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COMMERCE

A Micro-World Simulation to Study Routine Maintenance and Deviation in Repeated Decision Making

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Abstract

This paper presents a computer controlled micro-world simulation (COMMERCE) designed to study routine effects in deliberate repeated decision making. COMMERCE employs an economic scenario which requires the participant to recurrently make acquisition and disposal decisions concerning industrial goods in order to maximize monetary profits. COMMERCE allows the experimenter to induce a decision routine (preference) for a target option by varying the frequency of choice repetition during a learning phase. In subsequent test phases, routine effects can be assessed by a number of variables such as information search and choice behavior. The paper is arranged in two parts. The first part introduces COMMERCE on a descriptive level. The second part provides two demo versions of COMMERCE.

1. COMMERCE

A Micro-World Simulation to Study Routine Maintenance and Deviation in Repeated Decision Making

Decision research has neglected the role of past behavior in decision making for a long time (Betsch, Haberstroh & Höhle, 2000). The vast majority of researchers employed the gambling paradigm in their studies (Goldstein & Hogarth, 1997). In this research methodology, participants have to choose between a limited set of alternatives representing lotteries with stated probabilities of monetary outcomes. For example, in a seminal study on the reflection effect, Hershey and Schoemaker (1980) asked their students to choose between the following two alternatives: (A) $9000 for sure; (B) $10,000 with probability .9, otherwise nothing[1]. Decision problems of this type are commonly unfamiliar to the participant. All relevant information is given by the experimenter in order to reduce the influence of the participants' prior knowledge to a minimum. The reason is that decision researchers are commonly interested in rational, deliberate decision making rather than in spontaneous, automatic choices which, for instance, reflect prior preferences or habits. Hence, prior expectations, preestablished preferences and behavioral routines are treated as sources of error variance which are likely to overshadow, bias or suppress the functioning of deliberate decision making. The study and explanation of routinized choices in recurrent settings have been largely left to animal research and learning psychology (cf. Rachlin, 1989).

However, recent developments in the field indicate that this strict separation between rational, deliberate decision making on the one hand and spontaneous, routinized choices on the other is subjected to change (Beach & Potter, 1992). The change manifests itself in the emergence of research programs and theoretical developments which attempt to approach conditions of decisions in real world settings, which are characterized by a high degree of routinization (e.g., Klein 1999). With reference to this develop-

[1] In a loss condition, participants were presented with a mirror-image form of the outcomes: (C) -$9000 for sure; (D) -$10,000 with probability .9, otherwise nothing. Results show a reflection effect in choices in such that participants in the gain condition tend to be prefer the alternative with the sure outcome (A), whereas participants in the loss condition tend to prefer the risky alternative (D).

ment some authors even speak of a revolution. The most important insight driving this development may appear to be trivial from an outer perspective: Routinized decisions are not necessarily automatic, but can and often do involve thinking and deliberation. People, though often maintaining particular decision routines (e.g., ride the bike to your institute, have lunch at the Chinese restaurant, read a book in the evening), sometimes change their mind and deliberatively decide to deviate from their routines (e.g., go by car, have lunch in an Italian restaurant, go to the movies in the evening). Hence, it is not justified to neglect routines in decision research. Decision theory must be able not only to predict choices in new settings, but also in recurrent decision problems, in which a decision routine (a certain option preferred in the past) is contained in the option set -- a situation which is typical for proficient decision making.

Especially during the last decade, decision researchers have become increasingly interested in the functioning of routinized decision making. A number of studies concerned habits. Habits are over-learned routines which have become automatic. The most important lesson to be learned from this line of research is that strong habits can bias information search (Verplanken & Aarts, 1999) and can override deliberatively formed intentions (Oulette & Wood, 1998).

A growing body of research also considers decisions involving routines which have not been frozen into habit. The majority of these studies stems from field research in applied settings with experienced decision makers (e.g., fire-fighters, pilots, etc.). This approach is labelled „natural decision making research„ by its protagonists and currently unfolds a pronounced impact in the decision research community (Zsambok & Klein, 1997). It has brought forth a couple of insights into routinized decision making. Accordingly, decisions in experienced deciders often seem to be guided by processes of matching and mental simulation rather than by profitability calculations as postulated by classic decision theory (e.g., Klein, 1999).

Another line of research examines routinized decision making in the laboratory. For example, in our own studies we could demonstrate that highly routinized deciders are prone to underweigh new evidence in deliberate decisions, if this information contradicts routine choice (e.g., Betsch, Brinkmann, Fiedler, & Breining, 1999; Betsch, Haberstroh, Glöckner, Haar, & Fiedler, 2000). Moreover, routinized decision making is influenced by context factors. For example, perceived novelty of the situation increases the likelihood that decision makers deviate from their routines (Betsch, 1995; Betsch, Fiedler, & Brinkmann, 1998). The increasing interest in routinized decision making has also precipitated theory formation. Today, there are a number of theories available which allow us to account for routine effects in decision making (see Betsch, Haberstroh, & Höhle, 2000, for an overview).

However, facing this development, it is remarkable that the overwhelming majority of researchers merely *measure* routines instead of *manipulating* them under experimentally controlled conditions. In this paper, we present an experimental tool (COMMERCE) that allows the manipulation of routine strength and the assessment of routine effects on subsequent information search and choice. It is important to note to whom this tool is addressed. Our purpose is to provide a research tool primarily for *decision research.* With respect to its structure, COMMERCE approaches the methodology commonly used in decision research (gambling paradigm, process tracing methodology) rather than the micro-world simulations which are employed in problem solving research, although on the surface it may appear to be the opposite. We will get back to this issue in the discussion. In the first part of the paper we will give an overview of COMMERCE. Then we will describe the decision scenario, one typical trial, the various ways in which routines can be manipulated and how routine effects can be assessed. The paper also contains two demo versions and some technical information. The description of COMMERCE refers to the enclosed *short* demo version of the game. We recommend reading the following descriptions before running the demo.

2. Overview

The version of COMMERCE presented in this paper is a further development of an identically named micro-world which has been successfully employed in our own research (Betsch, Haberstroh, Glöckner, Haar, & Fiedler, 2000). It can be run on an IBM-compatible personal computer in a Microsoft Windows environment. Experimenting with COMMERCE requires the experimenter to have rudimentary programming skills in Visual Basic.

COMMERCE simulates a fictitious decision problem involving the recurrent acquisition and disposal of industrial goods (robots). In the game, the robots represent the behavioral options. The participant takes the role of a stockpile manager in a large firm which rents out robots in several markets which are represented by three emerging cities on the moon. The goal is to reach a certain amount of profit in one of these cities. In order to achieve this goal, the participant first has to figure out which brand of robot is greatly demanded in the target city. For this purpose, the participant is provided with forecast information from a market research institute and with rent-out statistics. Profit maximization requires the participant to accumulate robots in the stockpile of that brand which rents out well in the target city and to dispose of those robots from the stockpile which perform worse. This, in turn, necessitates recurrent acquisition and disposal choices. Both acquisition and disposal decisions have to be repeated a number of times, because the number of robots that can be acquired and disposed of within one trial is limited.

The purpose of forcing the participant to repeat acquisition choices for a certain brand is to induce a decision routine, i.e. a preference for a certain brand. Routine strength can be varied, for instance, by altering the frequency of repeated acquisition decisions needed to achieve the profit goal. Routine effects (routine maintenance and deviation) can be assessed in subsequent games in which the world is changed, so that the previously established routine becomes inadequate as a solution to the decision problem.

In the following section we describe the decision scenario in more detail. Subsequently, we describe all actions that are involved in one typical trial of COMMERCE. Then we discuss the possibilities of how routines can be manipulated and, finally, how routine effects can be measured.

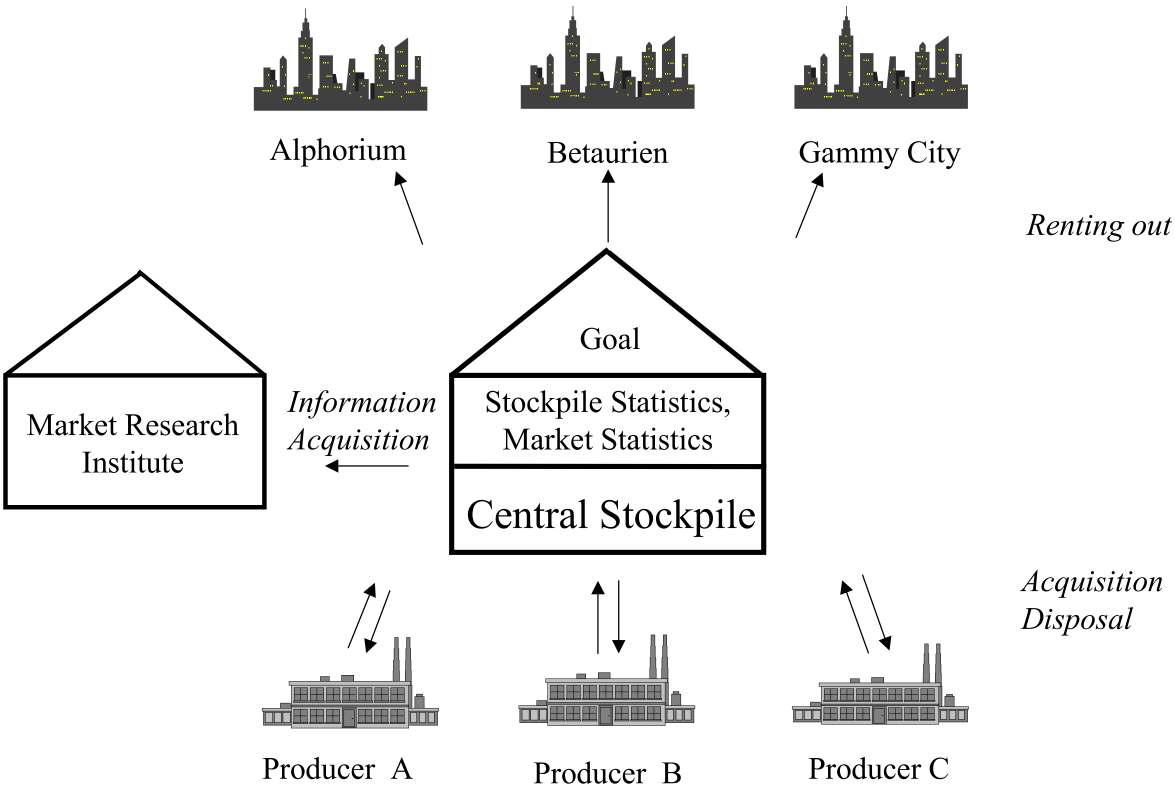
3. The Decision Scenario

The Reason Why the Decision Scenario is Hypothetical. A previous version of COMMERCE (Betsch, Haberstroh, Glöckner, Haar & Fiedler, 2000) involved a decision scenario which referred to real world situations. Specifically, the company in the simulation was located in England and held branches in truly existing cities (e.g. Manchester). The firm dealt with construction machinery, such as cranes and excavators. Although for our German subjects population this scenario was quite removed from their everyday experiences, a few participants reported that they had tried to base their decisions not only on the information given in the problem, but additionally on their prior knowledge about construction machinery and the economic situation in England. In order to prevent participants from enriching the scenario with their prior knowledge, we decided to employ a decision scenario in the present version of COMMERCE which was obviously hypothetical.

Introducing the Plot to the Participants. Participants are told that the decision scenario plays in a distant future in which mankind is going to colonize the moon. They learn that the company, in which they will work as a stockpile manager, rents out robots in three markets, representing emerging cities on the moon (Alphorium, Betaurien and Gammy City). The company is said to currently have leasing contracts for robots with three producers on the earth. The producing firms represent brands and are labeled with names (e.g. England HPO, IJF Firm, Ricci). The company holds branches in the three emerging cities where it rents out robots to the customers (see Exhibit 1). The robots are described as multi functional devices that can be utilized for terra forming and construction purposes. The leasing contracts with producers can be enlarged or reduced from month to month within certain limits. This allows the company to effectively adapt to market demands. Participants are informed that at the beginning of a game one city will be announced as the primary market. This means that profits have to be maximized in this market. In particular, participants are told that their task will be a) to reduce stockpiling costs by disposing of robots of those brands which do not rent out, and b) to maximize profits by enlarging leasing contracts for those robots which rent out well in the primary market. Reducing leasing contracts can be simply done by removing robots from the stockpile and sending them back to the producer. Contracts can be enlarged by ordering more robots of the desired brand. Participants are explicitly instructed that -- in order to maximize profits in the primary market -- the best performing brand has to be recurrently acquired, and the other two have to be disposed of in order to reduce leasing and stockpiling costs. We ask participants to use the various kinds of information (market research institute, payoffs: see below) to figure out market demands. By doing this, we create a decision situation that actually encourages individuals to employ controlled and systematic decision strategies.

In our own research we introduce the plot of the scenario audio-visually on the computer screen. During this introduction, participants receive detailed information about the task and are also guided through a demo version of COMMERCE. Of course it is possible to establish other kinds of scenarios, for example, to maximize profits in two markets. The only restriction is that the core structure of the game (see Exhibit 1) cannot be changed. Accordingly, there are always three markets and three options, represented by the three brands.

Exhibit 1: COMMERCE, structure of the micro-world simulation. Explanation see text.



In the next section we introduce the features of COMMERCE in detail by describing the procedures which are involved in one typical trial. The underlying task is the same as in the enclosed short demo version.

4. One Trial in COMMERCE

One trial of a game represents one month in the micro-world simulation. Within one trial the participant can inspect stockpile statistics and payoffs in the markets, consult the market research institute to consider forecast information, and alter the stockpile by ordering robots of a promising brand and sending back those which do not rent out in the market. After each trial, the payoffs in the markets are calculated by the programm. If a certain profit goal is reached, the whole game terminates. If not, the participant is presented with another trial. At the beginning of a trial, the participant is presented with a start window containing an action menu and the most important statistics.

Start Window. The left part of the display contains a trial counter (number of months), stockpile statistics, and the cumulated net-profit made in the branches. Stockpile statistics are displayed by colored bars and show absolute numbers of robots for each brand. In the enclosed short demo version, the stockpile initially contains 50 robots per brand, which are labeled: „England HPO“, „IJF Firm“, and „Ricci“. These labels represent the three industrial producers as said to be involved in the present game. The set of producers can change from one game to the next, but remain the same within one game (i.e., until a profit goal is reached). The profits made in the three branches are depicted graphically in a chart. For each branch a bar indicates the cumulated amount of net-profit (in $ 1,000) made so far in the respective market. The demo starts with an initial net-profit of $ 500,000 per branch which are labeled with the names of the emerging cities (Alphorium, Betaurien, Gammy City). The Betaurien bar is colored in red, indicating that this branch is announced as the primary market where profits are to be maximized to a given amount (see also the action button „Goal„, below). Additionally, the profit amount is presented in numbers in an attached table. Furthermore, this table contains the momentary change in profit in a gain-loss row. The change always refers to gains or losses obtained in the previous trial. Consequently, in the first trial of a game, the gain-loss value is set at zero. On the right side of the start window, the participant is presented with a menu containing six action buttons, each of which opens a pop-up window when activated by a mouse-click. The buttons are labeled „Robot Acquisition“, „Robot Disposal“, „Market Research Institute“, „Balance of the Previous Month“, „Goal“, and „End of the Month“. It is up to the participant to choose the order and the amount of actions he or she wants to perform within a trial. Except for „Goal“ all action buttons can only be activated once within a trial. We describe the actions in the following paragraphs.

Action Button: Robot Acquisition. As already mentioned, participants are informed in the introduction that their company holds leasing contracts with three producers. These contracts allow them to order more robots or to dispose of robots from the stockpile by sending them back to the producers. If the button „Robot Acquisition„ is clicked on, an interactive window, which allows the participant to make acquisition choices, pops up on the right side of the screen. It is possible to order different brands and different amounts of robots at once, with the restriction that the producers have different delivery limits. These limits are displayed on the screen as well and can change over trials. After the participant has typed in the amount of robots to be acquired and has clicked on a „Continue„ button, the brand logo(s) of the ordered robots appear on the screen. This is done to establish a visual representation of the options in the participant in order to enhance recognition of these options in subsequent test games.

Action Button: Robot Disposal. By clicking on this button, the participant can dispose of robots from the stockpile in order to reduce leasing and stockpiling costs. The interactive window virtually looks like the former one. The display contains information about disposal limits and allows the participant to fill in the number of robots that should be sent back to the respective producer.

Action Button: Market Research Institute. If the participant wants to search for information about future demands in the markets, she can consult a market research institute which provides forecasts in a 3 (markets) by 3 (brands) matrix format. Clicking on this action button activates a full screen interactive window containing the information matrix and instructions. The matrix resembles the „Mouselab„ (Johnson, Payne, Schkade & Bettman, 1986) which has meanwhile become a standard tool in process-tracing decision research. The participant can order pieces of information by clicking on initially blank boxes in the matrix. In contrast to the Mouselab, the participant in COMMERCE must first decide whether to inspect rows or columns, representing markets and brands, respectively. Afterwards, the participant can open the boxes in the respective row or column in the same fashion as in the original Mouselab. It is also possible to limit the number of boxes that can be opened within one trial. The search limitation is shown on the left part of the screen. If an information box is opened, a positive or a negative forecast appears. The forecasts are formulated as if they were certain information („The robot X will rent out at the Betaurien market„ vs. „The robot X will not rent out at the Betaurien market„). Actually, forecasts provide probabilistic information over trials because they are not always valid. In the short demo version the hit rate of the forecasts was set at 80% (i.e. 20% of the forecasts are wrong). To be specific, the hit rate of 80% in the basic demo version is realized in each set of ten consecutive trials. In COMMERCE the distribution of false and true forecasts are not generated by the program, but are scheduled by the experimenter in order to avoid clustering effects.

Action Button: Goal. Here the participant receives detailed information about the current goal. The goal is kept constant during a game. The display contains a written goal instruction as well as a chart (similar to the profit chart in the start-up window) in which the desired profit is indicated by a red bar. In the short demo version, the goal for the primary market (Betaurien) is set at $ 700,000. The participant is requested to achieve this goal as fast as possible (i.e. in a minimum of trials). The profits in the secondary markets (Alphorium, Gammy City) are not to fall short of $ 100,000.

Action Button: Balance of the Previous Month. Access to the pay-offs is first possible in the second trial of a game, because the pay-offs refer to the previous month. The button activates a 3 (branch) by 3 (brand) matrix depicting the overall gains (in black numbers) and losses (in red numbers) that each branch has made with the machines held in the stockpile. A gain entry indicates that the brand actually did rent out in the market. It represents the cumulated net profits made by all robots that have been rented out. The single net profits are calculated per robot by subtracting a cost constant from a renting price constant. The cost constant reflects stockpiling costs and the leasing costs that the company has to pay to the producer. The micro-world models demands in a market at a certain month as a dichotomous variable, i.e. a brand either has been demanded or not. If it has been demanded, then as many robots can be rented out as are available. Therefore, the total amount of gain obtained for a requested brand is a direct function of the amount of robots that are currently available in the stockpile. If a brand has not been demanded in a market, the respective cell in the pay-off matrix contains a negative entry. Such a loss entry reflects the cumulated costs of stockpiling and leasing costs for the brand that did not rent out.

In addition to the pay-off matrix, the display contains a summary of the transactions of the previous trial. Specifically, the participant is presented with the amount and types of robots that have been previously acquired and disposed of the stockpile.

Action Button: End of the Month. By clicking on this button, the current trial is terminated. Consequently, the programm updates pay-off and profit statistics. If the set goal is achieved, the whole game is terminated. In this case either another game is started or the micro-world simulation closes down and reads out protocols (transactions, searches, number of trials etc.) in an ASCII-format data file. If the goal is not achieved, the programm starts another trial. Number of trials (months) are counted and depicted in the upper left part of the start window of the next trial.

5. Manipulating Routine Strength

In COMMERCE, a routine is represented by an option (brand) which has turned out to be most beneficial for the goal to maximize profits in a certain market. Routine strength is operationalized by the frequency with which the routine option has been repeatedly chosen during a learning game or a sequence of learning games. The rationale behind this is that choice repetition has been proposed to be a powerful mean to strengthen situation-behavior associations in an organism (e.g., Hull, 1943; Ronis, Yates & Kirscht, 1989). In our own experiments, we so far have relied on choice repetition as a mean to induce behavioral routines in the individual (Betsch, 1995; Betsch, Brinkmann, Fiedler & Breining, 1999; Betsch, Fiedler & Brinkmann, 1998; Betsch, Haberstroh, Glöckner, Haar & Fiedler, 2000).

As mentioned above, learning a routine in the micro-world involves two steps. First, the participant must figure out which of the three brands is greatly demanded in the target market. The difficulty of this step depends on the *hit-rate of the forecasts* and the options‘ underlying *pay-off structure*. Both can be set in advance by the experimenter. For the demo, we have set the hit-rate of the forecasts at 80% and designed underlying pay-offs so that the routine option (England HPO) has a rent-out probability of 80% in the primary market. The remaining two options rent out in 50% (IJF Firm) and 20% (Ricci) of the trials, respectively. Due to our experiences, it normaly takes undergraduate participants less then 10 trials to figure out the target option, if they have been previously trained in COMMERCE for about 30 minutes (involving instructions, guided demo, and training game). For initial training games we usually set extreme pay-off probabilities (e.g. 90% vs 20% vs 10%) which create more obvious differences between the options. Second, the demanded brand must be accumulated in the stockpile in order to satisfy market demands and to reach a certain profit goal. This requires the participant to recurrently decide to acquire more robots of the requested brand. On the other hand, reaching a profit goal also requires the participant to dispose of those brands which do not rent out in order to reduce stockpiling and leasing costs.

The number of repetitions of the target choice[2] which are necessary to reach a profit goal cannot be exactly determined in advance, because participants are completely free

[2] The option which is intended to become the routine.

in their decisions. However, there are several parameters which can be changed to substantially reduce interindividual variance and, therefore, allow a manipulation of the average amount of choice repetitions quite precisely. These parameters are the *level of the profit goal* (i.e., the additional profit that must be achieved in a certain market), the *delivery limits* and the *rent prices* which jointly determine the number of target choice repetitions. Obviously, increasing the profit goal increases the number of target choices that are needed to finish the game. The same is true for delivery limits. If delivery limits for the best performing option are severe (e.g. if the numbers of robots that can be ordered per trial range between 0 and 5), the participant will need a higher number of trials to reach the goal, compared to conditions in which delivery limits are less severe (e.g. a range between 5 and 10 robots). In other words, the frequency of choice repetition in COMMERCE is positively correlated with severity of delivery constraints, all other things (e.g. goal level) being equal. In an application of a former version of the micro-world, we kept the goal level ($ 700,000) and the delivery limits (between 0 and 10) constant and varied the rent prices between groups ($ 200 or $ 500 per robot). Everything else being equal, there is an inverse relationship between rent prices and the number of choice repetitions needed to win the game. The smaller the rent prices, the more often the best performing option should be acquired in order to achieve a stockpile capacity that yields the required amount of profit. Accordingly, in the strong routine condition, participants repeated the routine choice far more often than participants in the weak routine condition. In the strong routine condition, the average number of trials needed to finish the game was almost twice as high as in the weak routine condition (cf. Betsch, Haberstroh, Glöckner, Haar & Fiedler, 2000).

6. Assessing Routine Maintenance and Deviation

The basic idea behind COMMERCE was to create an environment in which both the relative influence of prior behavioral knowledge (routines) and new evidence on decisions can be studied. To assess effects of routine maintenance and deviation, we have employed the following procedure so far. In a learning phase, routines were induced and routine strength was manipulated by techniques described in the preceding section. After a time lapse (one week) or a distraction task (lasting about half an hour), participants were presented with a test game to assess routine effects in decision making. For this test game, we had changed the micro-world so that the routine was no longer a good solution to the same goal as in the learning phase before. Such a change can be achieved by changing the pay-off structure so that the routine in the new situation rents out in the primary market in only, for instance, 40% of the trials. Such a situation requires the individual to dispose of robots of the routine brand from the stockpile as quickly as possible. Usually, we present the routine brand together with unfamiliar options and compare this group to a control condition in which the test game only contains new options. Such a design allows the assessment of mere routine effects by keeping other learning effects constant.

As the major dependent variable, the number of routine choices and control option choices can be measured and compared. More frequent acquisition of the routine compared to the control option, for instance, would indicate a routine maintenance effect. Besides this measure, a number of other intriguing variables can be assessed. For example, patterns of information search in the matrix of the market research institute can be analyzed and compared to previous search pattern during the learning phase. An information search might reveal confirmatory search patterns if the routine is involved. In fact, most of the techniques to analyse search patterns that are well-known from the process tracing literature (e.g., Payne, Bettman & Johnson, 1993) can be employed here as well, because all of the movements in the matrix are protocoled by the programm. Before boxes in the matrix can be opened, the participant must indicate whether he or she wants to inspect the matrix rowwise or columnwise. This measure allows a direct differentiation between the use of compensatory and noncompensatory search strategies in the individual. A further dependent variable is the amount of trials needed to finish the game. Routine maintenance under altered pay-off conditions obstructs the goal to achieve a certain amount of profit. Consequently, it will take the participant a higher number of trials to finish the game if he does not dispose of the routine.

7. Discussion

In the introduction we emphasized that our primary intention was to develop a research tool to study the effects of pre-established preferences (routines) in deliberative decisions. COMMERCE merges a routine training tool to experimentally induce routines with a classic information search paradigm known from process tracing research („Mouselab“) that allows the individual to actively search for information. Hence, COMMERCE provides a rather simple mean to effectively manipulate routine strength as an independent variable, and to subsequently assess a number of outcome oriented and process related measures as dependent variables. It closely approaches the structure of the gambling paradigm in such that it confronts the decision maker with a limited set of options which lead to monetary outcomes with fixed probabilities. The main difference is just that probabilities are not stated but that participants rather have to infer probabilities from prior outcomes (pay-offs) and forecasts.

On the surface, COMMERCE seems to resemble micro-world simulations which are well-known from the problem solving literature. It is important to note, however, that the tool may not suit the research interests commonly persued in problem solving research. Having said this, one is obliged to be explicit about the goals of problem solving research. Unfortunately, their is neither agreement on a universal definition nor on the research goals. Frensch and Funke (1995) discuss a plethora of different views. These authors arrive at the conclusion that it is not possible to come up with a global definition covering all of what has been termed „problem solving research„. Nevertheless, they identified a number of significant communalities among research on complex problem solving (CPS) rooted in the European tradition. The authors suggest the following definition for CPS:

„CPS occurs to overcome barriers between a given state and a desired goal state by means of behavioral and/or cognitive, multistep activities. The given state, goal state, and barriers between given state and goal state are complex, change dynamically during problem solving, and are intransparent. The exact properties of the given state, goal state and barriers are unknown to the solver at the outset.„ (Frensch & Funke, 1995, p.18).

The design of many micro-world simulations employed in CPS research obey to the criteria of the definition. They are complex, dynamic (i.e., actions change the properties of the system), and intransparent or opaque (i.e., absence of proximal cues identifying task state or task structure, Brehmer & Dörner, 1993). The probably best-known example is LOHHAUSEN (Dörner, Kreuzig, Reither & Stäudel, 1983). Participants have to control a town (Lohhausen) by manipulating taxes, working conditions, offers for leisure activity and many other variables. The simulation is highly complex: It involves more than 2000 variables. It is dynamic in such that manipulating one variable affects a vast number of interconnected variables which in turn can cause dramatic changes in the system. Moreover, LOHHAUSEN is opaque. The participant‘s goals are kept vague (system should prosper) and the interconnection of variables is unknown. Other simulations, such as MORO, TAILORSHOP, FIRE or LUNAR LANDER are less complex but basically obey to the same principles of construction. An overview of these and other simulations is given, for instance, by Brehmer and Dörner (1993), Buchner (1995), and Funke (1988).

In contrast to CPS simulations, COMMERCE is low in complexity, static, and transparent. It is low in complexity because it contains only a comprehensible number of variables (three options, pay-offs and forecasts for three markets). The simulated environment is kept stable across all trials within a particular game. Although changes between games are possible (e.g., market demands and set of options can be altered), the simulation is not dynamic because the participant‘s choices can never change the environment (e.g., demands in the market are not changed by stockpile decisions). The task of the participant is to adapt to a stable environment by figuring out the correct actions. Moreover, we took a great deal of care to make the simulation transparent to the participant. The decision maker in our simulation is fully informed about the goals, the possible actions, its consequences and its prior outcomes (pay-offs). Participants are explicitly instructed that the forecasts of the market research institute are probabilistic. Hit rates can be learned by monitoring pay-off and profit statistics. This allows for a strict test of the influences of routines on deliberative decision making. If the simulation were opaque, the reliance on routines could be attributed to the lack of information indicating the inadequacy of the routine. In such a case, obtaining routine-maintenance effects would be trivial.

Taken together, it is obvious that COMMERCE does not blueprint the complexity and dynamics of decision making in a naturalistic setting. This, however, is a great advantage if the research interest calls for employing an experimental method. All variables in our micro-world simulation are fully under the experimenter’s control. Due to these differences between COMMERCE and other micro-world simulations, our tool probably better suits the purposes of decision making research than those commonly persued in the field of CPS research.

In this paper, we have referred to one possible application of a former version of COMMERCE, which is described in detail in a recent paper (Betsch, Haberstroh, Glöckner, Haar & Fiedler, 2000; experiment 1). However, this is not the only way COMMERCE can be employed to study routine effects in decision making. In a running study, for example, we employ COMMERCE to induce a decision routine in the same manner as described earlier. Then we ask participants to think aloud while working on the test-phase decisions involving the routine. By adding such a qualitative methodology we hope for gaining more insights into the cognitive processes that underly routine maintenance and deviation, respectively.

A bundle of trajectories to future research designs emerge, if one considers the moderating role of context factors in routinized decision making. We will finally present one example which is theoretically rooted in the distinction between two functional requirements an organism has to satisfy in order to survive: routinization and contextualization (Athay & Darley, 1981). Routinization involves the acquisition of a behavioral repertoire which provides standard solutions (routines) for choice problems. Having such a repertoire available, the organism is prepared to make fast decisions which require a low degree of cognitive activity. In contrast, contextualization requires a higher degree of cognitive activity. It may involve active search for information, deliberative planning and calculated decision making. Contextualization is necessary to fine-tune behavior to the situational requirements, to detect changes in the environment which require behavioral changes, and to find solutions to new problems. Betsch (1995) provides a compilation of potential determinants for routinization and contextualization. It contains extraneous factors, such as time pressure and information overload, as well a number of factors which constitute the internal context for a decision.

One assumption, for example, holds that contextualization tendencies should become likely if the goals involved in the decision are highly relevant for the person. Accordingly, a person should devote more cognitive effort to those decisions involving goals ranking at a superordinate level in the personal goal hierarchy. In contrast, less effort should be devoted to decisions involving subordinate goals. Consequently, if changes in the environment indicate the inadequacy of a routine, individuals should be more likely to detect these changes and to deviate from the routine, if superordinate goals are involved in the decision. Routine maintenance, in turn, should become likely if the decision involves subordinate goals which do not evoke contextualization tendencies in the individual. In the above description of COMMERCE, we referred to a task in which participants learned a routine for single-goal decision problem (e.g., maximize profits in Betaurien). However, it is possible to associate different routines with different goals during a training phase. For example, participants could learn to prefer „Ricci„ when then goal is to maximize profits in Alphorium and to prefer „England HPO„ when the goal is to maximize profits in Betaurien. Later, in the test phase, participants could be confronted with a series of short games, one half involving Alphorium and the other half involving Betaurien as the primary market. The importance of these goals can be varied by manipulating the amount of profit which can be achieved in the two markets. For example, the pay-offs to be achieved in Betaurien can be set to be twice as high than in Alphorium. Participants can be told that their final payment will be contingent upon the overall profit achieved during the test phase. If the world is altered in the test phase, so that both routines are inadequate, one would expect that the number of routine maintenance decisions are higher in those games involving the less important goal (maximize profits in Alphorium) than those games involving involving the important goal (maximize profits in Betaurien).

This is just but one possible variation of COMMERCE. Evidently, experimental research in the domain of routinized decision making is still at its beginning, and studies addressing the moderating role of context factors are rare. COMMERCE may encourage decision researchers to study the context dependency of routinized decision making under highly controlled experimental conditions in which decision routines are not only measured but manipulated.

8. COMMERCE: Demo Version

Enclosed you will find a demo version of COMMERCE. In the following we will present some tips about the installation of the demo on your computer. First check the following system requirements: Windows 95 or 98, at least 8 MB RAM, 17" Monitor (recommended). Before starting COMMERCE, make sure that the graphic resolution is set at 800 x 600 pixels and that the font size is set on „small„. In the case that these items are not correctly set, change the settings in your control panel configuration (start - settings - control panel - display setting).

Installation. To install COMMERCE, download the archive *commerce.zip* from this articles mainpage, extract it to a temporary folder and start the *setup.exe* file. An installation assistant will guide you through the installation. The system files will be updated and the programm will be installed in the path *c:\commerce*. Do not change this path description. Otherwise COMMERCE will not run on your computer.

Warning. If you have already installed other Visual Basic programs on your computer, COMMERCE might conflict with the settings of the system. If this is the case, you might receive the message: „*Error: could not copy setup1.ex_ -> c:\windows...*„. If this happens, delete the file *c:\windows\setup1.exe* from your hard disk and start the COMMERCE setup again .

After having completed the installation of COMMERCE, the demo can be started by activating the *c:\commerce\commerce.exe* file. In the case of problems, do not hesitate to contact: andreas_gloeckner@psi-sv2.psi.uni-heidelberg.de

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