a low demand in this round.

For this reason, your payment for this round will be (if this round is selected by lottery at the end):

15,000 ECU – 3,060 ECU + 0 ECU = 11,940 ECU

Round 20 is finished. Please work on the questionnaire now.

Continue with the questionnaire

For participants in the POS-LCOSTS treatments, these numbers in green were replaced by 1,530 ECU and therefore, the payment for this round was 13,470 ECU.

Please describe briefly what influenced you to buy a certain amount of information (max. 50 words):

Continue

Please indicate how much you agree with the following statements. There are no right or wrong answers. Therefore, please indicate what reflects your attitude best.

When I bought information, I felt influenced by the amounts shown in the payoff matrix (see table 1 on the sheet of paper in front of you).	strong rejection	o o o o o o o	strong agreement
When I bought information, the extent of the information costs influenced me.	strong rejection	o o o o o o o	strong agreement
I decided instinctively whether to buy a further piece of information or not.	strong rejection	o o o o o o o	strong agreement
I decided for mathematical and / or analytical reasons whether to buy further information or not.	strong rejection	o o o o o o o	strong agreement

Continue

Please indicate how much you agree with the following statements. There are no right or wrong answers. Therefore, please indicate what reflects your attitude best.

For complex tasks, analytical skills are needed.	strong rejection	o o o o o o o	strong agreement
The more information is available for decision-making, the more complex the decision-making process becomes.	strong rejection	o o o o o o o	strong agreement
The more complex the task, the more cognitive resources are needed.	strong rejection	o o o o o o o	strong agreement
To me, complexity means that the solution is not directly obvious.	strong rejection	o o o o o o o	strong agreement
I found the task very complex.	strong rejection	o o o o o o o	strong agreement

Continue

Please indicate how much you agree with the following statements. There are no right or wrong answers. Therefore, please indicate what reflects your attitude best.

I do not feel comfortable about taking risks.	strong rejection	o o o o o o o	strong agreement
I prefer situations that have foreseeable outcomes.	strong rejection	o o o o o o o	strong agreement
Before I make a decision, I like to be absolutely sure about what the result will be.	strong rejection	o o o o o o o	strong agreement
I avoid situations that have uncertain outcomes.	strong rejection	o o o o o o o	strong agreement
I feel comfortable improvising in new situations.	strong rejection	o o o o o o o	strong agreement
I feel nervous when I have to make decisions in uncertain situations.	strong rejection	o o o o o o o	strong agreement

Continue

Please indicate how much you agree with the following statements. There are no right or wrong answers. Therefore, please indicate what reflects your attitude best.

The experiment was fun for me.	strong rejection	o o o o o o o	strong agreement
I identified with the task of the production manager.	strong rejection	o o o o o o o	strong agreement
I tried hard when working on the task.	strong rejection	o o o o o o o	strong agreement
I felt bored when working on the task.	strong rejection	o o o o o o o	strong agreement
I have experience of this kind of task.	strong rejection	o o o o o o o	strong agreement
My mathematical skills are extremely good.	strong rejection	o o o o o o o	strong agreement
My analytical skills are extremely good.	strong rejection	o o o o o o o	strong agreement
The experiment was explained thoroughly.	strong rejection	o o o o o o o	strong agreement
The explanations for this experiment were easy to understand.	strong rejection	o o o o o o o	strong agreement

Continue

Please enter your gender:

o male
o female

Please enter your age:

Please enter your main field of study:

Please enter your "Abitur" [university entrance Qualification] grade (please use a dot rather than a comma)):

Please enter the number of months of practical Experience you have had in private or public companies (including the time spent on internships but not school and university study time)

Continue

You will now solve some ARITHMETIC PROBLEMS:

Your objective is to solve correctly as many arithmetic problems as possible within the allotted time of 5 minutes. A problem always involves one of the four basic arithmetic operations. The solution contains whole numbers only. Therefore, please enter your solution without decimal places.

Each screen will display 20 arithmetic problems. You can decide freely how many problems you solve on the displayed screen. You can skip over one or more problems and you do not have to do them in any particular order. As soon as you have completed the problems on one screen or if you cannot solve any more or them, please click on "Continue". Then you will get some new arithmetic problems. The "Back" button gives you the option of going back to earlier inputs or to any gaps in your answers. The arithmetic problems will be shown like this:

14 x 7 =

You can use the paper and writing material in front of you should you need to.

The composition of your payment of these arithmetic problems is shown on the next screen.

Continue

You will only receive ECU for correctly answered questions, depending on the arithmetic operation involved, as follows:

Addition:	40 ECU
Subtraction:	80 ECU
Multiplication:	120 ECU
Division:	160 ECU

No ECU will be deducted for missing or wrong answers. ECU will be converted into Euro at an exchange rate of 2,000 ECU = 1 Euro, rounded up or down to the first decimal place. They will be paid out to you in addition to your payment based on the decision task (by lottery).

The remaining time for problem solving is shown at the top right of the screen. The time is determined in such a way that you cannot solve all the problems. So please work on as many problems as possible within the 5 minutes. As soon as the time has expired, you cannot solve any more problems. You will automatically find out about your results and your payment. For a good score you need to concentrate fully.

Please click on "Continue" to start solving the arithmetic problems.

Continue

Participants were provided with 8 screens containing arithmetic problems, such as those displayed on the following screen:

remaining time (secs): 298

95 x 3 =	553 + 494 =	910 – 645 =	76 : 4 =	26 x 5 =
185 + 375 =	472 – 203 =	144 : 3 =	76 x 5 =	580 + 711 =
445 - 92 =	112 : 8 =	41 x 5 =	859 + 286 =	164 - 15 =
64 : 4 =	28 x 9 =	749 + 322 =	107 - 80 =	159 : 3 =

Continue

You have run out of time for solving the arithmetic problems.

Please click on "Continue" to find out what your payment, consisting of the decision task (by lottery) and of the arithmetic problem task, will be.

Continue

Participants were provided with a results screen. The following screen displays an exemplary results screen of a participant in the TP-POS-HCOSTS treatment:

Round	Budget (in ECU)	- costs for acquired information (in ECU)	+ additional payment (in ECU)	= total payment (in ECU)
1	15,000	3,000	10,000	22,000
2	15,000	3,000	10,000	22,000
3	15,000	1,904	0	13,096
4	15,000	3,000	10,000	22,000
5	15,000	2,448	-8,000	4,552
6	15,000	1,904	0	13,096
7	15,000	3,740	10,000	21,260
8	15,000	680	10,000	24,320
9	15,000	2,448	10,000	22,552
10	15,000	1,428	-8,000	5,572
11	15,000	68	-8,000	6,932
12	15,000	68	10,000	24,932
13	15,000	204	-8,000	6,796
14	15,000	204	10,000	24,796
15	15,000	0	10,000	25,000
16	15,000	1,904	-8,000	5,096
17	15,000	408	10,000	24,592
18	15,000	0	-8,000	7,000
19	15,000	3,060	10,000	21,940
20	15,000	68	-8,000	6,932

Based on the decision task, your payment will be as follows:

Round 9 was selected by lottery.

Therefore, your payment will be: 22,552 ECU

Based on the arithmetic problems, your payment will be as follows:

You solved 23 problem correctly and will receive 2,040 ECU for it.

2,000 ECU are equivalent to 1 Euro.

Therefore, your total payment will be:
22,552 ECU + 2,040 ECU = 24,592 ECU
11.28 Euro + 1.02 Euro = 12.30 Euro

Please click on "Quit" now!

Quit

APPENDIX B: Descriptive statistics

Independent variable			Experiment 1		Experiment 2		Experiment 3	
			Treatments					
			1*	2**	3*	4**	5*	6**
Decision rule	N		700	760	700	700	740	780
	Frequency in %	1	76.43	82.11	85.43	86.43	87.97	87.95
		0	23.57	17.89	14.57	13.57	12.03	12.05
Uneven number	N		700	760	700	700	740	780
	Frequency in %	1	42.86	51.84	45.71	52.00	62.57	53.59
		0	57.14	48.16	54.29	48.00	37.43	46.41

*Note. * time pressure; ** no time pressure*