An Approach to a Knowledge Reconstruction Engine for Supporting Event Planning

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Abstract

The main goal of our research is to establish "methodology for investigation of event" and to construct "a knowledge reconstruction system" to provide event planners with "chances" to design effective and attractive events. The methodology described here is to articulate gaps between event planners' intention and event visitors' mental impression at real event sites. Visitors' interactions with event objects were observed and their verbal reports (protocol data) and their actions were recorded with wearable computers and ordinary digital video camera, incorporation with Dentsu Inc. Their cognitive processes were analyzed with retrospective report method of protocol analysis. In this paper, we are going to describe the methodology adopted for investigating Visitors' Mental Transition (VMT) in the real world and examples of obtained results. From analysis of the data, we obtained a prospect that our microscopic approach is useful and effective toward event-planning in the real world. Concepts and prototype of "knowledge reconstruction system" are described.

Introduction

Every year, event-planning companies hold various events. So far event-planning is conducted with implicit knowledge of experienced planners and effectiveness of events is measured only by questionnaires. In actual situations, it is said that planners cannot obtain adequate and proper knowledge for future planning from statistical data derived from questionnaires because:

- The questions are composed of only what the planners pay attention to in advance. That means they fail to obtain something unexpected.
- The planners cannot understand how and why the data was produced. It makes it difficult for the planners to utilize the knowledge.
- Even though free-answer questionnaires are adopted, at real event sites it is difficult to let the visitors answer the questions in detail.

That means planners are unable to evaluate events they design. Planners need to know what visitors to events actually feel and how they behave when they are at the event booth to construct strategies for next event-planning. This is because knowledge itself cannot be applied to real situations if it does not have a context where it was produced(Fischer & Ostwald 2001). Though quantitative data is powerful to form a conclusion, it should be accompanied by qualitative data as a reason so that planners can utilize the knowledge. Qualitative data and quantitative data should complement with each other.

In this paper, we are going to propose a methodology to grasp visitors' mental transitions (VMT) and "a knowledge reconstruction system" through applying the framework of creativity support to actual event designing works. As its first step, experiments were conducted at actual event sites: "Tokyo Motor Show 2001" and "World PC Expo 2001", in cooperation with Dentsu Inc. Visitors' interactions with the event objects were observed and their verbal reports (protocol data) and behavior were recorded. And furthermore, concepts and a prototype of "knowledge reconstruction system" are described.

Related Work

Research on Knowledge Management

In research field of knowledge management, Fischer(Fischer & Ostwald 2001) emphasizes that knowledge management is a cyclic process involving such three related activities as creation, integration and dissemination. That is, knowledge must be created, integrated and disseminated, which is what they call "design perspective" of knowledge management. Knowledge management should be regarded as one of the design problems. Schön(Schoen 1983) explained a design process is regarded as a "dialog" between a designer and his/her material. Usually this process is ambiguous and dealt in the designer's mind.

Here is a point that should be supported by a proper tool. Norman(Norman 1994) has claimed that cognitive artifact should support our activities by amplifying our reflective thinking. Hori(Hori 1994)(Hori 1996) has concluded that by articulation of knowledge it is possible to support creative activities. That is, "knowledge reconstruction system" is required to provide a place to amplify reflective thinking of a user and proper knowledge to create new knowledge. In the context of knowledge management, a tool must pro-

vide not solutions to problems the user encounters (= traditional expert systems) but a place to refer such knowledge that helps the process where the user solves problems(Smith & Farquhar 2000). The tool should be not only knowledge base and retrieval system but also it should support to create new knowledge. That is what we call "knowledge reconstruction".

Analysis and Methods for Investigation of Cognitive Processes in Creative Activities

Recently, creative activities are regarded as a cognitive process(Finke, Ward, & Smith 1992). Suwa et al.(Suwa, Purcell, & Gero 1998) have devised a scheme for coding designer's cognitive actions from video/audio design protocols. Relations among cognitive processes were systematically described and analyzed. This method is useful to code and analyze human cognitive processes in a certain task.

In marketing, human-computer interaction, ethnography and cultural anthropology field, several methods to investigate human behavior and thought are also proposed and practiced(Ishii 2001)(Underhill 2000)(Ericsson & Simon 1993)(Emerson, Fretz, & Shaw 1995), though their definitions are not so strict:

- Questioning methods
  - In-depth interview: An interviewer extracts subconscious of an interviewee with techniques of psychological analysis methods such as free-association and projective technique.
  - Detailed interview: An interviewer obtains widespread information of a person. The information is not very deep.
  - Group interview: A group is asked to discuss a certain topic and an investigator obtains qualitative information from the discussion.
- Observation methods
  - Observation of an unspecified number of general public: An investigator observes how the people, for example in a shop, behave in the shop and/or through a recorded data from a fixed video camera and so on(Ishii 2001)(Underhill 2000).
  - Observation of a specified person or a group: This method is used for investigation in ethnography, cultural anthropology and analysis of organizations(Ishii 2001).
- Combined method of Question and Observation
  - Retrospective Report Method (for one person): The experimenter asks a subject to recall what they thought at the time when he/she was doing a certain task. Visual aids like video are also used together to help subjects recall as precisely as possible. The verbal data is collected and analyzed (= protocol analysis).

Questioning methods have a problem of selectivity. That is, what is asked is highly depend on the interviewer's skill. Observation methods are also problematic because what the people think is unobtainable only through observation. In our research, retrospective report method is adopted because the retrospective report method focuses on investigation of a sequence of a visitor's mental transition. And questions asked in this method are as follows with a visual aid.

- *What did you look at?*
- *What did you think when you look at it?*
- *What did you do?*

Basically a report is supposed to be made by a subject spontaneously. If a subject kept silent the questions were asked to promote his/her utterance. These questions are independent of a skill of an interviewer and selectivity. The main aim is to find actual connections among "what they look at or interact with", "what they think" and "how they behave" at actual event sites. Retrospective report method is suitable to collect these data without changing their cognitive process during doing a task (=browsing the event site). A visual aid was used to avoid a risk that the subjects change their memories. Think-aloud is also alternative, but it was not adopted because as the experiment was held in actual event sites it was difficult for the subjects to think aloud among the other visitors. Under this situation, their cognitive processes would be changed with think-aloud.

Methodology and Experiment

Target Events

As the objective of this investigation is to grasp visitors' mental transition in a microscopic way, we adopted a methodology called "protocol analysis(Ericsson & Simon 1993)". To obtain actual cognitive processes at event sites, the experiment was conducted at following two events held at Makuhari Messe in Japan.

- World PC Expo 2001 (WPC: 19-22, Sept., 2001)
- Tokyo Motor Show 2001 (Motor Show: 26, Oct. - 7, Nov., 2001)

Three booths for WPC and one booth for Motor Show were selected for the experiment in cooperation with their event organizers.

Articulation of Planners' Intention

To investigate what planners intend and how they implement event objects to express their intentions, we had interviews with the planners in advance. Planning papers were obtained in advance to extract messages and themes that the planners try to convey to visitors. A question asked to the planners is: "how did you implement the event objects to express your intentions?"

Recording Units for Collecting Protocol Data

To collect protocol data, two wearable computers were prepared in cooperation with MIT Media Lab and Intelligent Cooperative Systems Laboratory at Research Center for Advanced Science and Technology, the University of Tokyo. And a normal digital video camera was also prepared. But this time the wearable computers were limited because of the sponsors' intention. At WPC, it was possible to use the

wearable computer from MIT Media Lab for several sessions of the experiment, but all wearable computers were prohibited at the Motor Show. That is why the normal digital video camera was adopted for collecting protocol data. This is a good example of difficulty to conduct an experiment in the real world. Investigators have to find a possible way for investigation. We consider that validity of a wearable computer was proved for investigating human cognitive process in the real world. In fact, a wearable computer was adopted in another project to investigate effectiveness of POP (Point Of Purchase) at a real super market.

Subjects and Collecting Protocol Data

9 subjects (one person for 3 sessions + one pair for 3 sessions) at WPC and 12 subjects (one person for each session) at Motor Show were employed. The subjects were asked to look around the designated booth(s). After visiting the booth, a detailed interview was conducted. Its procedure was:

1. *Retrospective reports with visual aid the subject recorded*: The subjects were asked to report "what you look at", "what you think about it" and "what you do" along with the VTR as a memory aid. This interview is called "VA (Visual Aid) Interview".
2. *Questions about the subjects' impression on the event objects*: The questions were made based on the interviews with the planners and the planning papers. This is to investigate how the planners' intention and the visitors' impression match or mismatch with each other.
3. *Keyword questionnaires*: The keywords are also based on the interviews with the planners and the planning papers. This is to investigate what keywords the planners presented were impressive.

In the retrospective report, we followed the rules of protocol analysis(Ericsson & Simon 1993). That is, the data should include only what they think at the right moment they behaved.

The result of retrospective report method can compensate for the results of questions and questionnaires. The former results provide with the latter "a context where the information was produced". The results are compared with the planners' intention to articulate which intentions matched and which did not.

Each protocol data is devided into "Perceived Object (=what you looked at)", "Thought (=what you thought by looking at the object)" and "Action (=what you did)".

Results and Discussion

Our microscopic approach revealed a lot of findings that are beyond the planners' expectation. It was observed that these findings devote to create new knowledge, that is, "knowledge reconstruction". In this section, the findings are described and, further more, observed examples of "knowledge reconstruction" is also described.

Effect of the Other Visitors

The other visitors can provide a context that raises a degree of satisfaction of the visitor. Following report was obtained:

"A companion took a picture with a family. Both of the companion and the child smiled. My (= the subject's) children also like cars. They would be delighted if I took them here. That is a good idea."

This observed data was reported to a planner and he hit upon a new strategy:

"By inviting families which are customers of the company, the other visitors will feel in a way mentioned above. Moreover, the invited family will also feel better because they feel "they are invited as special guests" and this family can enjoy being a customer of the company, which will be great benefit to the company, too."

This is a good example of "knowledge reconstruction". We call it "reconstruction" because implicitly they might know the follows:

- Another visitor at an event site effects a visitor.
- Customers are delighted if they are invited as special guests.
- If customers like the company, it is beneficial to the company.

But these pieces of information have not been connected. That means the knowledge obtained through this analysis can support event-planning if it is properly reported to the planners. We are going to propose a supporting system that provides "knowledge for strategies with real context".

Of course we are not denying such methods as questionnaires with free-answer or formal interview. But with the retrospective report method it is possible to pick up knowledge with "real context". In addition, this method enables investigators to know what they have not intended in advance.

Effect of the Other Booth

Following phenomenon was observed at WPC:

- A subject first went into the Fuji Xerox booth. He was interested in a leaser printer because he personally would like to buy one and the presentation of a leaser printer at the booth was good.
- Next he went into Canon booth with saying "I wonder where leaser printers are". Though Canon does not have leaser printers, he was looking for them from the beginning to the end. He finally said "I cannot find leaser printers" and left the booth, having set a low valuation on the booth.

This phenomenon was reported to the planners and they were impressed:

Normally planners do not take it into consideration that what kinds of commodities appear in the next booth. It is

something out of our sight. It is too much for us if commodities next to our booth make visitors' evaluation on ours low!

"Unexpected facts" should also be reported to know what is going on in the real world.

Line of Visitors' Flow and Effect of Congestion

Planners design lines of visitors' flow in the booth. They have a story to make the visitors understand what the company would like to convey. For example, an ordinary story that planners intended is:

1. Let visitors know something new at a main stage of our booth.
2. Lead them to exhibition corners that show real products.

Though these are very simple, actually following facts were observed at Motor Show. The expected lines of visitors' flow are indicated in the Figure 1. The main expected flow is (1)-(5) and second flow is (a)-(f).

- Only two out of the twelve subjects followed the main flow.
- The rest at first stopped at the car at the corner of the booth (bottom-right in Figure 1) and they go along the cars aligned (to the left in the same figure). Then they followed the almost same flow as the second expected.

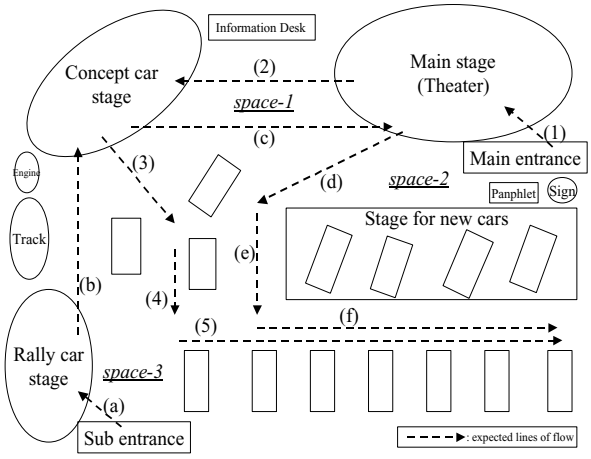

Figure 1: The Design of Booth

This phenomenon is closely correlated to the amount of the visitors in the booth. A booth image reported on planning papers is usually without visitors. That is, planners do not consider how and where congestion will take place. The subjects reported the following negative comments:

- As the main stage was too crowded to see, it was not easy to enter the booth (space-2 and space-3 in Figure 1). But inside of the booth (space-1 in Figure 1), it was not so crowded.
- As the entrance and passages were so narrow that I (the subject) could not find which way to take.
- I could not find a regular route. I did not know where I should go.

This knowledge about congestion can be developed to very simple strategies of designing the booth:

- An object where a lot of visitors will stay for a certain time period should be apart from entrances because congestion impedes the visitors to enter.
- Places where congestion is expected should be designed with a passage wide enough for visitors to come and go.

These strategies are not adopted at a phase of designing booth, though they seem to be a matter of course. That means that with results of comparison of planners' intention with visitors' mental impression, it is possible to provide with the planners this kind of knowledge that supports event-planning. This knowledge should be available at the very phase of planning.

Through the comparison of the planners' intention with the visitors' mental impression, a following gap was also extracted about congestion. The planners' understanding of congestion is different from that of the visitors:

For Planners The booth should be designed to let visitors stay as long as possible because a crowded booth attracts another visitors and satisfies a client of the booth. The main stage at the entrance will work as a stopper of visitors.

For Visitors It was too crowded to see objects, even to walk. They do not dare to queue even though they are interested in an object. They would like to look around the event more freely even if, for example, they have to pay. The entrance blocked them to enter.

This difference of understanding is also critical to booth designing. As it is pointed out(Underhill 2000), congestion is one of the most critical factors to visitors. That means control of lines of visitors' flow must be definitely taken into consideration in designing phase. This knowledge should be reported to planners in the right context, i.e. their planning phase. Though they might know implicitly that congestion provides discomfort, the knowledge is not utilized in a proper way. It is a part of knowledge reconstruction to provide "the right thing at the right time and the right place"(Fischer & Ostwald 2001).

Stages

Ordinarily event planners agree that length of a show at a main stage should be within ten minutes. Although length of visitors' staying at a booth is usually investigated with quantitative analyses, the length of staying at stages is left unchecked. Neither is it unchecked at which scene of the stage the visitors leave. That means strategies of designing stages does not exist explicitly[1]. So it is worthwhile investigating the length of the visitors' staying and at which scene they leave the stage. An example of analysis of the stage is described. One of the stages was composed of six scenes with technical information and images of benefit. This stage

[1]Perhaps the planners might have strategies implicitly.

lasts for about twelve minutes and starts every ten minutes. Figure 2 shows the length of stay at a main stage.

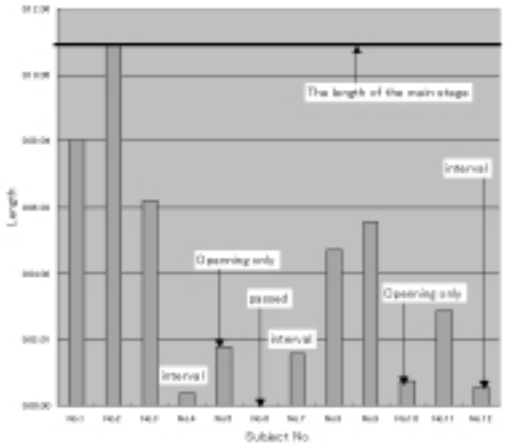

Figure 2: The Length of Visitors' Stay

The planners' hypotheses about the stage are:

- Twelve-minute stage is short enough to let visitors watch whole of it.
- The technical parts of the stage are not so attractive that it is difficult to keep visitors watch these parts.

But from the analysis, such data and tendency as follows are obtained:

- The average length of stay is about 3.6 min.
- The visitors left or got tired of the stage when the image of benefits started.

It is worth noting that one third of the subjects visited the main stage during interval. As main stage is normally designed to express what the company would like to convey most, scheduling is also critical problem.

Though there was one subject who watched the whole stage, he reported that he could not understand what the scenes with comfortable images try to convey. There also exists a gap between planners' knowledge and actual situation. This phenomenon also must be reported.

Attention Management

Fischer(Fischer & Ostwald 2001) has claimed "attention economy", that is, the scarcest resource for most people is attention. At event sites a lot of attractive objects are scattered, therefore it is important to manage visitors' attention. In Motor Show, there found an example of lacking this viewpoint.

Planners' intention: They put five screens at the main stage. The total width of screens was intended to be beyond a range of visitors' vision. The planner's intention was let the visitors absorbed in the visual presentation. And they put a transparent model car in front of the screen, which is a typical stage effect of SUBARU.

Visitors' impression: The following comment was obtained:
A narration of a companion, the moving car and pictures on the screen were presented. Though they do not move extremely, they distracted me.

From the questionnaire, most subjects reported the transparent car was interesting. But in the actual situation, subjects did not set a high valuation on it. This example indicates that our approach can reveal what is unobtainable from ordinary questionnaires.

Comparison with Quantitative Methods

Again, we are going to compare our approach with the others. The method adopted in this experiment is one of the methods for protocol analysis. Protocol analysis is not the method for theory construction but the method for data collection(Shannon 1984). It aims to investigate what microscopic cognitive processes and their transitions are like. In the context of creativity support, the data should be analyzed to detect unknown variables and patterns that provide chances to produce new strategies with designers. There are several examples of obtained knowledge that could not be obtained through statistical methods.

At Motor Show, several points were selected to ask subjects to evaluate with 3- or 5-point scaling. The examples of the questionnaire are:

- Did you look at or touch the listed exhibitions?
- Were you interested in the listed exhibitions?
- Rate your impression on the listed exhibitions.

The list of exhibitions is:

- Presented cars
- Catalog
- Technical exhibitions
- Arrangement of the booth
- Reception of the staff
- Clothes of the staff
- Design of the booth
- Stage effects of the booth
- Information the stage conveys
- The way that the stage conveys information

Answers to the questions with point scaling provide only "good", "OK", "bad" and so on. They do not provide "how and why it was good, OK or bad". Free-answer sheet can be a help to compensate for this problem, but it only provides evaluation on spots that the planners select in advance. That is, it does not yield a chance to find new variables, though our approach provides such knowledge as "what the visitors looked at", "how and why the visitors moved in the booth" and so on. Through protocol analysis, at least following knowledge is found with "the real context".

- Effect of the other visitors (in our result, for example, "effect of a family")

- Effect and difference of understanding of congestion between designers and visitors
- Attention Management

These pieces of knowledge with the real contexts are useful to establish new strategies, although statistic data lack their contexts. That is why we propose "knowledge reconstruction system" that provides with planners "knowledge with real context". As mentioned before, we do not intend to deny quantitative methods. Qualitative and quantitative methods should complement with each other. The former is for establishing the hypotheses and the latter for verification.

Towards a Knowledge Reconstruction System

Concept of the System

Though the importance of knowledge has been claimed since middle of the 1980s, the main concern of business theory is how to obtain and accumulate established knowledge. Little research has been conducted on how innovative knowledge is created. Nonaka et al. (Nonaka & Takeuchi 1995) have claimed that there are four modes of knowledge transition: Socialization, Externalization, Combination and Internalization and that knowledge should be regarded as spiral-up cyclic process. Though a lot of companies have attempted to apply this theory to their actual works, it does not seem to be successful. Nonaka's theory is proposed as a theory and no method to apply it to the real world has been indicated. In addition, this is the theory for "transition of knowledge mode", not the theory for "manipulation of knowledge mode by the user".

Knowledge cannot be separated from actual contexts to utilize it, i.e., knowledge management. That means that it is necessary to preserve knowledge together with "its real context". Event planners need to know how the knowledge was produced. It is impossible for planners to observe the real site of event because they have to be in the backyard in case someone has to contact with them. However, it is necessary for planners to obtain and understand knowledge, to integrate and create innovative knowledge, and to apply knowledge to actual event-planning. This is what we call "knowledge reconstruction". Knowledge must be dynamically integrated and innovated. We are going to propose "a supporting system for knowledge reconstruction". At the current state, our research obtained such perspective that our approach can be a driving force of this cyclic process.

To accomplish this aim, our system should be implemented with following features:

- Accumulating the knowledge: the system should accumulate the data of the analysis, planning sheets, meeting memos and so on.
- Browsing and reconstruct the knowledge: the system should present the knowledge with its real context to promote and amplify a user's reflective thinking (Schoen 1983)(Norman 1994). And moreover, it should promote discovering and creating process of knowledge.

We adopt spatial representation to present data to a planner. Hori(Hori 1994) has conducted an experiment to investigate effects of spatial representation in conceptual design. A system named AA1 presented words, which represented a concept the user vaguely conceived, on the two-dimensional space, the user could change their locations on the space. This action helped the user clarify his/her concept gradually and such phenomenon was observed as the user came to generate new concept by looking at the blank area on the space.

Yamamoto et al.(Yamamoto 2000) have presented a theoretical framework for a method of supporting by an interactive system at an early stage of creation of information. The interactive system aimed to support the process to create information, which is still ambiguous in the user's mind through trial-and-error. They concluded that it is not "a representation for a design solution" but "a representation for understanding a design solution" that a designer needs at the early stage of the creation of information. That is, the spatial representation can support to clarify gradually the designer's concept that was ambiguous through the interaction between the designer and the system in the divergent thinking process.

Yamamoto et al.(Yamamoto 2000) and Amitani et al.(Amitani & Hori 2001) have claimed that supporting system to create information with linearity should provide gestalt with the user. As to event-planning, a planner has to develop a plan spatially and temporally. It is necessary to take linearity into consideration and providing gestalt should support it.

Prototype of the System

As our investigation externalized a lot of knowledge successfully, we are going to propose the supporting system for knowledge reconstruction.

Figure 3 shows Nonaka's 4 modes of knowledge transition. In this context, our research intends to:

- Apply Nonaka's theory to actual situations
- Propose a methodology and a system to support to apply this theory to actual situations

Figure 3: A Cyclic Process of Knowledge Reconstruction

In Figure 3, italic phrases are what we are going to provide:

Externalization This mode is supported by the methodology we proposed in the former sections. In addition, it is necessary for a user to have "a browser" to discover unexpected knowledge that was unobtainable or discarded by traditional methods. We are going to propose an interactive browser that promotes a user's reflective thinking.

Combination From the data obtained through the analysis, this mode is supported by "exhaustive search" and "interaction with spatial representation". Based on the conclusion of Hori (Hori 1994) and Yamamoto et al. (Yamamoto 2000), spatial representation is adopted to show what were focused by both the visitors and the planners and relationships among the focused objects.

Internalization It is expected that this system promote the user's understanding

Socialization For example, "pursuasion of clients" is expected by using this system.

The system is composed of two parts: *"ChronoSpace"* and *"ContextMap"*. Figure 4 and Figure 5 are snapshots of the components.

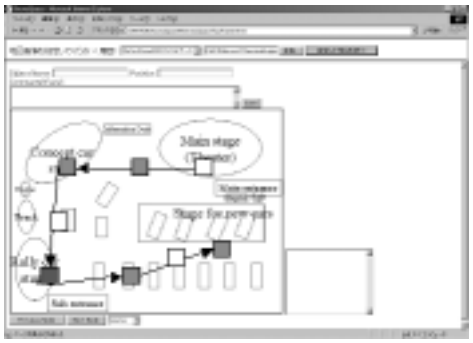

Figure 4: A Snapshot of the System: ChronoSpace

Figure 5: A Snapshot of the System: ContextMap

Here the two components are described briefly. In the next section interactions are described in detail.

ChronoSpace is an interactive browser of data obtained from the investigation. It shows a map of, for example, an investigated booth and shows a line of a visitor's flow in the booth. It generates nodes on the map where protocols were obtained. These nodes are generated automatically by matching object names put in advance and time-sequential protocol data. This representation provides "linear (time-sequential)" information with "gestalt" (Yamamoto 2000). It facilitates the user to grasp essense of information.

The user browses the obtained protocol data one by one by clicking "Next" or "Previous" button for each subject at each event. If the user found something interesting to him/her, he/she attaches "Success" or "Failure" tag on the node. It promotes reflective thinking of the user and helps the user to utilize the knowledge for a next planning.

ContextMap is also an interactive browser of data on which a user attached "Success" or "Failure" tags. While ChronoSpace is a browser for flows of each visitor at each event, ContextMap provides wholistic view of focused data of all the subjects at all of the investigated events. It arranges focused event objects (rectangles on Figure 5) on a two-dimensional space along with their similarities. When the object is clicked, its content (protocol data) is shown in a text box. TF-IDF was adopted to calculate their similarities.

These two components work in cooperation with each other. In a following section, a scenario to utilize the system is described.

Expected Interaction

There are three types of expected interaction with the system:

1. Interaction for reflective thinking
2. Interaction for planning
3. Interaction for persuading clients

To use ChronoSpace, a preprocessed booth map and protocol data are necessary. First, a map of the investigated booth is inserted to ChronoSpace. Then a user puts a name on each event object on the map. The names are correspondent to those in the list of "perceived objects" in protocol data. As the protocol data are time-sequential, it is possible to generate a flow of each subject's line by matching the object names on the map an d the perceived objects list automatically. The names are, for example, adopted from planning sheets. Then anybody can complete this preparation. In a real workplace, it is necessary to formalize procedures as possible.

Interaction for reflective thinking

Using ChronoSpace, a user browses each protocol data. The user needs to grasp what the visitors really looked at, what they thought about and how they acted. Normal statistical data does not provide this type of "data with their context". Without contexts, knowledge cannot be understood nor be utilized. ChronoSpace allows the user to browse each protocol datum of each subject along with a flow of a subject's line. By pushing "Next Node" and "Previous Node" buttons, the user can browse protocol data forward and backward. If the user finds something interesting, he/she can put a tag "Success" or "Failure" on the node. It enables the user

to accumulate remarkable phenomena and also promotes the user's reflective thinking.

Interaction for planning

ContextMap enables the user to do case studies. The user can grasp the remarkable phenomena on the two-dimensional space. While ChronoSpace allows the user to investigate microscopically, ConextMap allows macroscopic investigation. The tagged objects are arranged on the space along with their similarities. The similarities are defined by resemblance among protocol data calculated by TF-IDF. Then the user can investigate which object can cause what effect.

As the arrangement does not always fit to the user's mental world, the user can modify it by moving objects on the space. Through this rearrangement the user is gradually able to construct his/her concept space to utilize knowledge. ContextMap also allows labeling a group on the space. The grouping and labeling functions facilitates the user to use the system as their own knowledge. Shipman et al. (Shipman & Moran 1995) have claimed that incremental demand-driven formalization reduces a user's cognitive load. ContextMap allows the user to structure the knowledge base incrementally along with the user's own vocabularies and mental world.

Interaction for persuading clients

This is the most important interaction when a system is applied to a real workflow. No system can be adopted into a workflow if it does not provide a proper and direct usage. It is necessary to indicate "how it is utilized". Persuasion of clients is one of the most required factors to a system and the system should support it.

As ContextMap arranges all the tagged objects on a two-dimensional space along with their similarities of effects extracted from protocol data and it collaborates with ChronoSpace, the system indicates:

- Every imaginable means is taken into consideration
- It is easy to understand which objects can cause a certain effect
- It is possible to know a real context where a certain effect was caused to use ChronoSpace

Then, for example, following scenarios of persuasion are expected:

- By using successful instances, "there is a successful instance like this, so this time we adopt it"
- By using failure instances, "there is a failure instance like this, so avoid this way"
- By looking at blank spaces, "this time we are going to adopt an innovative method that has never been appeared before"

A prototype of the system is under construction. We are going to have planners use it by way of trial to observe knowledge reconstruction processes.

Conclusion

In this paper, we proposed a methodology and prototype of system for "a knowledge reconstruction system". The methodology is microscopic investigation to understand cognitive processes and their transitions. The most important point of our approach is that theories and methods used only in laboratory experiments are applied to a real world problem, that is, event-planning.

Problems of the traditional way of event-planning are:

- Planners say that statistical investigations do not provide with them useful knowledge to utilize for future planning. It is because the data lacks its context.
- Because of that, it is difficult for the planners to obtain enough feedback from investigations hence it is also difficult to organize strategies for future plans. The state of the art the statistical methods do not offer knowledge with their real context.
- As questions the planners ask to visitors with questionnaires are restricted to the planners' views, they can confirm only what they point out in advance. That means it is little possibility to discover what is important that have been unknown.

Our approach effectively deals with these problems. First, by adopting retrospective report method, it is possible to extract not only points planners decide in advance but also unexpected behaviors and impressions of visitors. It promotes the planners to find knowledge that have been unknown to them.

Second, as our approach provides "knowledge with its real context", the planners can directly understand the context where visitors have impressions. It helps the planners obtain meaningful feedback to create new strategies for future events.

Through protocol analysis, following knowledge is found with "its real context", which has not been obtainable from traditional statistical investigation.

- Effect of the other visitors
- Effect and difference of understanding of congestion between designers and visitors

These knowledge with its real contexts are useful to establish new strategies, although the statistic data lacks hence they are discarded. That is why we propose "knowledge reconstruction system" that provides with the planners "knowledge with real context".

A knowledge reconstruction system is currently under construction and there left a lot of things to take into consideration. Our long-term plan is:

- To establish a system prototype
- To apply this system to the real event-planning site
- To investigate how the way of knowledge management changes
- To obtain feedback to refine the system

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