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A case study of motivational design:  
Multi-media courseware  
"The Secret of Aunt Mariko"

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#### Abstract

This paper reports on a project to develop a laser-disc based multimedia CAI courseware on English listening comprehension skill using a role-playing game format. It was a three-year project by RISE, an affiliate of the International Trade and Industry Ministry of Japan. The product is first briefly described in terms of its hardware, software, and courseware. Then theoretical backgrounds, especially that of motivational aspect of the courseware, will be introduced, using the ARCS motivational design model. Finally the developmental process and research activities, which were involved in the project, will be summarized.

#### THE PROJECT

The aim of this project was to build a shared chunk of know-how knowledge in utilizing multimedia technology to be applied in educational material development. It was sponsored by the Mechanical Social Systems Foundations, an affiliate of the International Trade and Industry Ministry of Japan, in order to form a project-based research and development team in the Foundation of Research Institute of Software Engineering (RISE). RISE was granted roughly 100 million yen, or 1.25 million Australian dollars, to conduct this three-year project including prototype development (1st year), stand-alone courseware development (2nd year), and networking (3rd year). This paper deals mainly with the project's second year, when stand-alone courseware was designed, developed, and pilot-tested. Project members were from diverse sectors, ranging from hardware manufacturers and an entertainment software house, to a public broadcast system and university researchers. The project was

chaired by the third author of this paper, and the members were divided into five research teams. The teams were Theory and Display Design Team (to where the authors of this paper belong), Storyboard Team (consisted of English Educators), Development Team (software house) , Evaluation Team I (researchers to plan and conduct evaluation studies), and Evaluation Team II (hardware manufacturers to assist conducting evaluation). Each team worked individually and cooperatively throughout the project years. Based on the basic research concerning current research trends and technology available to develop a prototype of "new" courseware, the project decided that the goal of this effort was to make the product "appealing". By finding out why TV games are so popular and by translating the reasons into educational product, the project attempted to seek a way to keep motivation to learn to be continued. The basic elements to be incorporated into the final product were defined as interactive multimedia presentations, a role-playing game format, and an affective control mechanism.

## THE PRODUCT

### Hardware configurations

The product "The Secret of Aunt Mariko" runs on a Macintosh (4.5MB RAM) with a video digitizing board (e.g., RasterOps 245TV) to show full-color motion pictures from a laser disc. A laser disc player (e.g., Pioneer LD-V800) is to be controlled by the Macintosh using an RS-232 cable. A pair of speakers is also required to play sounds directly from the laser disc player. With the hardware described above, full-motion video can be merged with texts and graphics created by the computer and displayed on a single color monitor screen. A mouse is used when a user makes choices.

### Multimedia nature of the software

The product consists of multimedia data: live video and stereo sounds on the laser disk; digitized video and sounds in the QuickTime format, digitized sound narrations both in Japanese and in English, text data in both languages, computer graphics and still pictures. About 200 cuts of live video were filmed at University of California, Riverside, by an executive director of NHK (Japan Broadcasting Corporation, the public TV station), then stored on a single side of a 60 minute laser disc. All other data are stored on a hard disk, for which a total of 62.5MB are required.

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Figure 1. Insert about here

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An authoring software for multimedia presentations, Macro Mind

Director, is used to control all the data mentioned above, in

accordance with the flow of the program and with the choices of the user. The program to run this software looks just like the script for an ordinal CAI courseware; the difference is that not only texts and illustrations are to be selected and displayed by the program, but also other forms of multimedia chunks of data, such as clips of full-motion picture, are accessed and presented to the user.

### Courseware

Using the hardware and software described above, the core of this project is to plan and produce courseware, by which the contents and flows of the study materials are represented. Courseware follows a grand story to investigate the secret of Aunt Mariko by finding out the location a photo was taken. The old photo shows young Aunt Mariko standing by a river, who was studying in the United States. Depending upon the correctness of choices in the adventure, the user will see different endings (solve or falsely solve the mystery) or will not be able to see the ending at all and be forced out in the midst of the adventure (timeout).

In the quest for the secret of aunt Mariko, the user of the program has to listen to English conversations, in order to select a better answer in return. The choices consist of either 'guesses' of what was heard, or 'actions' to advance the situation. By doing so, the user is expected to develop his or her listening comprehension skill, which is the educational objective of this courseware in the cognitive sense.

For the choices based on a misunderstanding of what a character of the scene said, the program does not answer by saying "No, the correct answer is such and such". However, the program either branches to an additional happening and branches back to the original scene, or asks the user to try to listen again by representing the question slower. This brings the user repetitive opportunities to listen to the same questions, with a time penalty. For those who often fail to make best choices, they will run out of time to complete required quests. Then they would be forced out from the program and must start over again from the beginning, to get repetitive chances of listening.

The second educational objective is to prevent the user from becoming bored of or feeling forced into the repetitive training of English conversation. This objective deals with the affective aspect of learning, especially with motivational concerns. It is expected that by making an English student to amateur investigator, the perceived goal of the courseware would become not to study English but to have fun of solving the Mariko's secret. Any improvement of listening comprehension skill would then become almost a byproduct of having fun with this "entertainment", where boredom is no longer the issue.

In order to come closer to the mystery of the aunt Mariko, the user of the courseware take a role of our hero Ken'ichi, who lives in a dormitory of an American university and is asked by

his uncle (Mariko's husband and his financial supporter) to find out the secret in 5 days. Each day is filled up with an adventure an American college student's everyday life, such as a surprise party, a date with Sari, and making a phone call to reserve a dinner party at a Chinese restaurant. Depending on how well the user performed on the previous day, a chance to challenge for a clue to the mystery will become available, such as searching the aunt's name at the alumni association and doing an interview with whom Mariko may have been acquainted. On the final day, Ken'ichi will be told by his uncle the real reason of his asking Ken'ichi to investigate the secret, the reason being different depending on the total score of the quest, or he would be cut out the financial support if the performance were too low.

## MOTIVATIONAL DESIGN

The ARCS motivational design model

The presenter (first author) of this paper was brought into the project because of his background in motivational design, particularly the use of the ARCS model originated by Keller (1983; 1984). The ARCS model of motivational design suggests four basic categories of motivational strategies: gaining and sustaining ATTENTION, establishing perceived RELEVANCE of instruction, building CONFIDENCE in succeeding the given task, and providing with SATISFACTION for the consequences of the effort put into the learning. The name of the ARCS represents these four basic categories.

Numerous strategies have been suggested in various instructional settings such as classroom activity planning, message design, textbook enhancement, and computer courseware design (Keller, 1984; Keller & Burkman, 1993; Keller & Kopp, 1987; Keller & Suzuki, 1988). The model has become well known due to its applicability to any forms of instruction, and its comprehensive structure addressing psychological research literature (Newby, 1991).

### Motivational Analysis of the Product

The characteristics of the product "The secret of Aunt Mariko" have been analyzed according to the four basic categories of the ARCS model, as shown in Table 1. This summary is based on the comments from the originator of the ARCS model in September 1992 to a prototype product, with some additions from an analysis of the final product in February 1993 by the Theory Team of the project.

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Table 1. Insert about here

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### Process of Motivational Design

It is apparent in Table 1 that many motivational strategies can be identified in all of the ARCS four categories. However, as Keller suggests, it is not the best way of motivational enhancement to adopt as many strategies as possible. In stead, inclusion of the strategies should be selective, in order to fit the motivational characteristics brought by the learner, the task, and the learning environment. The notion of systematic motivational design comes in to play an important role in this regard.

In the course of the systematic process of defining, designing, developing, and piloting an instructional material, Keller (1987) suggests 12 phases or activities of motivational design. Among these there are the three important activities; that is, audience analysis, selective adoption of motivational strategies, and formative evaluation and revision of the material.

Audience analysis refers to making a learner profile as to how appealing the instruction would be, based on the ARCS four categories. This provides a basis for the selective adoption of motivational strategies, where relative emphasis of motivational enhancement is judged to match learners' profile. For example, if the learners are expected to be anxiously waiting for the instruction, then strategies for getting Attention will be omitted because they would be unnecessary. If, on the other hand, the learners are forced to be "captive audience", then Attention strategies will be necessary to prevent the learners from thinking something else in the air.

The third of the important activities is formative evaluation and revision of instructional materials using empirical data. It should be noted that the summary of motivational characteristics shown in Table 1 is merely a theoretical observation, which suggests possible motivational effects of the product. Actual effects can only be examined with empirical data from courseware evaluation, as shown later in this paper.

Despite of the recommended procedures of motivational design described above, the motivational design in this project came into a play almost post hoc, trying to interpret the ideas formulated by the project's Development Team with expertise and experiences of producing commercially well-known TV games. Table 2 shows some observations of the design and development procedures of the project in terms of motivation design.

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Table 2. Insert about here

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The notion of motivation design and the ARCS model's categories and strategies did help clarifying the goal of the project and various means to that end, it was how far the contributions from this Theory Team could go in this particular case. In other words, the role of theoretical notions was more descriptive than

prescriptive, not suggesting the best of the alternatives from the theory, but trying to explain, using the theory, why the experts took certain actions .

## EVALUATION RESEARCH

In order to see if the aims of the project were met or not, several evaluation methods were examined and conducted, mainly by the Evaluation Teams of the project. The evaluation methods included (1) questionnaires administered prior to and after the evaluation session to the participants from the target audience, (2) a protocol analysis to observe and analyze the process of using the courseware, and (3) a game-design expert interview to try to clarify the rules of judgments in the course of game design, applied to the development of this courseware. Despite of a review of prior research studies, the project group did not feel comfortable as to how to go about conducting the evaluation. It should be noted that the methods of evaluation per se were to be examined their validity through the usage in this study. Brief descriptions of the methodologies and the results are as follows:

### Questionnaire

Pre and post session questionnaires were administered to all of the 39 participants (mostly college students) of the evaluation study. Pre-session questionnaire asked participants' biographical data, experiences of learning on computer, characteristics of the most memorable computer courseware using 17 5-point Likert scale items, and TV game experiences and impression of the most memorable TV game, with 18 Likert items. Post-session questionnaire asked English learning experiences, and reactions, opinions and feelings about the courseware "The Secret of Aunt Mariko", using a total of 81 Likert items. Among the items concerning the English learning aspects of this courseware, two items on participants' subjective judgment of improvement of listening comprehension (both the contents and the words of narrations and questions) were rated higher than other items (such as remembering dialog patterns). A comparison between game aspects of this courseware and impression of the most memorable TV game revealed that both were rated similarly, suggesting that this courseware was considered to be one of the best "games" they ever played.

Many of the participants expressed their continuing motivation to spend more time on this courseware, to recommend this courseware to their friends, and to wish if it could be used in their schools. This verbal commitment was supported by frequent observations of voluntarily choosing to remain using the courseware after the evaluation session when they were told that they could do so.

## Protocol analysis

Protocol analysis, or discourse analysis, refers to recording and categorizing learners' conversation while studying courseware (Yoden, 1991). In the process of the formative evaluation of this courseware, some of the participants were asked to use the courseware in a pair, by orally exchanging feelings and ideas before making any choices. The evaluation process was videotaped, which was to be analyzed into sentences and classified using predetermined utterance categories. The amounts of utterance in each category were compared with each other to see the kinds of mental activities frequently occurred during the learning process.

The results from an analysis of two pairs of participants indicated that (1) the operation of the courseware was clearly understood, which was judged by few conversation concerning how to proceed to the next screen; (2) the courseware was affectively stimulating, judged by frequent utterance in affective nature, such as curiosity, joyfulness, and surprises; (3) the courseware requ