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# Recovering the garbage can
# Orderly/disorderly paradox

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February 2007

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## 1. Introduction

Cohen, March, and Olsen (1972) developed a simulation model on decision making in organized anarchies. In organized anarchies, an organization is a collection of four elements (choice opportunities, problems, decision makers, and solutions), and a decision is an outcome of the interactions of these four streams. Choice opportunities are viewed as garbage cans. Various kinds of problems, decision makers, and solutions move in and out of choice opportunities, as if garbage were thrown into cans. When the total energy of the decision makers in a choice opportunity exceeds the requirements to solve the problems, the choice is made, as if clearing out a full garbage can.

Generally, the garbage can decision process works in such a way that the combinations of the four elements randomly change, and decisions are made depending on timing (e.g., Weick 1979; Hatch 1997; Daft 2004). A condition for this decision process is "unsegmented" structures, in which problems, decision makers, and solutions can move freely among choice opportunities; that is, a disorderly decision process is considered to emerge from a disorderly structure.

Bendor, Moe, and Shotts (2001), however, examine the simulation model of Cohen et al. (1972) and criticize this generally accepted view. They clarify that decision makers (and occasionally problems) move together in a single pack, and decisions made are not dependent on timing under the unsegmented structures. They regard this process as an orderly decision process; that is, an orderly decision process emerges from a disorderly structure.

This paper reexamines the simulation model and the garbage can model studies. I rewrite the simulation model written originally in FORTRAN and examine the results reported by Cohen et al. (1972). When rewriting, I used Fortran 90, Microsoft Excel, and a multi-agent simulator KK-MAS[1]. I also correct the rounding error and the strange setting of an initial value.

This paper shows that the simulation results are paradoxical. As shown in cell A of Table 1, under the unsegmented (disorderly) structures, the orderly decision process is observed as shown by Bendor et al. (2001). As shown in cell B in Table 1, under the hierarchical (orderly) structures, the disorderly decision process is observed, which is not referred by Bendor et al. (2001).

**Table 1: Interpretation of the simulation results**

| | | Decision process | |
|---|---|---|---|
| | | Orderly | Disorderly |
| Structure | Disorderly (unsegmented) | A<br>Bendor et al. (2001) | C<br>Generally accepted view (illusion) |
| | Orderly (hierarchical) | - | B<br>This paper |

This paper suggests that these paradoxical simulation results are observable in actual organizations. The case studies corresponding to cell B of Table 1 have been reported by the original authors. The hierarchical structures mean, by definition, that the number of accessible choice opportunities differs between each problem and decision maker. For example, March & Romelaer (1976), studying the decision process of a university, report that the people in administrative positions had to devote their energies to various choice opportunities and the professors could engage in the specific choice opportunity related to their own interests. This represents a hierarchical structure. As a result, March and his colleague observed the random movements of problems and decision makers, and the decisions depending on timing.

This paper presents a case corresponding to cell A of Table 1. This case illustrates the employees' behavior at a Japanese firm introducing the concept of the nonterritorial office, in which no one has a specific desk and there are no partitions. This type of office can be considered to make

[1] KK-MAS is a simulator to run multi-agent simulation and was developed by Kozo Keikaku Engineering Inc. (http://www.kke.co.jp/index.html).

the structure unsegmented. Although we might assume that the employees would sit randomly in this office, I observed that they got together and sat in clusters for discussions. In addition, the employees can solve problems efficiently in this office.

Finally, this paper shows that the generally accepted view is a mere illusion created by the subsequent studies of Cohen et al. (1972). When describing the simulation results, the original authors have accumulated and omitted key sentences in order to create the illusion without running the simulation model. The original authors created the illusion of the garbage can model, and Bendor et al. (2001) criticize the illusion.

## 2. Description of the Garbage Can Simulation Model

Classical theories of choice in organizations have three assumptions: 1) decision makers know all outcomes of all alternatives, 2) they share the same goal, and 3) they have consistent and precise preferences. Theories of bounded rationality relaxed the first assumption, and theories of conflict relaxed the second. Most theories of organizational choice, however, do not relax the third assumption. One of the few theories relaxing it is the garbage can model (March & Olsen, 1986).

Cohen et al. (1972) develop the garbage can model for describing decision making in organized anarchies. Organized anarchies are organizations characterized by problematic preferences, unclear technology, and fluid participation. In this circumstance, an organization is a collection of choices looking for problems, issues looking for decision situations in which they might be aired, solutions looking for issues to which they might be the answer, and decision makers looking for work. A decision is an outcome of the complex interactions of these four independent streams within an organization. Cohen et al. (1972) considered that participants take part in decisions with changing (inconsistent and imprecise) preferences and make decisions by timing of choices, problems, and participant availability.

Since such a model of organizational decision making must concern itself with a complicated interplay among problems, solutions, decision makers, and choice opportunities, it is difficult to build a mathematical model. Then, Cohen et al. (1972) translate the situations of decision making into a computer simulation model and examine how decisions are made.

The image of the simulation model is as follows: Choice opportunities are viewed as garbage cans in the model. Various kinds of problems, energies, and solutions are dumped by participants into choice opportunities, as if they threw garbage into cans. When the total energy in a choice opportunity exceeds the requirements to solve the problems there, the choice is made, as if a full garbage can were cleared out.

Figure 1 illustrates the flow chart of the simulation model. The model has five fixed parameters: 1) number of time periods, 20; 2) number of choice opportunities, 10; 3) number of decision makers, 10; 4) number of problems, 20; and 5) the solution coefficients for the 20 time periods, 0.6 for each period. The solution coefficient defines the effective energy devoted by decision makers (discussed later).

The model has eight variables (also see Table 2). This paper especially focuses on "Access structure" and "Decision structure." Access structure is a list of choice opportunities to which the problem has access. This structure has three types: 1) Unsegmented (each problem has access to all choice opportunities), 2) Specialized (each problem has access to only one choice opportunity), and 3) Hierarchical (the number of accessible choice opportunities differs among each problem). In the same manner, decision structure is a list of choice opportunities to which the decision maker has access. This structure has three types: 1) Unsegmented (each decision maker has access to all choice opportunities), 2) Specialized (each decision maker has access to only one choice opportunity), 3) Hierarchical (the number of accessible choice opportunities differs among each decision maker).

The 324 cases are obtained by considering the possible combinations of the six variables except energy requirement (ER) and effective energy (EE). For each case, simulations are conducted obeying the following rule:

1. Choice opportunities and problems enter following ec and ep[2].
2. Decision makers and unresolved problems are attached to choice opportunities not made, following A, D, and allocation assumptions. The assumptions allocate problems and decision makers to the choice opportunity closest to a decision (EE-ER is minimized).
3. ER of each choice opportunity is obtained based on L.
4. EE of each choice opportunity is obtained based on E and the solution coefficient. To be specific, it is the sum of the energies devoted by decision makers to choice opportunity, deflated by the solution coefficient 0.6.
5. If ER-EE is zero or below, the choice opportunity is decided, and the problems are resolved. However, if ER-EE is more than zero, it becomes opposite.

[2] A choice opportunity and two problems enter per time period over the first 10-time periods.

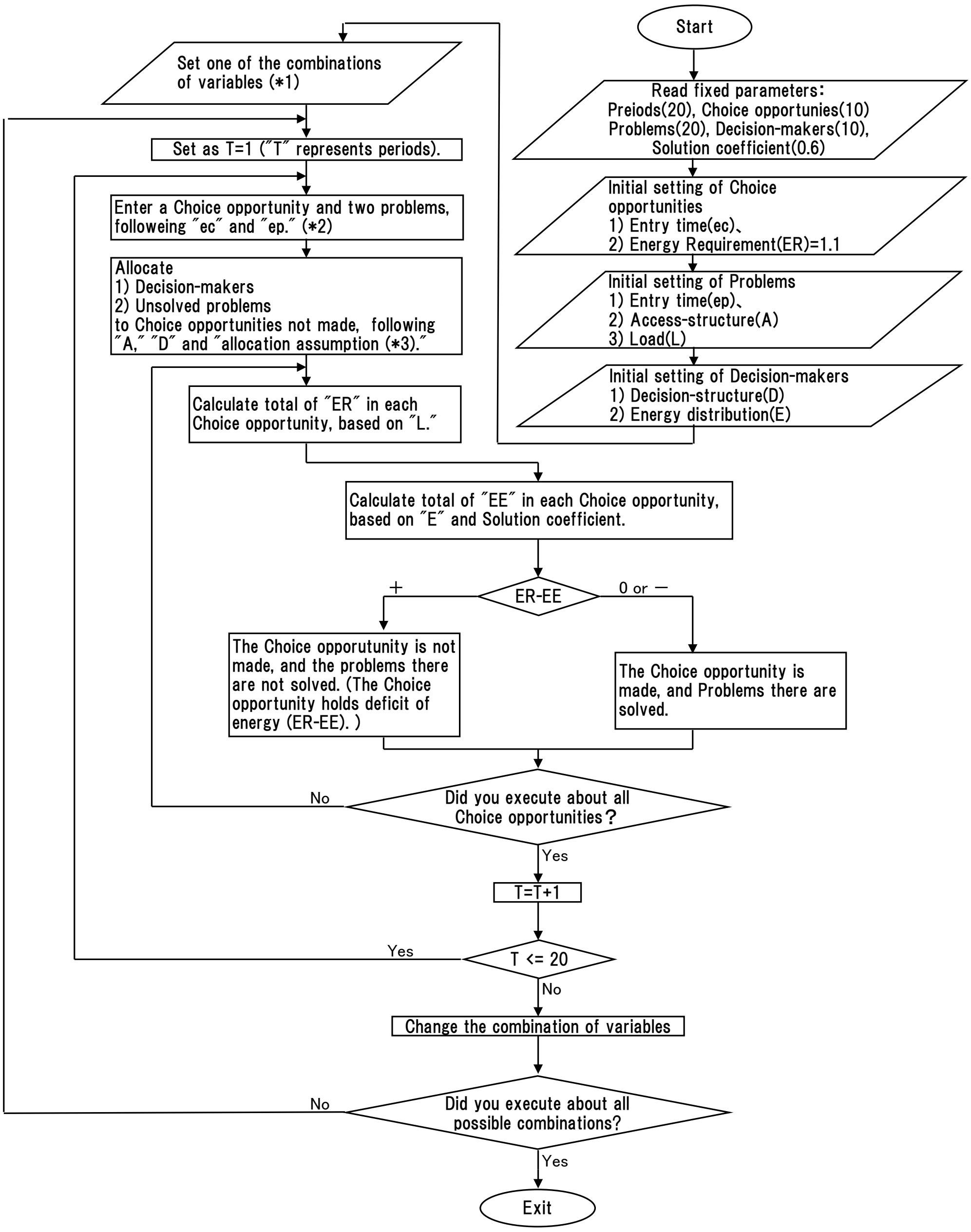


**Figure 1: The flow chart of the simulation model.** The number of all possible combinations is 324 because ec and ep have two types and A, L, D, and E have 3 types respectively (*1). All choice opportunities and problems enter over the first 10 periods (*2). The assumptions allocate problems and decision-makers to the choice opportunity closest to a decision (EE-ER is minimized) (*3). (Enta, 1987, p. 107, revised by the author)

**Table 2: The variables of the simulation model**

| Variable | Definition |
|---|---|
| Energy Requirement (ER) | The energy required to make a choice:<br>The initial value = 1.1 |
| Effective Energy (EE) | The sum of the energies which decision makers have devoted, deflated by the solution coefficient:<br>The initial value = 0.0 |
| Entry time of choice opportunity (ec) | The calendar time at which that choice opportunity is activated.<br>Two types:<br>* One choice opportunity enters per time period over the first 10 time periods. |
| Entry time of problems (ep) | The calendar time at which that problem is activated.<br>Two types:<br>* Two problems enter per time period over the first 10 time periods. |
| Access-structure (A) | A list of choice opportunities to which the problem has access.<br>Three types:<br>1) Unsegmented: each problem has access to all choice opportunities.<br>2) Specialized: each problem has access to only one choice opportunity.<br>3) Hierarchical: the number of choice opportunities to which each problem has access differs. |
| Load (L) | The energy required to solve a problem.<br>Three types: 1) light, 2) moderate, and 3) heavy. |
| Decision structure (D) | A list of choice opportunities to which the decision maker has access.<br>Three types:<br>1) Unsegmented: each decision maker has access to all choice opportunities.<br>2) Specialized: each decision maker has access to only one choice opportunity.<br>3) Hierarchical: the number of choice opportunities to which each decision maker has access differs. |
| Energy Distribution (E) | The distribution deciding how much energy each decision maker has.<br>Three types: 1) equal energy, 2) important people more energy, and 3) important people less energy. |

The above rule induces three types of decisions. If the choice opportunity having problems (ER > 0) is decided, the decision is based on the resolution. The decisions are also made even if the choice opportunity has no problems. Cohen et al. (1972) consider two types of these decisions. The first is “decision by oversight,” which is made before decision makers enter the choice opportunity. The second is “decision by flight,” which is made after all problems in the choice opportunity leave there.

## 3. Generally Accepted View of the Garbage Can Model

### 3.1. Original Authors

From the simulation model, Cohen et al. (1972) draw the implications that decision makers, problems, and solutions move around choice opportunities and their combinations randomly change ("Random Movements") in the garbage can decision process. They state, "A major feature of the garbage can process is the partial uncoupling of problems and choices. … choices are made only when *the shifting combinations* [italics added] of problems, solutions, and decision makers happen to make action possible" (p. 16).

Cohen et al. (1972) also insist that decisions are made depending on timing[3] and do not always solve problems. They state, "Quite commonly this [decision making] is after problems have left a given choice arena or before they have discovered it (decisions by flight or oversight)" (p. 16). This does not mean, however, that decisions are always made by flight and oversight. When interpreting the meaning of "depending on timing" strictly, it is reasonable to consider that decisions are made by random combinations of the three decision styles ("Random Decision Styles"). Cohen et al. (1972) state, "it is clear that the garbage can process does not resolve problems well. But it does enable choices to be made and *problems resolved* [italics added], even when the organization is plagued with goal ambiguity …" (p.16).

The subsequent studies by the original authors insist that this decision process can be observed typically under the unsegmented structures. Cohen, March, and Olsen (1976) state, "In situations in which load is heavy and the structure is unsegmented, intention is lost in context dependent flow of problems, solutions, people, and choice opportunities" (p.37). March and Olsen (1986) state, "In the absence of structural constraints within a garbage can process, solutions are linked to problems, and decision makers to choices, primarily by their simultaneity" (p.17). March and Olsen (1989) state, "in purest garbage can situation we assume that any problem and any decision maker can be attached to any choice" (p.13).

### 3.2. Standard Textbooks

Standard textbooks on organizational theory reflect the implications stated by the original

[3] Cohen et al. (1972) do not use the word "depending on timing." However, Cohen et al. (1976) state, "outcomes are frequently sufficiently dependent on elements of exogenously determined timing …" (p.37).

authors of the garbage can model. These textbooks often use the word “random” and “disorderly” for explaining the garbage can decision process.

Weick (1979) states as follows:

> A crucial variable that is emphasized in this model is timing. It is assumed that there is a continual stream of people, solutions, choices, and problems that flow in an organization. Every now and then some clusters of these elements coincide, and a decision is produced. In other words, problems may attach themselves in first to one choice situation and then to another, and the same holds true for people and solutions. (p.21)

Hatch (1997) states as follows:

> In the garbage can model, problems, solutions, participants, and choice opportunities are independent streams of events that flow into and through organizations, much like a *random* [italics added] selection of waste gets mixed together in a garbage can. Whenever solutions, participants, and choice opportunities connect, a problem may be identified or solved. Because of the *randomness* [italics added] of the process, however, choices may be made without solving a problem, some problems are never solved, and solutions may be proposed where no problem exists. (p.278)

Daft (2004) states as follows:

> With the concept of four streams, the overall pattern of organizational decision making takes on a *random* [italics added] quality. … Organization decisions are *disorderly* [italics added] and not the result of a logical, step-by-step sequence. Events may be so ill-defined and complex that decisions, problems, and solutions act as independent events. When they connect, some problems are solved, but many are not. (p. 467)

### 3.3. Academic Articles and Works

Many academic articles and works regard the garbage can decision process as disorderly. Kingdon (1984) assumes the combinations of the four elements would randomly change: “The solutions and problems that come to the fore might change from one meeting to the next, as given participants attend or fail to attend” (p. 86). Although the studies casting doubt on the garbage can decision process have been published since the late 1980s (e.g., Pinfield, 1986; Levitt & Nass, 1989; Mezias & Scarselletta, 1994), they share the view that the model itself illustrates the disorderly association of the four elements.

Many academic articles and works assume that the unsegmented structures cause this disorderly decision process. For example, Grandori (1984) states as follows:

> This is consistent with the model and research results of Cohen, March, and Olsen (1972) and March and Olsen (1976), in which they consider conditions of extreme lack of knowledge (unclear preferences, technologies, and participants) in which decision processes are characterized by “unsegmented access structures.” In this particular case, the connections among choice opportunities, participants, problems, and solutions - i.e., decisions - are simply a function of timing. (p. 200)

Padgett (1980) tries to accommodate the garbage can model to hierarchical organizations, and this idea itself shows that many studies assume the garbage can decision process can be observed typically under the unsegmented structures.

To sum up, the generally accepted view of the garbage can model is that the unsegmented structures lead to a disorderly decision process (random movements and random decision styles).

## 4. Criticism from Bendor et al. (2001)

Bendor et al. (2001) examine the simulation model of Cohen et al. (1972) and criticize the generally accepted view of the garbage can model. The criticism to the simulation model would be the most crucial though they examine the garbage can studies extensively.

First, Bendor et al. (2001) point out that the unsegmented structures lead not to random movements but to “Single Packed Movement” in the simulation model. Single packed movement means that decision makers and problems move together from choice to choice, and that the combinations of the four elements do not randomly change. Second, they point out that the unsegmented structures lead not to random decision styles but to “Single Decision Style,” which means that all decisions are made by only one decision style. They report that all decisions are made by resolution under light and heavy load, and are made by flight under moderate load. Therefore, Bendor and his colleagues criticize the simulation process as the remarkable order.

Bendor et al. (2001) propose through a deductive process that the simulation model should be discarded for its invalidity. They examine the correspondence between the simulation model and the base theory (“organized anarchies”), and point out that the inappropriate rules of the model produce the paradoxical result. Eventually, they conclude that the generally accepted view is an inappropriate mix of the simulation model and the base theory, and that the simulation model should be apart from the base theory and should be replaced by a new one. This is the recycling plan of the garbage can studies proposed by Bendor et al. (2001).

Olsen, one of the original authors, provides several arguments against this criticism through an inductive thought (Olsen, 2001). He points out that the simulation model of Cohen et al. (1972) is only one of the simulation models having been proposed, and that the significance of the model should not be exaggerated. Besides, he insists that the garbage can model is still effective for studying organizational behavior because a disorderly decision process can be seen in actual organizations.

This paper will examine the results of the original simulation model again. Cohen et al. (1972) is cited 899 times[4] and is more significant than the other garbage can simulation studies[5]. Therefore, the criticism from Bendor et al. (2001) has a great impact. This paper, however, reconsiders it from an inductive viewpoint. First, we should confirm whether a disorderly decision process (random movements and random decision styles) can be observed in the simulation model if Olsen's argument was appropriate. Second, we should confirm whether an orderly decision process (single packed movement and single decision style) can be observed in actual organizations though Bendor et al. (2001) regard the simulation model as no significant to study.

## 5. Retest of the simulation model

As the source code is given in the appendix of Cohen et al. (1972), I could reconstruct the simulation model precisely. To examine whether the simulation model were reconstructed precisely, I used the measures of "Problem activity[6]," "Decision maker activity[7]," and "Decision difficulty[8]." I used these measures because 1) Cohen et al. (1972) describe the computational algorithms of these measures in the source code, and 2) they accurately report the results of these measures. Table 3 shows the results of the reconstructed simulation model. Although some differences from Cohen et al. (1972) can be seen in detail, almost the same result is obtained. Therefore, we can conclude that the simulation model is reconstructed precisely[9].

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[4] The retrieval result from "Web of Science" on February 4, 2007.

[5] There are few studies on the garbage can model using simulation. I can find only Anderson and Fischer (1986), Masuch and LaPotin (1989), and Takahashi (1997). Besides, these papers have been cited only several times.

[6] Problem activity is the total number of time periods. A problem is activated and attached to a choice, summed over all problems.

[7] Decision maker activity is the total number of times. Any decision maker shifts from one choice to another.

[8] Decision difficulty is the total number of time periods during which a choice is activated, summed over all choices.

[9] Normally, the numerical results are the same because the same random numbers are used. The differences of the results might be caused from a rounding error. The figures in the Table 3 are the ones after correcting the rounding error. I reconstructed the simulation model with Fortran90, Microsoft Excel, and a multi-agent simulator KK-MAS and obtained the same results respectively.

**Table 3: The examinations of the reconstructed model's preciseness**

| Measures | Cohen et al. (1972) | Reconstructed model | Corrected model |
|---|---|---|---|
| Mean problem activity | | | |
| Light load | 114.9 | 114.8 | 109.1 |
| Moderate load | 204.3 | 201.3 | 192.5 |
| Heavy load | 211.1 | 210.0 | 225.3 |
| Mean decision maker activity | | | |
| Light load | 60.9 | 61.0 | 62.0 |
| Moderate load | 63.8 | 66.0 | 78.2 |
| Heavy load | 76.6 | 76.9 | 65.7 |
| Mean decision difficulty | | | |
| Light load | 19.5 | 19.5 | 18.3 |
| Moderate load | 32.9 | 34.1 | 42.6 |
| Heavy load | 46.1 | 46.1 | 36.5 |

When examining the source code, I realized a strange setting. The initial value of Energy Requirement (ER) of choice opportunities was set at 1.1 (see Table 2) as if there were problems in the choice opportunity from the start. Then, I corrected the value from 1.1 to 0.0. Table 3 shows the results of this corrected simulation model. Although great differences from Cohen et al. (1972) can be seen at some points, we should consider these results as true ones.

First, under unsegmented access and decision structures, single packed movement and single decision style are observed. Figure 2[10] shows that decision makers gather and solve problems immediately under light load. Figure 3 shows that, under heavy load, decision makers and problems move together from choice to choice, and decisions are made only by flight. These results show single packed movement and single decision style pointed out by Bendor et al. (2001). However, the result that all decisions are made by flight under heavy load is different from Bendor et al. (2001). This is because I corrected the initial value of ER.

[10] Following Bendor et al. (2001), I scaled the figures down by half for simplification: Five choice opportunities, ten problems, five decision makers, and ten periods. The essence of the results does not change even though they were scaled down.

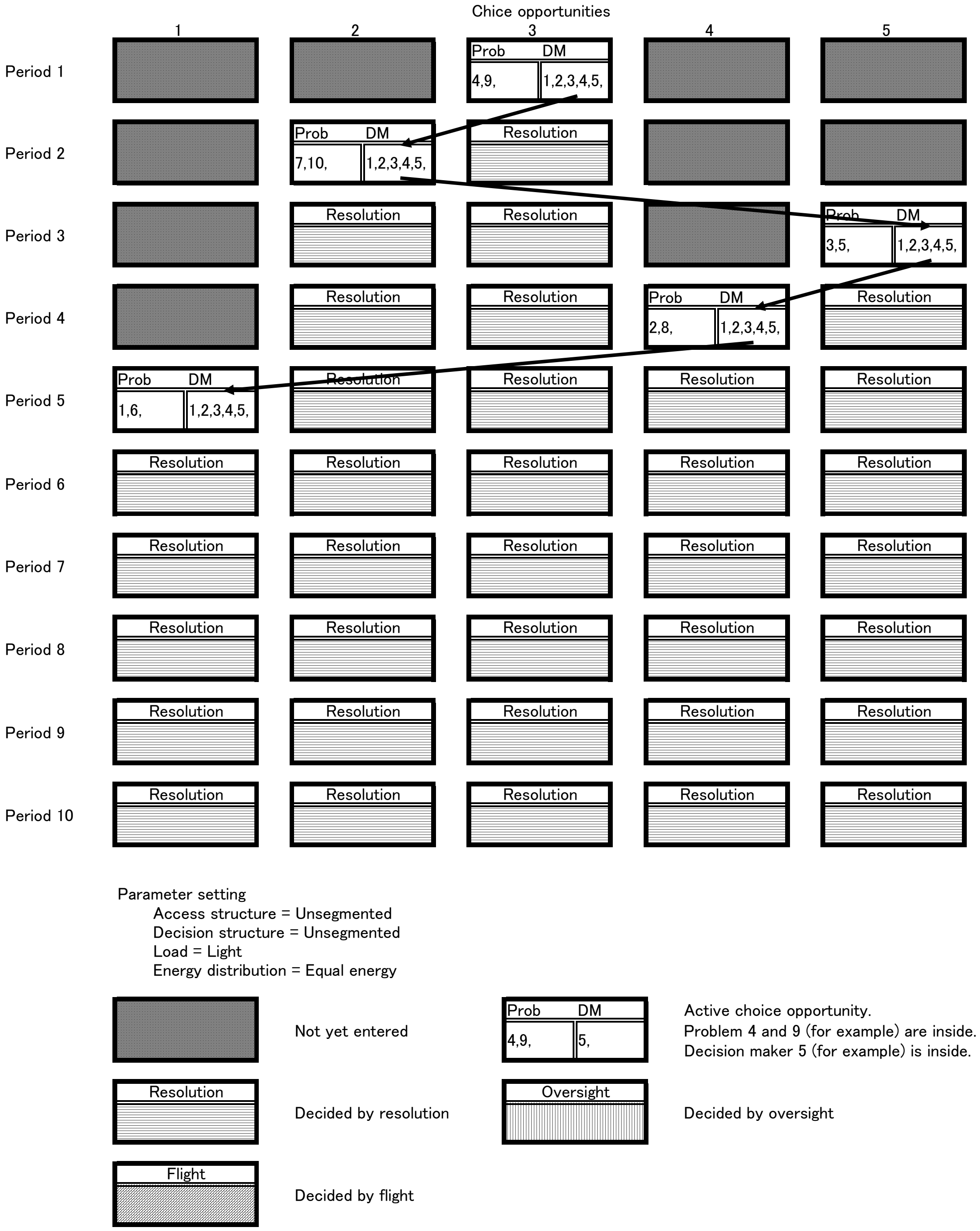



**Figure 2: A simulation process under Unsegmented strcutures / Light load**

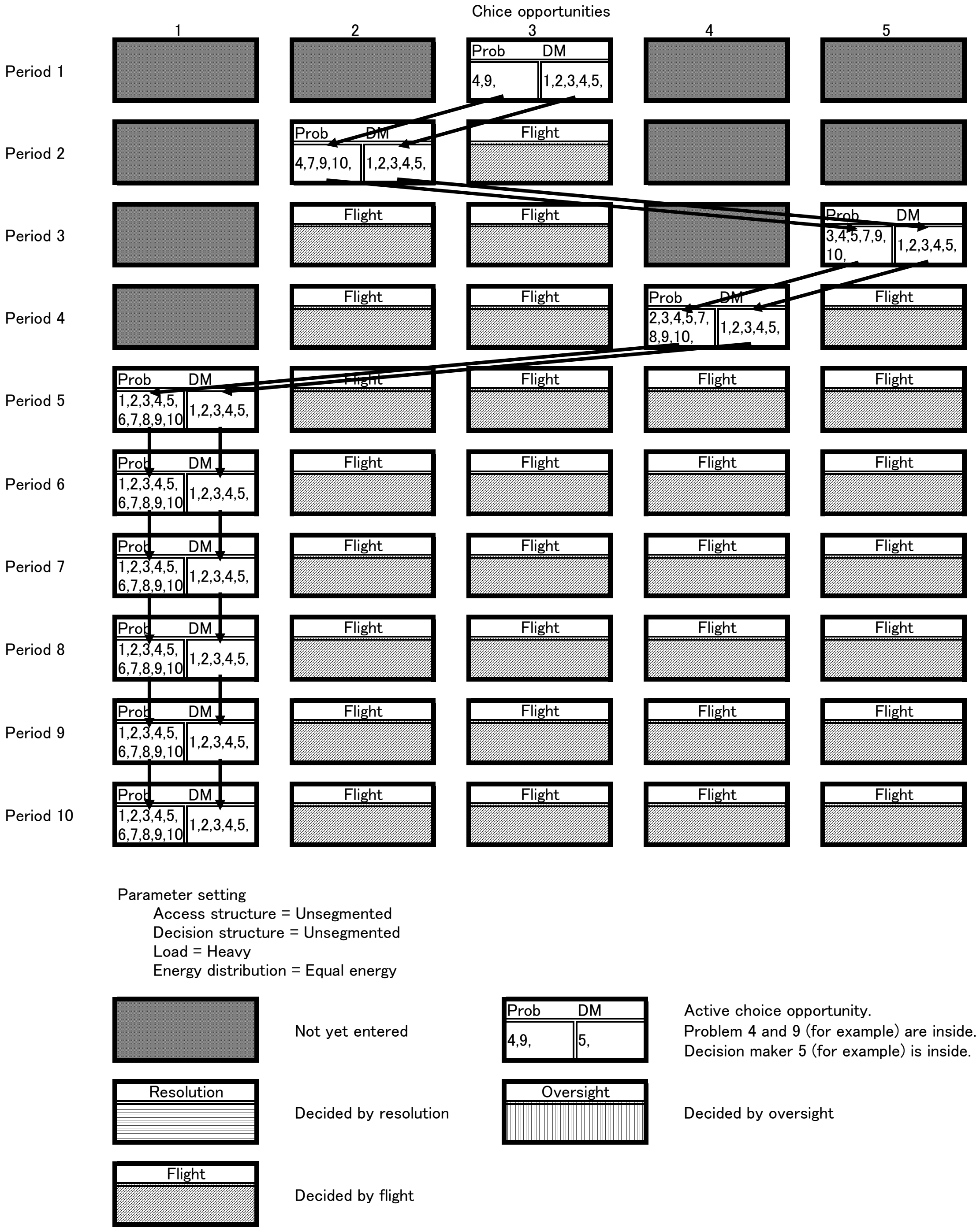



**Figure 3: A simulation process under Unsegmented structures / Heavy load.**

Second, under hierarchical access and decision structures, random movements and random decision styles are observed. Figure 4 shows that the combinations of decision makers and problems are shifting, and that decisions are made sometimes by resolution and sometimes by oversight and flight under moderate load[11]. Table 4 shows the proportion of each decision style under each structure. The proportion of resolution is low under the hierarchical structures though resolution has a majority under the specialized and the unsegmented structures. The number of times of each decision style is almost equal under the hierarchical structures though the proportion of oversight is relatively low.

**Table 4: The proportion of each decision style**

| | Access and Decision structures | | |
|---|---|---|---|
| | Specialized (%) | Hierarchical (%) | Unsegmented (%) |
| Decision styles | | | |
| Resolution | 51.7 | 38.4 | 70.7 |
| | (125) | (131) | (246) |
| Oversight | 48.3 | 20.5 | 5.2 |
| | (117) | (70) | (18) |
| Flight | 0.0 | 41.1 | 24.1 |
| | (0) | (140) | (84) |
| Total | 100.0 | 100.0 | 100.0 |
| | (242) | (341) | (348) |

Note: Figures in parentheses are base number of times for the percentages. The figure in each cell of the table is the sum when Access and Decision structures are constant and the other parameters (ec, ep, L, E) are variable.

Under the hierarchical structures, the choice opportunities which each problem and decision maker can enter are different respectively. Therefore, even if problems or decision makers intend to move together to another choice opportunity, some problems or decision makers cannot move there. As a result, the cluster of problems or decision makers breaks up. As such a process develops, the combinations of problems and decision makers in each choice opportunity change, and decisions are

[11] This result does not depend on load.

made depending on timing. This result is not referred by Bendor et al. (2001).

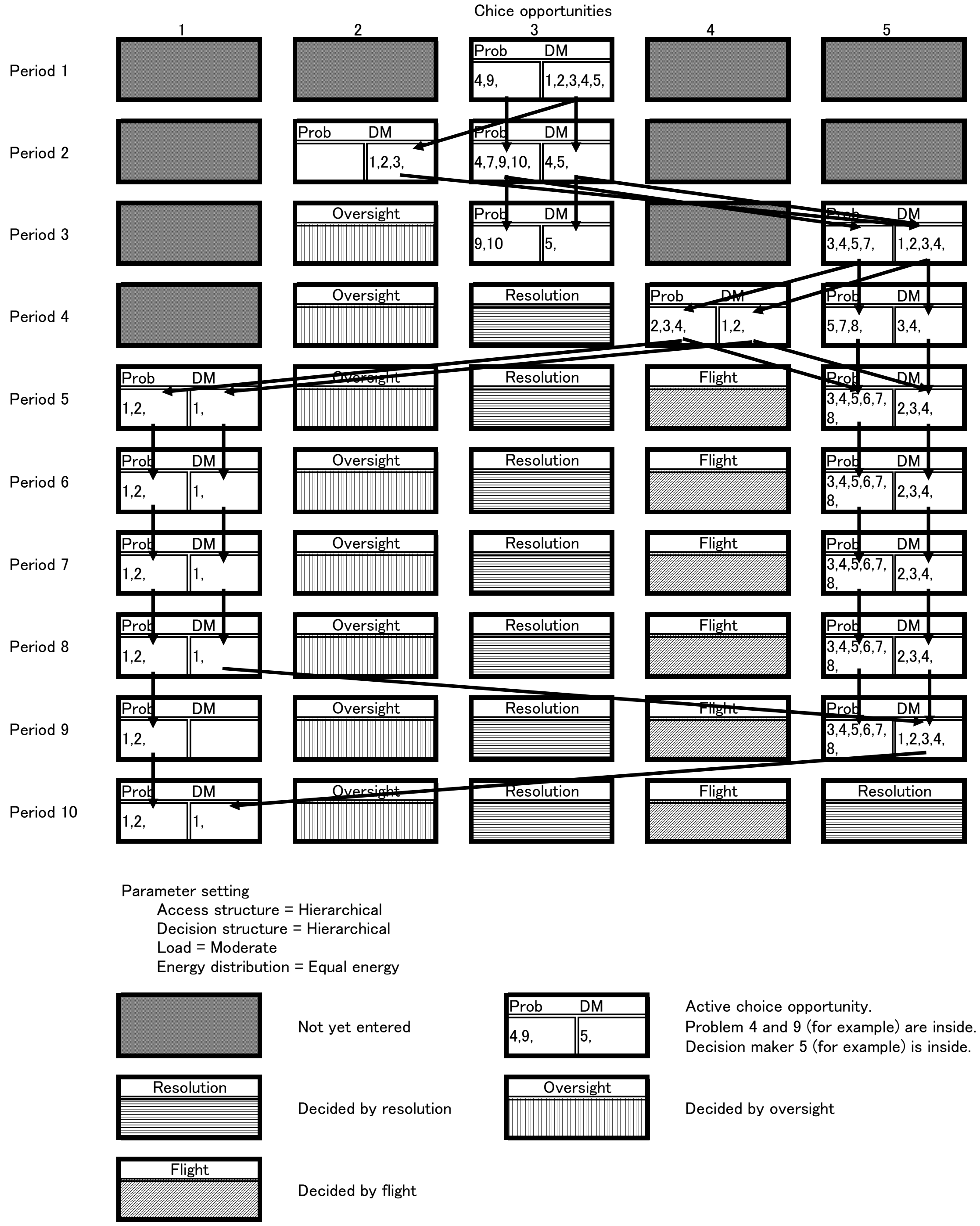



**Figure 4: A simulation process under Hierarchical structures / Moderate load.**

The genuine results of the simulation model are as follows: 1) the unsegmented structures lead to the orderly decision process (single packed movement and single decision style), and 2) the hierarchical structures lead to a disorderly decision process (random movements and random decision styles).

## 6. Hierarchical Structure Case

The original authors examined the decision making of American universities and translated its essence into the garbage can model. In some works, case studies of university decision making are presented (e.g., Cohen & March, 1974; Cohen & March, 1976; March & Romelaer, 1976). I reexamined these case studies and realized that these studies are about a disorderly decision process led by hierarchical structures.

### 6.1. Disorderly Decision Process in Universities

The original authors describe the decision process of universities as disorderly. First, they describe random movements of people (carriers of problems and energies). For example, March and Romelaer (1976) note that actors wandered in and out as the decision process developed, and that a different group was involved at each stage (overlapping to some degree with some previous stages). Second, they describe random decision styles. Although March and Romelaer (1976) note that decisions were made by oversight and flight because of random movements, they also report that the issues addressed by that university (e.g., eliminating the program in Speech) were resolved eventually. Therefore, they regard the decision process as a mixture of the three decision styles rather than as being full of oversight and flight. Finally, they describe this decision process in terms of a bizarre soccer game: “Consider a round, sloped, multi-goal soccer field on which individuals play soccer. Many different people (but not everyone) can join the game (or leave it) at different times. Some people can throw balls into the game or remove them. Individuals while they are in the game try to kick whatever ball comes near them in the direction of goals they like and away from goals they wish to avoid” (p. 276). This metaphor represents the disorderly decision process.

### 6.2. Hierarchical Structures in Universities

When carefully considering the cases reported by the original authors, we realize that the cases are about hierarchical structures. The original authors report that people in administrative positions had to devote their energies to various choice opportunities, and that the professors not in a significant position could engage in the specific choice opportunity related to their own interests. March and Romelaer (1976) report that as administrative actors (deans, chair people, provosts, and the like) were busy, their attention is divided among various concerns and a multitude of decision situations. Administrative actors also changed their positions more rapidly than the issues were resolved. However, there were some people devoting more energy to the choice opportunity than the people filling in administrative positions. Cohen and March (1976) state, “some people consistently spend more time than others. Some problems are always there. There are important structural and normative constraints on the access and decision structures” (p. 175). Therefore, we can categorize these cases as ones under hierarchical structures.

To sum up, the simulation result of the disorderly decision process under hierarchical structures is paradoxical but can be observed in the decision making process of universities reported by the original authors of the garbage can model.

## 7. Unsegmented Structure Case

### 7.1. Outline of the Case

An unsegmented structure case is the nonterritorial office of a Japanese company in the telecommunications industry. The company’s corporate marketing division originally assigned one desk to each employee and used partitions to hinder the line of vision. In 2001, the division moved to a new type of office. The first feature of the new office is open-plan setting (removing high partitions). We can see at a glance all the employees in the new office because small plants and plant pots are used instead of partitions. The second feature is free-address setting (replacing assigned desks by freely available ones). The employees can work anywhere at any time in the new office. Even the department heads and the section chiefs cannot have their own rooms and desks. The employees take their notebook computer, look for an empty place, and start working. At the end of the day, they clear their desks and leave for home. The third feature is the computerized database (enabling to monitor most of the business documents on the intranet). Unless the employees can carry their belongings and gain information for business anywhere, they cannot change their location daily. The executive being in charge of the office relocation thoroughly scanned the document to solve this problem. The employees could reduce their belongings by this thorough computerization. Then, the executive made each employee have an individual homepage and open it on the intranet. The individual homepage contains the owner’s detailed self-introduction, as well as business documents and materials. The self-introduction consists of qualifications, favorite jobs, and records of the projects he or she has carried out. As a result, the employees could acquire computerized documents or information anywhere through each employee's homepage and intranet when necessary. In this manner, the employees can move freely in the office.

This case is based on the interviews, observations of that division's office. I interviewed the executive being in charge of the office relocation (the interview lasted for two hours on June 4, 2004). At this interview, I explained the garbage can model and showed the simulation process as a computer animation[12]. Then we discussed the correspondence between the simulation results and the employees' behaviors in the new office.

### 7.2. Orderly Decision Process in the Nonterritorial Office

The executive said that the employees work near the person with whom they want to consult, and that the members of the same project sit together, though we assume that they sit randomly in the office. I could observe that an employee sat next to his senior to learn how to work, and another sat with the members involved in the same project. In addition, before the relocation, the employees had to reserve the conference room and to wait in order to have a meeting. After the relocation, they have to only look for vacant spaces in the office for meeting. I could hear from an employee that he was able to have a business meeting without reserving the conference room.

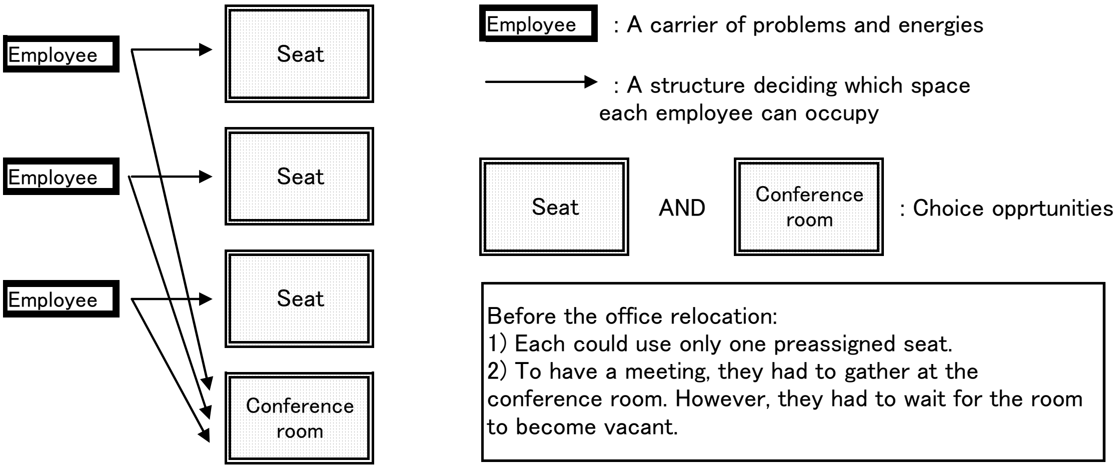
The executive said that the employees became able to solve problems instantly after the office move, because they can sit together and work jointly. Before the office relocation, it was difficult for the employees to solve problems through discussion with their colleagues, because each of them worked separately at its own desk. Besides, after the relocation, even if they require some documents urgently, they do not have to examine and to report later because they can immediately extract information through the intranet. Even if they have something that they could not understand, they can search for and contact those being familiar with that problem through each employee's homepage immediately.

### 7.3. Unsegmented Structures in the Nonterritorial Office

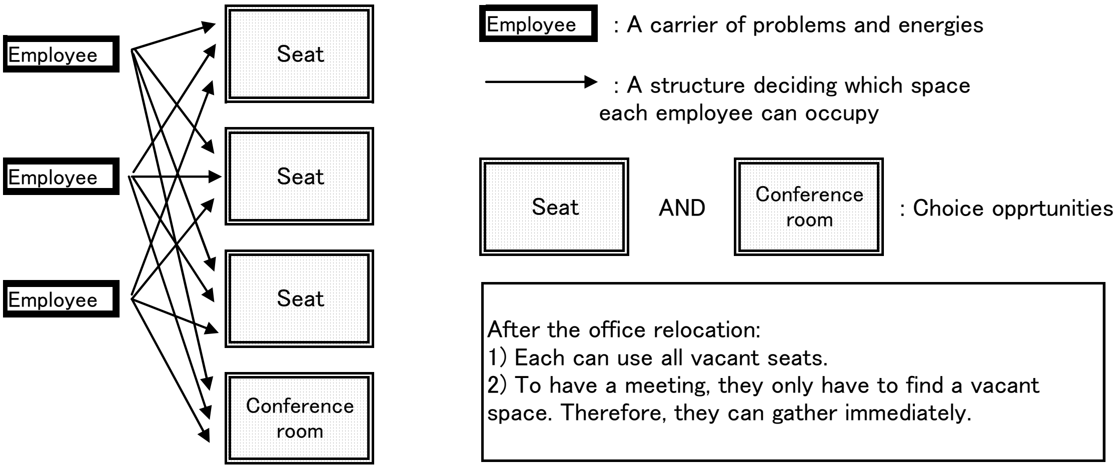
Since the arenas for decision making and for performance of the duties are usually conference rooms and desks (seats), we can consider them as choice opportunities. We can also regard employees as carriers of problems and energies. Therefore, the access and decision structures would

[12] I reconstructed the simulation model with a multi-agent simulator, KK-MAS, which is excellent for drawing the simulation process as a computer animation.

be considered as structures deciding which seats or conference rooms are available to each employee[13] (see Figure 5).




(a) Before the office relocation




(b) After the office relocation

**Figure 5: An interpretation of the office relocation**

[13] Although we have to divide access structure and decision structure normally, we put them together in a structure deciding which space each employee can occupy. The employees not only devote their energies to dealing with their task, but also report problems to the others. Therefore, we can consider the employees as carriers of problems and energies. Weiner (1976) also adopts the same view.

It could be considered that access and decision structure were almost specialized before the office relocation because each seat (choice opportunity except conference rooms) was assigned to each employee (problem or decision maker). In such a case, as the employees could not use other vacant space, the members engaged in related business had to wait for the conference room to become vacant before they could arrange even a casual meeting. That is, they had to wait for the choice opportunity that all members could access to become activated (see Figure 5 (a)).

It could be considered that access and decision structures became unsegmented after the office relocation because all the employees could choose any seats freely. In such a circumstance, if there are vacant seats or space, they can gather there and discuss immediately. They do not need to wait for the specific choice opportunity (the conference room) to become activated (see Figure 5 (b)). As a result, they can solve problems instantly.

In all, the members would be able to gather and to solve problems in the reformed office. This might correspond to the simulation results under the light load and the unsegmented structures.

## 8. Generally Accepted View as an Illusion

As stated so far, the unsegmented structures lead to single packed movement and single decision style, and the hierarchical structures lead to random movements and random decision styles. Therefore, we can assume that there are no grounds for the generally accepted view (random movements and random decision styles caused by the unsegmented structures).

I will point out that the generally accepted view is a mere illusion having been created by the subsequent studies of the original authors. When describing the simulation results, the original authors have accumulated and have omitted keywords or sentences, to make the illusion without running the simulation model.

First, it is a mere illusion that the unsegmented structures lead to random decision styles. Cohen et al. (1972) state as the simulation results, “Resolution of problems as a style for making decisions is not the most common style, except under conditions where flight is severely restricted (for instance, specialized access)” (p. 9). March and Olsen (1986) state, “Resolution of problems is not the most common decision style, except where load is very light or problems and *decision makers* [italics added] are severely restricted in movement” (p.18). March (1994) states, “Resolution of problems is not typical except … when there are severe restrictions on the movements of problems, *solutions*, and *decision makers* [italics added]” (p. 202). First, the original authors discussed only the restriction on problems’ movements as a condition for random decision styles. They have brought, however, the movements of decision makers and solutions into the argument without retesting the simulation model of Cohen et al. (1972).

Second, it is a mere illusion that the unsegmented structures lead to random movements. Cohen et al. (1972) state as the simulation results, “a typical feature of the model is the tendency of decision makers and problems to track each other through choices. … both decision makers and problems tend to *move together from choice to choice* [italics added]” (pp. 9-10). March and Olsen (1986), however, only state, “decision makers and problems tend to track one another through choices” (p.18), as a feature of the unsegmented structures. March (1994) only states, “decision makers, problems, and solutions tend to track each other through the system” (p.202), as well. First, the original authors pointed out that “tracking each other” means “moving together (single packed movement).” However, they have omitted the sentence about single packed movement and have left only the sentence “tracking each other.” As a result, “tracking each other” might have become considered unconsciously as random movements.

## 9. Conclusion

Table 5 summarizes the reconsideration of the dispute stirred up by Bendor et al. (2001). The genuine results of the simulation model are as follows: (1) a disorderly decision process (random movements and random decision styles) emerges from an orderly structure (the hierarchical structures) and (2) an orderly decision process (single packed movement and single decision style) emerges from a disorderly structure (the unsegmented structures). These simulation results are paradoxical but can be observed: (1) Hierarchical structure cases have been reported by the original authors (e.g., Cohen and March 1974; March and Romelaer 1976) and (2) an unsegmented structure case study is the nonterritorial office presented in this paper. The original authors have created the illusion of the generally accepted view of the garbage can model, and Bendor et al. (2001) criticize this illusion. The case studies reported by the original authors and the simulation result presented by Bendor et al. (2001) are in different cells in Table 5. Therefore, they are inconsistent with each other. The former case studies are supported by the simulation result of this paper, and the latter simulation result could be supported by the case study in this paper.

**Table 5: Genuine results of the garbage can studies**

| | | Simulation process (movements / decision styles) | Case study |
|---|---|---|---|
| Structure | Orderly (hierarchical) | Disorderly (random / random)<br>This paper | University decision making<br>Cohen and March (1974)<br>March and Olsen (1976) |
| | Disorderly (unsegmented) | Orderly (single-packed / single)<br>Bendor et al. (2001) | Nonterritorial office<br>This paper |

Considered inductively, it is premature to decide that Cohen et al.'s (1972) simulation model has no significance for study. A recovery plan for the garbage can studies would be to reconsider their theoretical background from the paradoxical simulation results. Why the disorderly decision process is observed under hierarchical structures makes an interesting research question. Another recovery plan would be to draw implications for making sense of complex organizational behavior from the paradoxical simulation results. In this paper, the office relocation of the company was considered as a case of unsegmented structures and a light load. The company, however, might be faced with a heavy load. The employees might always allow difficult problems to pass without solving them. Otherwise, the managers might reduce the load or temporarily create segmented structures. In this way, the simulation model provides useful suggestions to add depth to the considerations of organizational behavior.

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