

# ACTIVITY PATTERN-BASED DESIGN CODESIGN MEDIA FOR SUPPORTING COMMUNITY

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## ABSTRACT:

In Japan, many family become nuclear family, and lonely or elderly couple family increases. In an aging society, local communities are needed to support senior people's life. Activities in business usually have clear objective, however we usually don't have clear objective of activities of local community. Therefore, new design method is needed to make appropriate application software.

To support local communities and senior people, we need to describe their activities to model them and to design tools and systems based on the models. We focused on commonness of activities. We have extracted patterns from activities for reusing in developing tools and systems. We considered that designs based on activity patterns create high quality systems. We call this design process “Activity Pattern-Based Design Method (APBD Method)”.

In this research, we studied mainly former parts of the APBD Method. The former parts are the describing activities and modeling them.

**Keywords: Activity Pattern, Community, Codesign**

## 1. BACKGROUND AND OBJECTIVE

### 1.1. THE DIFFICULTY OF NEW ARTIFACT DESIGN

A new design method is necessary to develop appropriate software for artifacts that do not have the constraint of a body, such as equipment or systems that contain software applications and software.

The reason for this is that in the design of traditional artifacts that have the constraint of a body, regardless of the type of item created, it is easy to determine whether or not the user-requested specifications were met. However, in the case of artifacts such as software, which has very few constraints, the ease of use is formulated by the designer alone. As a result, an artifact that is difficult for the user to use and understand is created, and this is why there exist so many difficult-to-use devices and systems released on the market.

So, what can be done to develop an appropriate device or system? Basically, there is no problem on a technical level. There are several challenges that must be faced however, the first of which is to understand the content of the user’s request and establish a method to convert that request into design specifications. The goal of this research is to understand user activities and develop a process and method that is capable of conducting efficient and high-quality design development that conforms to user activities.

### 1.2. TARGET DOMAIN AND CHALLENGES

The method of understanding user activities and conducting design based on activity analysis has already been researched and implemented. Such work mainly involved cases in which the objective was clear, such as in business or education. However, unlike business activities and the like, local community activities and activities such as communication within the family do not necessarily have clear objectives. Therefore, it is not easy to create appropriate tools to support these activities. In addition, communities such as the local community are at the frontline of support for the elderly. Each resident's day-to-day life occurs in the local community, and families that in the past included multiple generations have become nuclear families. Furthermore, in our present aging society, this is the most important community.

In order to support these types of community activities, a design process or method is needed that can interpret activities which may be difficult to see from the outside or activities which do not have a definite shape, and then transpose these activities to a design exercise, and finally end with the output of a product or system. We focused on the commonness of people's activities and extracted activity patterns that can be shared and accumulated in development. Our goal is to use these patterns to create a design process that can perform efficient and high-quality development. We call this design process the Activity Pattern-Based Design Method (APBD Method).

## 2. THE TRADITIONAL DESIGN METHOD

### 2.1. CHALLENGES FOR THE NEW ARTIFACT DESIGN METHOD

In order to design traditional artifacts such as chairs or televisions, the user needs would be understood via a market survey or user interview. The needs would then be converted into specifications, and finally the design process would begin. Because there was not a large physical difference between the engineer, designer, and user, it was possible to assume the user's usage situation, and this was sufficient as long as the interaction between the artifact and the user was not complex. However, in the case of computers or devices and systems with internal computers, there is a significant difference in the knowledge shared by the engineer, designer and user. It is therefore necessary to design in accordance with the user's knowledge and experience. However, there is as yet no method as a design technique that adequately seeks to understand user knowledge and experience.

In recent years a method to express user and device or system interaction known as the scenario method has been receiving attention. It establishes a persona that reflects the knowledge and experience of the main user. By describing the behavior of that persona, the required specifications of the device or system can be defined (Cooper 1999). This method does not, however, resolve all of the problems. Those problems of how to depict the persona and how to handle activities with unclear objectives remain. Also, in order to guarantee the quality of design within a limited development period, it is difficult to consider each individual activity every time. A design process is needed that can allow the experience gained from each individual development to be accumulated.

## 2.2. DESIGN METHOD USING PATTERNS

There are many commonalities in human activity. Cognitive science has recognized concepts such as mental models and there exist scripts that recognize that these common parts (Johnson-Laird 1983).

In the design field, and especially in the fields of environment and architecture, patterns have been researched, and actual design examples exist (Lynch 1960; Alexander 1977; Alexander 1979). We share the opinion that the patterns which are developed by organizing the impressions that people get from objects designed by people and users can be used in new design situations.

Also, Unified Modeling Language (UML) is widely used in software development to guarantee the quality of designs created within a limited development period. In UML, Use Cases are effective in the investigation stage of required specifications, the stage in which what should be designed is considered (Cockburn 2000). However, Use Cases are too partial and rigorous to be applied to user activities.

Contextual Design, developed by Beyer and Holtzblatt (1998), was created in practice and serves as a reference for the five views that describe the steps and activities from research and modeling to specifications and design. However, the implementation of Contextual Design is centered on jobs or education with clear objectives, so whether or not it can be applied to activities with unclear objectives such as local community communication needs to be confirmed.

### 3. PROPOSAL FOR A NEW DESIGN METHOD, THE APBD METHOD

The goal of this research is to create a design method that can be applied to the development of devices and systems that will support activities in which the objectives are unclear, such as local community or family communication activities.

This time, development was centered on the first half of the development process, “from activity description to activity modeling”. In addition, the website design development was carried out following the derived model.

#### 3.1. THE AIM OF APBD METHOD

We have suggested a design process, the Activity Pattern-Based Design Method (APBD Method), which creates support systems suitable for activities with unclear objectives, such as community communication.

The APBD Method has the following aims and characteristics.

- a) In order to guarantee the quality of design within a limited development period, it extracts content that the user does repeatedly, including content from different activities. The developed activity patterns are then easier to use in the design development.
- b) In order to allow newly created artifacts to be naturally introduced into user lives, the method focuses broadly on the activities of the region and users, and extracts and describes human relationships, the process of activities, and cultural values.
- c) Though not required, for a more realistic understanding of the activity situation, the method known as Codesign, which involves developing the artifact while participating in user activities, can be implemented. Codesign is a development technique in which the developer participates in the activities and the users participate in the development in order to conduct the research, development, and verification (Morozumi 2005).

#### 3.2. THE APBD DESIGN PROCESS

The APBD design process has 4 steps (Figure 1).

- 1) As Is Realities: Describe the current state. Understand the issues.
- 2) As Is Models: Modeling the activities. Understanding the similarities of the activities. It is especially important to identify the commonalities in the activities when changing from As is Realities to As is Models during modeling, then Pattern-based design will be possible.
- 3) To Be Models: Depict the ideal state. Perform an appropriate segmentation of the As is Models, and create To Be Models built from a combination of design patterns (creating specifications). The decision of how to solve the current issues will be determined by considering the external factors at that point.
- 4) To Be Realities: Make the specifications realistic. Give substance to the specifications by considering the technical and monetary aspects.

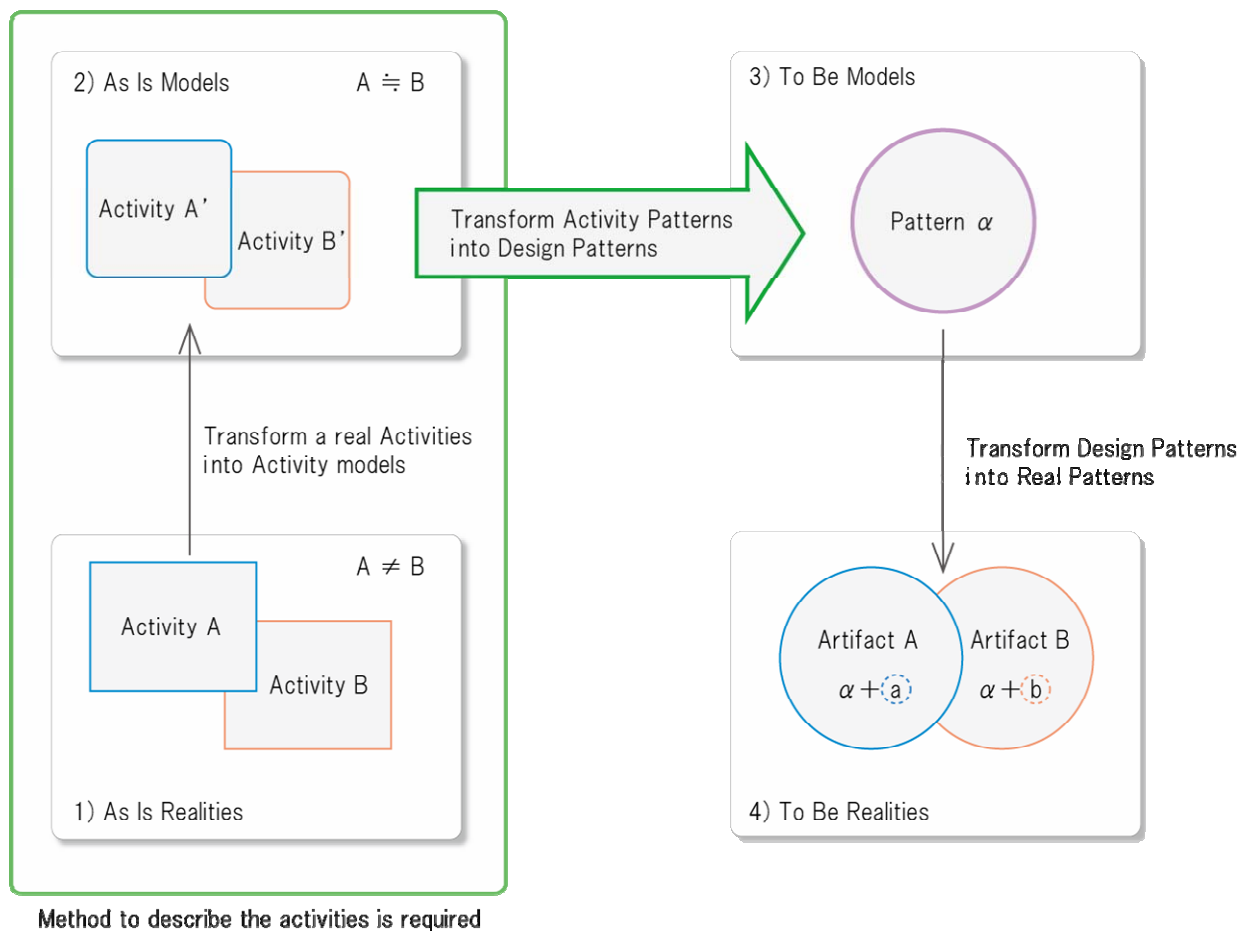


Figure 1: Activity Pattern-Based Design Method Process

### 3.3. DEFINITION OF ACTIVITY PATTERNS

The “activity patterns” in this research are defined by any activity or action that fulfils any one of the following three conditions.

- An action that the same individual consistently performs within the same activity  
e.g. Create and file a document to be issued
- A similar action that the same individual performs within different activities  
e.g. The range of publication differs depending on the information content
- Actions that different people consistently perform within similar activities  
e.g. Receiving approval for a document to be issued to the person in charge

### 3.4. ACTIVITY LEVELS

In order to identify the commonalities in a complicated activity and develop patterns, we divide the activity objectives into four levels (Figure 2).

The four levels are described as follows.

#### 1) The superordinate position level:

A high level objective that encompasses all of the activities, an activity that has multiple subordinate activities for multiple subordinate objectives.

e.g. Flower arranging club (companion activities), regular meetings, emergency drills.

#### 2) The subordinate position level: Activities that are one level below the superordinate position level. An activity with a clear objective (subordinate objective) and that consists of multiple tasks.

e.g. Information sharing, information transmission, determining participants.

3) The action level, the element of activity: Has an independent objective, and multiple methods exist to execute that objective. This level has independent objectives at the unit that comprises the subordinate position level.

e.g. Information creation, approval, distribution of information.

4) Task: Work to produce a concrete result.

e.g. Think of documents, type in, output.

The “operation” and “action” levels exist beneath the previously mentioned levels.

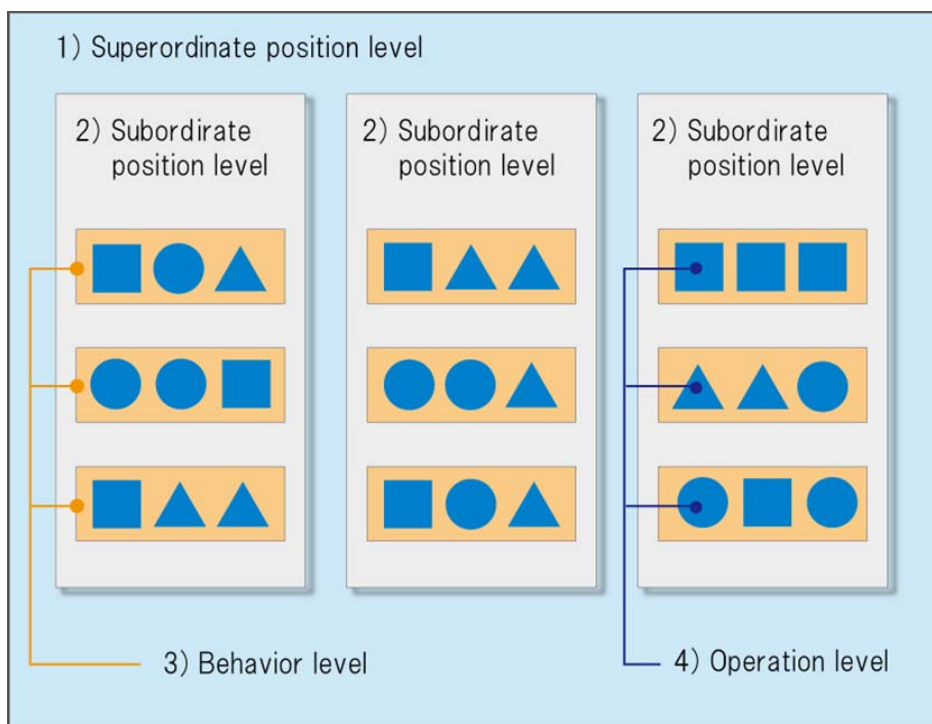


Figure 2: Levels of Activities

### 3.5. DESCRIPTION METHOD

The method for describing activities and the process for modeling activities is based on “Contextual Design”. The notation system has been improved in order to make the community activities easier to comprehend.



Activities are described by the five views below. This is explained by the following example of activities related to the opening of a personal computer training school.

- The Relation Model: Displays the relationship between people and objects, and the emotions brought about in those relationships (Figure 3). This is a model similar to “The Flow Model” in Contextual Design. Objects are noted with a shadowed box. Information is noted as a box with no shadow. The relationship between each element is noted with arrows and solid lines.

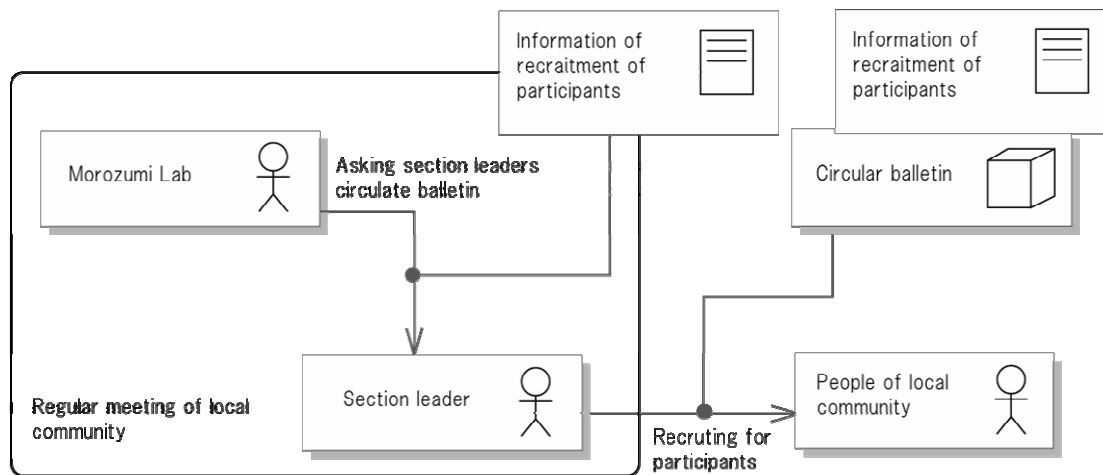


Figure 3: The Relation Model (Recruitment of PC class participants)

- The Sequence Model: Displays the sequence of the activities and actions that the user performs. Clearly notes the objective (Figure 4). The figure below shows the process from recruitment to the final decision of personal computer training school participants. Tasks that occur in parallel are noted side-by-side.

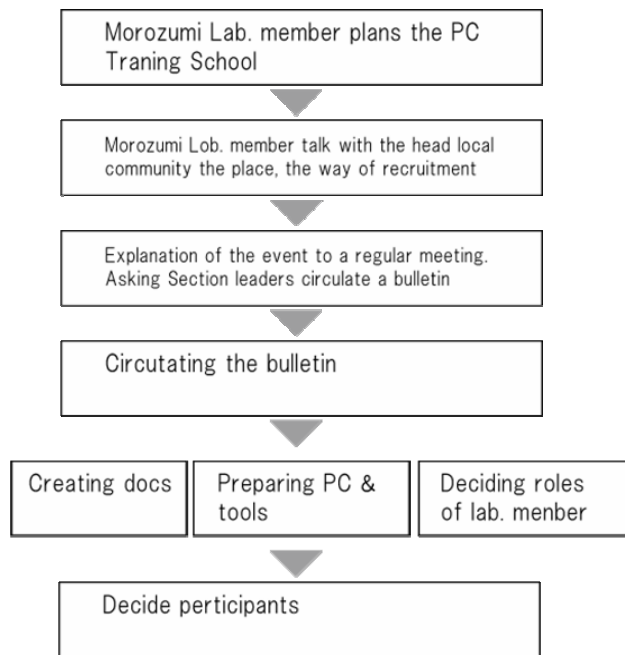


Figure 4: The Sequence Model

· The Cultural Model: Displays the values and emotions of the people involved in the environment in which the activity is taking place (Figure 5). Even if an independent diagram is drawn, it is also acceptable to document it accompanied by the Relation Model or Sequence Model as shown in the figure below.

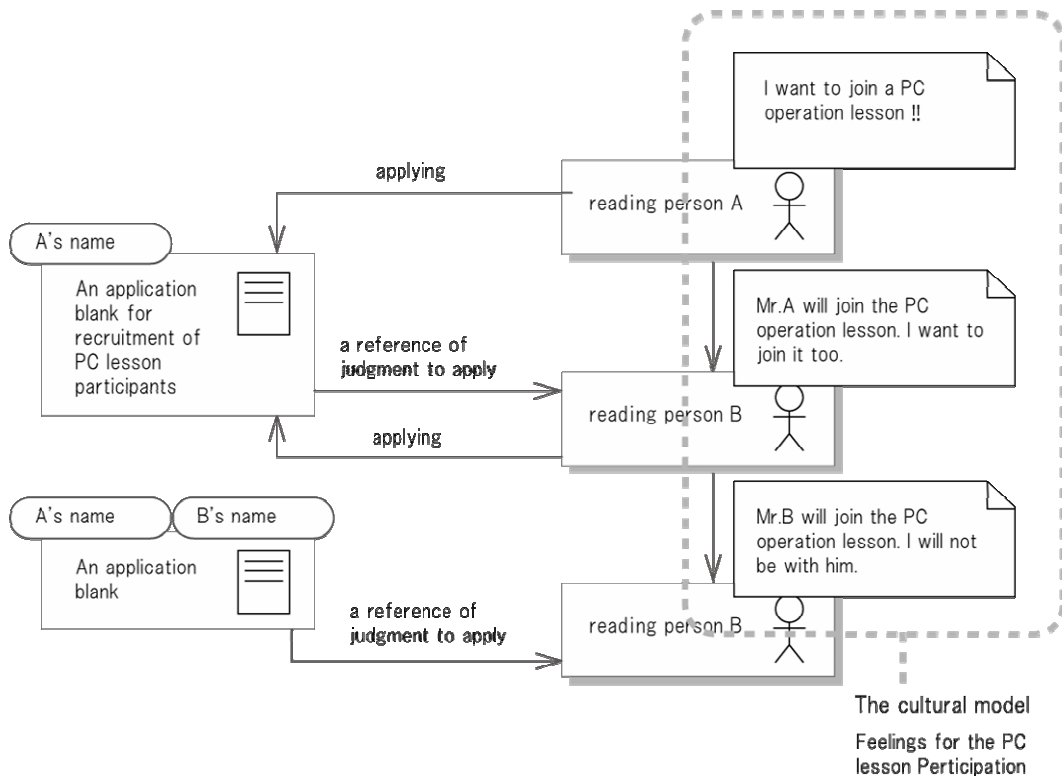


Figure 5: The Cultural Model (portion attached to persons shown on the right side)

- The Physical Model: A diagram displaying the location in which the activities are performed. This figure shows how the physical environment affects the activities (Figure 6). The figure below shows the layout of the personal computer training classroom.

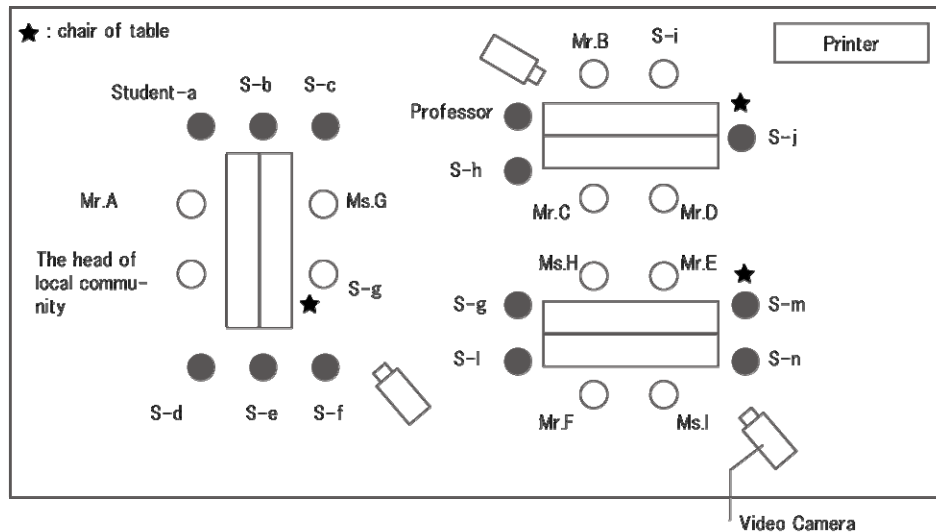


Figure 6: The Physical Model

- The Artifact Model: All the artifacts that the user will create or use in order to perform the activities (Figure 7). The figure below is an example of the recruiting list for the personal computer training school participants.

参加を希望する方は名前・住所・電話番号を記入し、希望する日を選択してください。

名前 (フリガナ)	電話番号	住所	参加希望日
		〒	<input type="checkbox"/> 7月25, 26日 (月, 火) <input type="checkbox"/> 7月29, 30日 (金, 土) <input type="checkbox"/> どちらでも良い
		〒	<input type="checkbox"/> 7月25, 26日 (月, 火) <input type="checkbox"/> 7月29, 30日 (金, 土) <input type="checkbox"/> どちらでも良い
		〒	<input type="checkbox"/> 7月25, 26日 (月, 火) <input type="checkbox"/> 7月29, 30日 (金, 土) <input type="checkbox"/> どちらでも良い
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		〒	<input type="checkbox"/> 7月25, 26日 (月, 火) <input type="checkbox"/> 7月29, 30日 (金, 土) <input type="checkbox"/> どちらでも良い

参加者募集用紙

Figure 7: The Artifact Model

### 3.6. ACTIVITY DESCRIPTION PROCESS

The standard process for describing and modeling activities is now described.

<As is Realities Description>

#### 1) Activity Research

→ Participate in activity (in the case of Codesign), research, gather material.

#### 2) Describing Activity

→ Participate in activity, research, describe the materials that were gathered with the sequence model from beginning to end.

#### 3) Sequence Model Arrangement

→ Check that the blocks comprising the Sequence Model are each described as actions with their own independent objective.

- When there are multiple objectives, break them down into “action” levels having their own independent objective.
- When described at the task level, which is more simple than an action, decide whether the task should be included in the previous or following action. Then incorporate it into that action as a task.

#### 4) Activity Level Division

→ Multiple actions that have the same objective should be gathered as a subordinate position level. Using that subordinate position level as a standard, again group it as an “superordinate position level”, as something which comprises the subordinate position level, then divide the activity into levels like an action.

#### 5) Describe Activity Details

→ In the subordinate position level, or within an action, focus on the portions that could possibly be developed into a pattern. Then create the related Relation Model, Cultural Model, Physical Model, and Artifact Model taking care not to omit any activities.

<Describing As is Models>

##### 1) Modeling Activities

→ Focus on the subordinate position level and action level, model it.

##### 2) Extracting Common Activities

→ Extract common activity patterns by comparing several modeled activities from the community or the family.

## 4. PRACTICING THE APBD METHOD

A local community website was developed using the APBD and Codesign methods. Also, the potential application of the APBD Method was verified by analyzing individual and family communications.

#### 4.1. TARGET COMMUNITY

We selected a local community (the smallest administrative service unit) in the suburbs of Sendai, the central city of the Tohoku district in Japan as the target for our support activities. This local community is called Takimichi. We have been designing tools and systems at Morozumi Laboratory to support community activities since 2004 with the “Takimichi Neighborhood Association” as a Codesign partner.

The Takimichi Neighborhood Association has a population of 1,498 (as of 2003), approximately 650 households, and 25.3% of the population is elderly, which is a much more advanced aging society than Sendai’s average of 14.9%.

Under the neighborhood association chairperson’s leadership, various independent initiatives are being proactively undertaken by the Takimichi Neighborhood Association to regenerate the region including, the “Takimichi Oyaji Club” targeting elderly men and the “Wan-Wan Patrol” for local crime prevention. At Morozumi Laboratory, PC training schools are held, as well as how-to courses on computer use. At the same time information is being collected regarding PC and network usage requests and operation knowledge. In 2004 a website to support the local activities was launched, called the “Takimichi Fresh and Alive Plaza”. Morozumi Laboratory currently develops and administers this website. Also, from 2006, a TV with a networked PC (known as Home Server) was set up in the homes of three Takamichi Neighborhood Association member families, their usage of which is continuously being researched.

#### 4.2. ANALYZING AND DESCRIBING ACTIVITIES

An example from local community information sharing activities, and also individual and family information sharing activities will be used to explain how activity patterns are analyzed, and what kind of design development is done when using the APBD Method.

#### 4.2.1. INFORMATION SHARING ACTIVITIES IN THE LOCAL COMMUNITY

Currently public information shared by the neighborhood association is distributed via a circulated bulletin. We analyzed these information-sharing activities. As a result, currently 11 distinctive elements of activity have been extracted. Here we will explain two of those elements.

##### a) Method for creating and circulating bulletin information

The bulletins circulated in the neighborhood association include information such as information the government has made public, information that has been created as the committee chairperson and the board members feel necessary, and information contributed by the neighborhood association members and concerned parties. The source of information distribution varies, but the Neighborhood Association Chairman always verifies the information before it is distributed to the townspeople. By doing this, inappropriate material can be removed before being distributed. Therefore, the information created by the townspeople flows in the way depicted in Figure 8 (example of a disaster prevention notice). Also, when organizing the situation of concerned parties and information, it can be displayed as the Relation Model shown in Figure 9.

Research has shown that the task of creating and circulating information via the bulletin had a high degree of commonality. The same activities could be seen whether the information content was related to the opening of the personal computer training school or an accident and the response. As a result, the figure created as the As Is Model was the Relation Model (Figure 10). One characteristic is that the documents circulated among the neighborhood association must have the Neighborhood Association Chairperson's approval or they will not be circulated. The information status also changes depending on whether or not it has been approved.

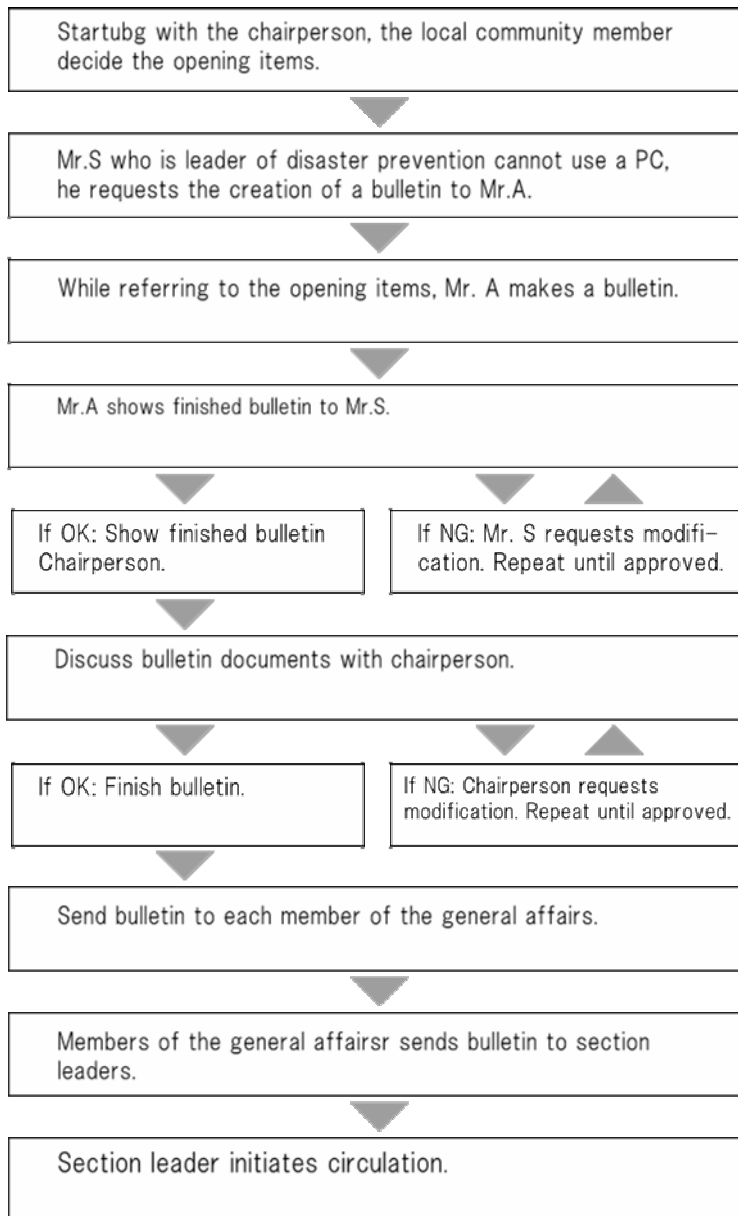


Figure 8: Flow of Creation and Circulation of Bulletin Documents (the Sequence Model)



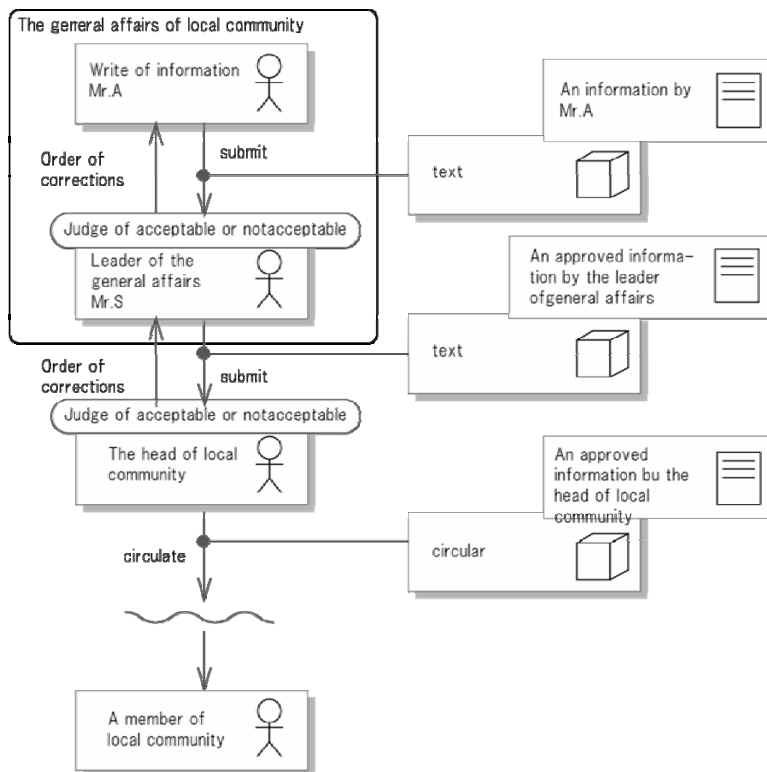


Figure 9: Information Creation and Situation of People and Information Related to Circulation (the Relation Model)

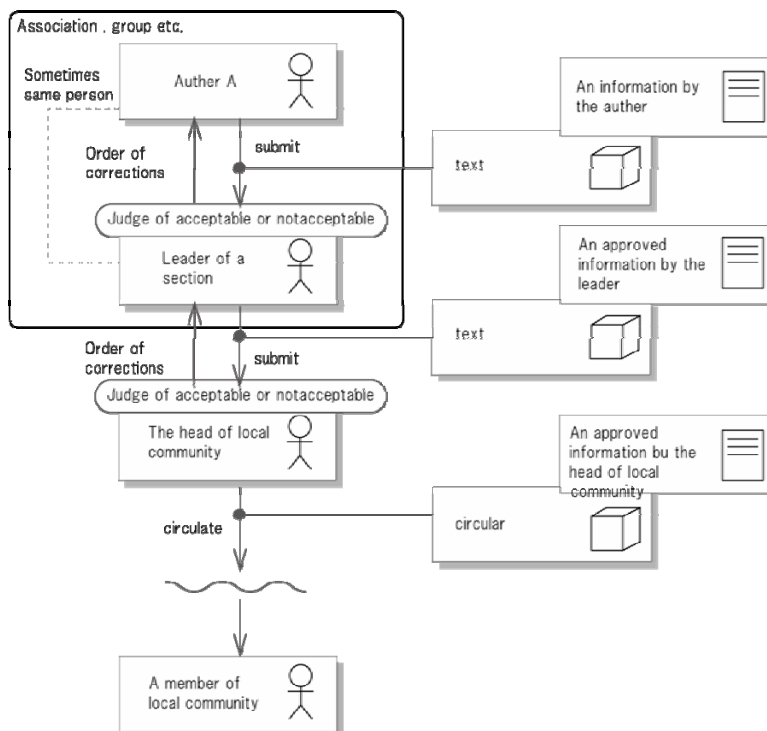


Figure 10: Information Creation and the Circulation Model (the As Is Model)

b) Method for controlling information scope of disclosure

The bulletin is physically distributed only within the town. Thus there are problems in that it takes time to circulate, and once circulation has begun it is difficult to verify the information. However, on the other hand, it has the benefit that when doing recruiting activities and the like, even if private contact information is written down, the number of people who can view the private information is limited, thus reducing any concern in that respect.

In changing this information sharing method from a circulated bulletin to a website, the merits and demerits will be switched. A new challenge, the demerit of being unable to list contact information because it can not be certain who is able to view the website is introduced. Regarding this point, the Relation Model and Cultural Model are described in Figures 11 and 12.

Based on these, the To Be Model concerning information publication is shown in Figure 13.

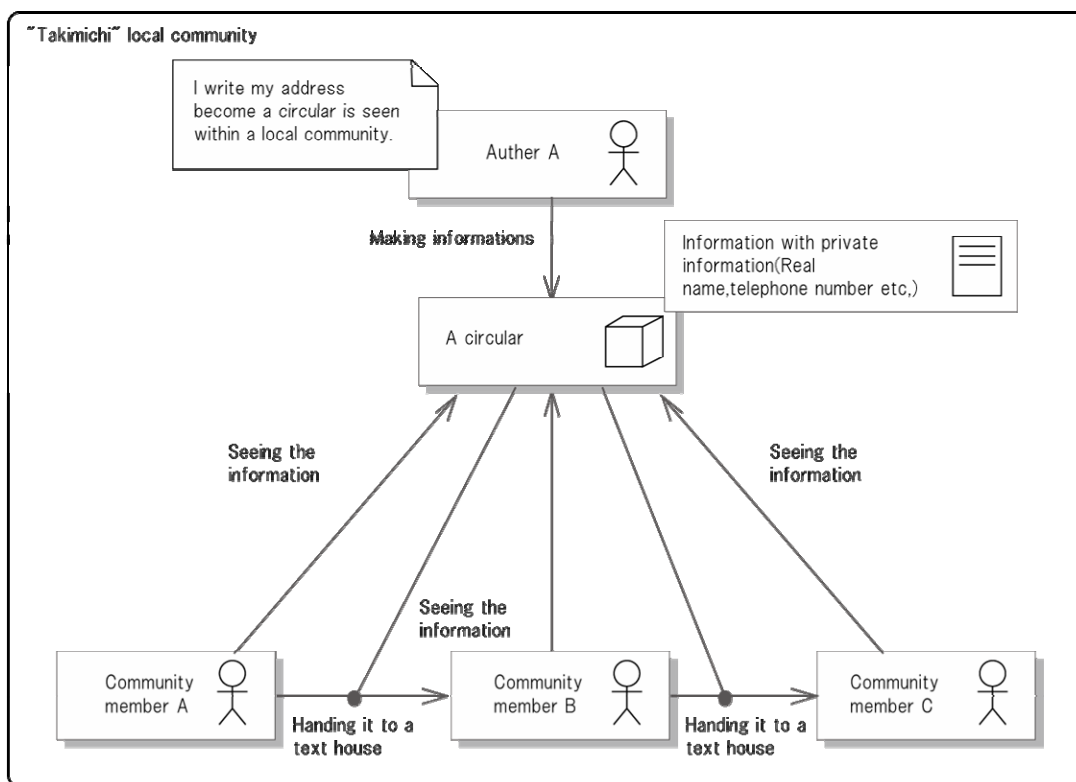


Figure 11: The Relation Model and Cultural Model for Circulated Bulletin Reading

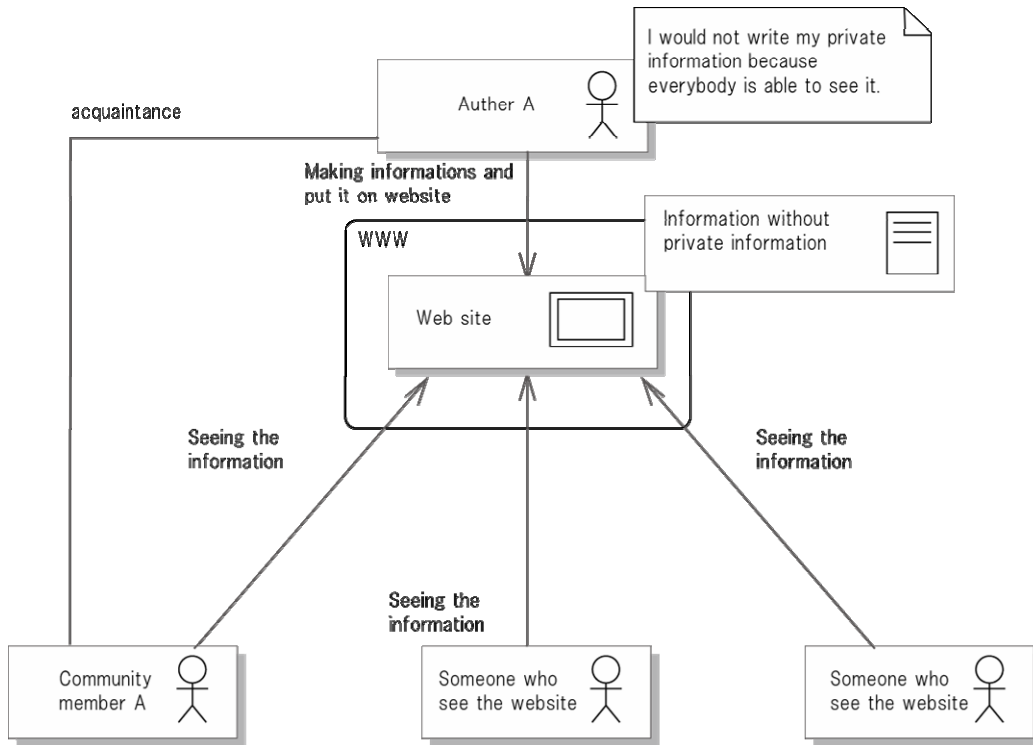


Figure 12: The Relation Model and Cultural Model for Website Reading

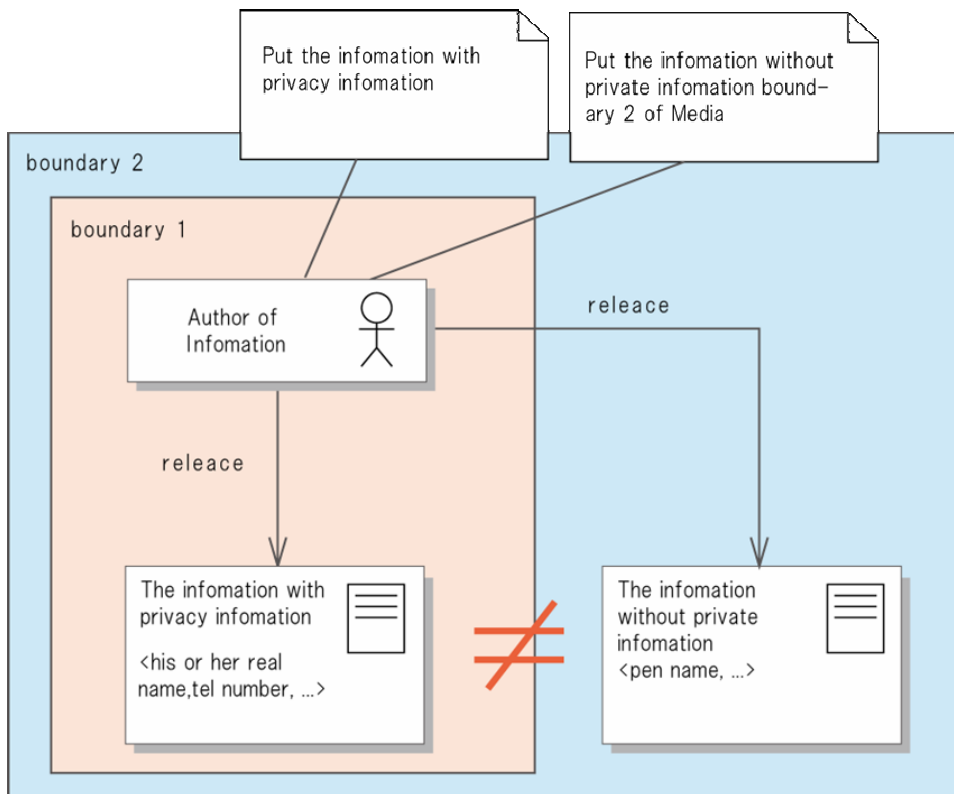


Figure 13 The To Be Model for Information Release Range and Published Information

## 4.2.2. INDIVIDUAL AND FAMILY INFORMATION SHARING ACTIVITIES

As a result of the research, 15 activity elements were extracted for individual and family information sharing activities. Of those, two similar elements will be explained here.

The first is the activity of talking to an acquaintance using information on the website about yourself as a medium (Figure 14). The other is the activity of talking to family using information on the Home Server as a medium (Figure 15). As shown in both the example activities in Figures 14 and 15, when communicating with an acquaintance or family, participants try to facilitate smooth communication by using images and the like regarding a topic that they know. The Home Server development is still in the activity analysis stage, but it is expected that by developing patterns from similar activities as shown here, we will be able to create design patterns for the Home Server development as well.

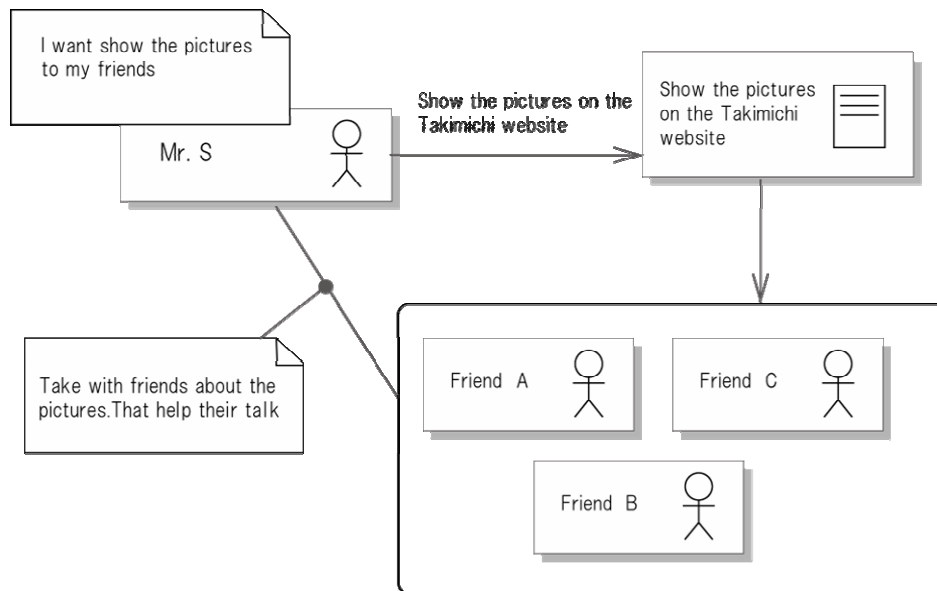


Figure 14: The Relation Model, Cultural Model (Case Mr. S' conversation with his friend)

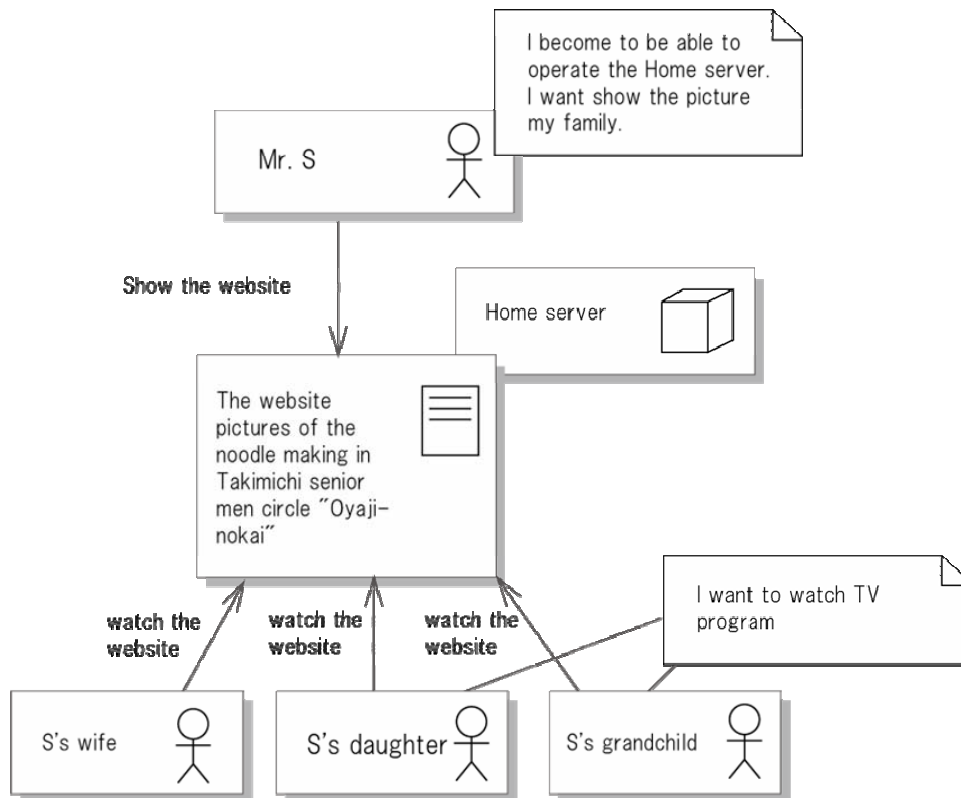


Figure 15: The Relation Model, Cultural Model (Case Mr. S' conversation with his family)

#### 4.3. ACTIVITY PATTERN BASED ON DEVELOPMENT OF DESIGN

We built a website which reflects the activity patterns extracted from the analysis results (Figure 16). The method of editing and approving information on the website reflects the editing and approval method that is currently in use and is described in 4.2.1.a) (Figure 17). Also, the information scope of disclosure discussed in 4.2.1.b) includes two types of disclosure scopes available for selection. One type of information is viewable only by members of the neighborhood association, and the other type of information is viewable by anyone. Also, the design is such that the information viewer will know that these two different scopes of disclosure exist (Figure 18).



Figure 16: Top Page of Takimichi Community Site named “Takimichi Fresh and Alive Plaza”

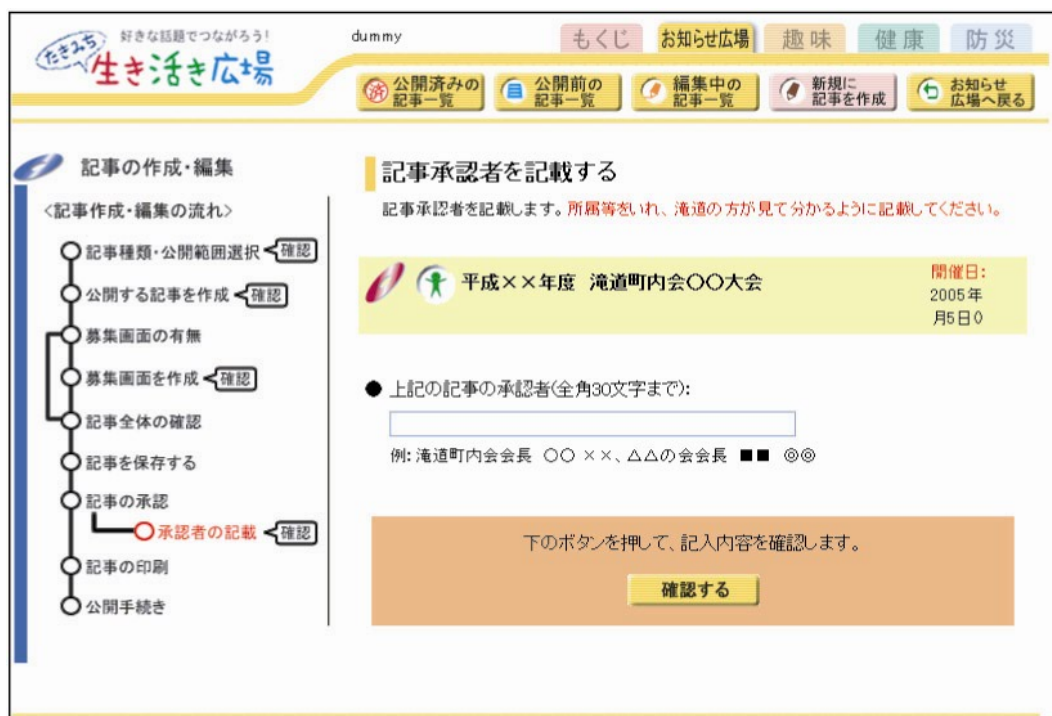


Figure 17: Screen Shot During Editing Process (Old Version):  
Guidance Showing the Flow of Create and Edit, and Approver Name Input Field.



Figure 18: Screen Explaining that an Access CD is Required to View Restricted Information

## 5. DISCUSSION

### 5.1. APBD METHOD EFFECTIVENESS VERIFICATION

We allowed the local members in charge of information transmission to actually use the website for community support that was developed by the APBD Method and then conducted verification experiments. As a result, because the website activity flow is similar to the currently existing flow, the website was naturally accepted. From this, we find that the APBD Method is an effective method for developing a system that is easily accepted by the user.

### 5.2. ACTIVITY LEVELS AND COMMONALITIES

Here we will discuss activity levels and commonalities by using the concrete examples of the “PC Training School” hosted by Morozumi Laboratory and the Takimichi Neighborhood Association’s “Oyaji Club Cooking School for Men” (Figure 19).

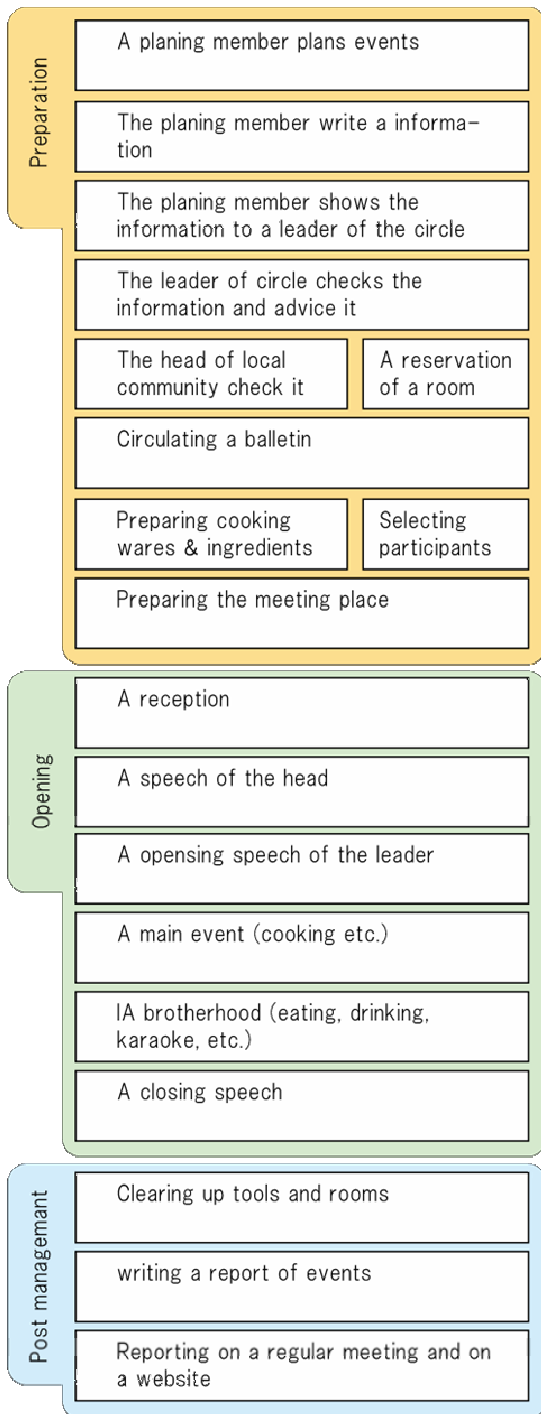
The “PC Training School” and the “Oyaji Club” are both different activities on the “superordinate position level” level. However, the three subordinate position level items that comprise the “superordinate position level” level, namely “preparation”, “opening”, and “post-management”, have commonalities. Moreover, each activity that makes up the subordinate position level items consists of almost the same configuration.

There are many people who interact at the “superordinate position level” level, and because they have various objectives, and the main objectives also exist at the “superordinate position level” level. However, because at the subordinate objective level and action level the activity objectives become clear to some extent, it seems that some commonality exists.

Considering these other analysis examples together as well, we discovered that many Common Activity Patterns exist at the “subordinate objective level”, and the “action level”.



**The sequence model of a senior men club "Oyaji-no-kai"**



**The sequence Model of a PC Traning School**

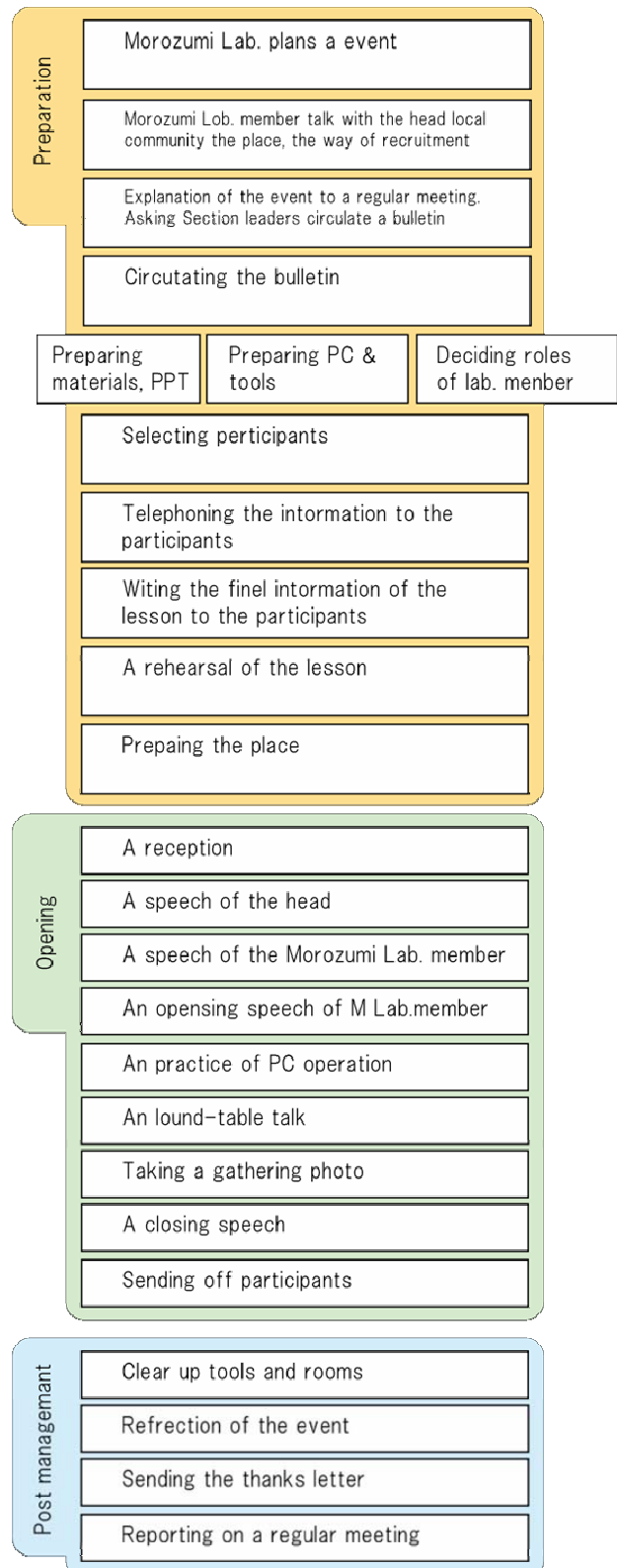


Figure 19: Activity Level with a High Degree of Commonality

### 5.3. VERIFYING THE POTENTIAL OF DEVELOPING PATTERNS

As a result of verifying the potential of patterns by applying them to multiple activities of the local community, we have verified that patterns are widely adaptable. We were also able to work from creating the description of individual and family activities through to the design proposal. Furthermore, though still only partially complete, we were able to confirm pattern commonalities in local community activities and individual and family activities.

Thus, we have been able to verify the potential of supporting development by creating activity patterns.

### 5.4. DIFFERENCES WITH CONTEXTUAL DESIGN

The differences with the previously cited contextual design can be summarized in the following way. Contextual Design is a strong method for jobs with a clear objective (work place) and in education. However, when the subject is community or family communication, where the objective is not clear, Contextual Design is not as effective. In these cases the activity itself exists, but human relationships are not clear. The method to describe Contextual Design, in which the Relation Model plays an important role, requires extra consideration. The focus in the APBD Method is that the actual situation as occurs in reality is recorded “as is”, and is later segmented and converted into a Sequence Model. Furthermore, it is possible to include the Cultural Model that reflects the emotions of concerned parties with the Sequence Model. The APBD Method is well suited to the modeling of vague activities that occur in reality and to allowing these activities to be the basis for development.

## 6. SUMMARY AND FUTURE CHALLENGES

We have succeeded in verifying that in cases where the objective is not clear, such as local activities and individual or family activities, it is possible to develop supporting systems using the APBD Method. Also by creating activity patterns we were able to show the potential for developing high-quality designs that are highly compatible with user activities.

Future challenges include the following:

- 1) Develop a method to change the As Is Models to the To Be Model which appear in the latter half of the APBD Method,
- 2) Perform continuous verification application for Activity pattern extraction and system development, and
- 3) Create an activity pattern dictionary.

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