

# Visualizing Family Trees: Development of a Dynamic Family Retrieval System

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## ABSTRACT

We present a family retrieval system that can move person objects and has a chronological display to understand family history and organize family information. Based on questionnaires, we designed symbols for person icons and such links among icons that show gender, dead or alive, married or divorced, the adoption and adoption dissolution. The following are our paper's main contributions: (1) a prototype system with a dynamic and chronological display; (2) a methodology to design symbols of family trees for family retrieval systems; (3) appropriate symbols for computers for family retrieval systems.

## Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces – *Screen Design*.

## General Terms

Design, Human Factors

## Keywords

family tree, dynamic display, chronological display, design of symbols

## 1. INTRODUCTION

Understanding family histories and organizing such family information is important. Jones [1] argues that “the term Personal Information has several senses: 1. The information people keep for their own personal use.” Family information is one example of such knowledge that people keep for their personal use. We believe that family information is a crucial element of personal information; however, it has not been frequently investigated by Personal Information Management (PIM). Some PIM software [2] deals with such family information as health data, but it seldom provides such facilities as visualizing family trees to help users understand family histories.

Outside PIM, typical family tree systems can input and statically display parent and children relationships. But such systems suffer from the following problems. They cannot move person objects, have no chronological display, cannot deal with such relationships as marriage, divorce, adoption, and the adoption dissolution. Quickly understanding a family history and the complicated relationships of a family chronology is difficult. For example, when a woman has a second child, is the baby's grandmother still alive? What is the relationship between one's father and a

particular woman to whom he was talking during a family reunion?

We propose a dynamic system that can display all person objects and move them as users want.

To develop dynamic family tree systems, we must consider two basic designs: structure of family trees and symbols of person objects and relationships. In this paper, we concentrate on consider how to design the person objects and their relationships.

Typical family tree systems do not show gender. Such crucial information as dead or alive, married or divorced, and adoption and the adoption dissolution are generally missing as well. This information is sometimes provided by annotations to each person's object. Some systems [3] show such information, but its design process is unknown.

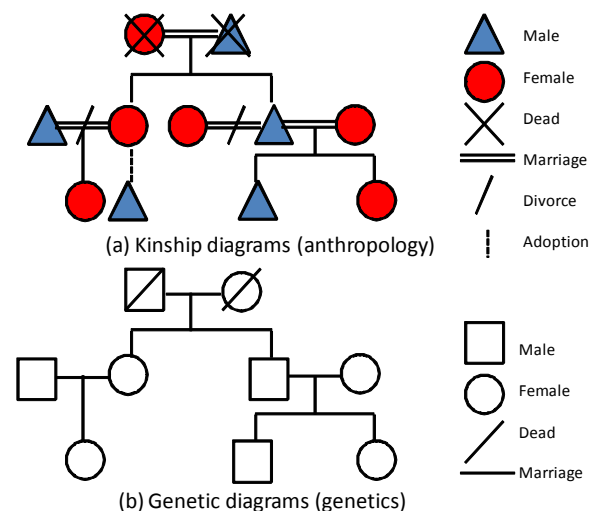


Figure 1. Existing family tree diagrams.

Formal or informal rules exist for drawing family tree diagrams on paper based on specific purposes. Many similarities and differences can be found. Kinship diagrams in anthropology and genetic diagrams in genetics are famous for their special purposes. For example, in kinship diagrams in anthropology, triangles indicate males and circles indicate females. A cross is put on these symbols if the person is dead. Figure 1 (a) is an example of a kinship diagram described in [4]. In genetics, squares represent males and circles are used for females. A slashed line indicates

that a person is dead. Figure 1(b) is an example of a genetic diagram [5] that interprets the above kinship diagram. A solid double line between couples indicates marriage in the kinship diagrams and incestuous marriage in the genetic diagrams. Such differences reflect different purposes. Since the genetic diagrams store health information for clinical purposes, non-biological information such as divorce and adoption is unimportant.

In addition, no international rules exist for drawing family trees in which users can move person objects on computers for family information retrieval.

In this paper, we first investigate the basic design of symbols and develop a system based on our results.

Below, in Section 2 we describe our investigation on how to display family trees on computers. Our family tree design will be explained in Section 3. The implementation and examples of the system are described in Section 4. We discuss the significance of our research in Section 5.

## 2. INVESTIGATION

### 2.1 Method

We conducted two questionnaire surveys. The subjects were 37 Japanese undergraduates (19 males and 18 females; average age, 19) in the first survey, and 36 (16 males and 20 females; average age, 19) in the second. After explaining some conditions, we asked subjects to select the best display from two to four options of person objects or relationships. The options were selected by preliminary experiments. The following were the instructions.

This survey will determine how to design display data in family tree retrieval systems. Select only one symbol as the most appropriate to indicate a question's semantics or the data relationships and write it in the answer column. If you cannot select one, write none. Please select as intuitively as possible.

Figure 2 is an example of the questionnaires. The subjects selected one from three choices about indicating an adoption: (1) a double solid line, (2) a dashed line, and (3) a solid line with annotation "adoption."

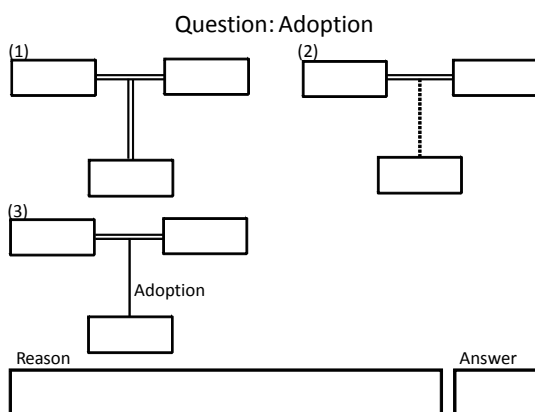


Figure 2. Example of questionnaire sheets.

The questionnaire items are listed below.

- (1) Shape of person icons (male/female, dead/alive)
- (2) Relationships of marriage and divorce

- (3) Relationships of adoption and adoption dissolution
- (4) Relationships of unmarried parents and children, and affiliation of children
- (5) Location of person icons (among parents and children)

## 2.2 Results

### 2.2.1 Overall Results

We first show the results in which we obtained significant differences in a chi-test ( $p < 0.05$ ).

- (1) When distinguishing gender by colors, the shape of the person icons should be the same (97% in two selection options).
- (2) If solid lines are used for the frames of the icons of the living, dashed lines should be used to indicate the dead (1st time: 76% in four options, 2nd time: 58% in three options).
- (3) A double solid line should indicate marriage (73% in three options.)
- (4) A father should be located on the left between a father and a mother (when their birth dates are unknown: 100%; when the father is older than the mother: 100%; when the mother is older than the father: 86%).
- (5) Children should be located left to right by birth order (when the son is older than the daughter: 100%; when a daughter is older than a son: 67%). The son should be located on the left among the children when their birth dates are unknown (100%).
- (6) "Adoption" should be described along a solid line that indicates a parent-child relationship (81% in three options).
- (7) Adopted children should be located from left to right by birth order (76% in two options).
- (8) A dashed line should indicate unmarried-parents who have children (78% in three options).
- (9) "Affiliation" should be described next to the father's side with a solid line that indicates a parent-child relationship (56% in four options).

For the following, there were no significant differences in the chi-test. We show the answers that got maximum numbers.

- (10) When a double solid line indicates marriage, "divorced" should be annotated above the line (39% in three options).
- (11) When there are biological and adopted children, they should be located from left to right by birth order without any distinction (46% in four options).
- (12) To indicate the adoption dissolution, "adoption dissolution" should be annotated along a solid line that displays the parent and adopted children relationship, and a cross should be marked on the solid line (39% in three options).

### 2.2.2 Analysis

About distinguishing genders, many subjects answered: "When color is used to distinguish gender, the shape should be the same because it is easy to see."

Symbols for the dead caused disagreements. Many subjects answered that, "a dashed line is good because it represents disappearance." One comment about slashed lines complained that "it is difficult to see the names."

A cross for divorce was also selected but the number was smaller than the description. Comments included, "when couples have

children, a cross is ambiguous because it's unclear whether it is put on the marriage and/or the parent-children relationship,” and “a cross for the adoption dissolution is acceptable because there is no ambiguity.”

Neither dashed nor double solid lines were rejected for adopted children. The subjects probably aren't accustomed to such traditional symbols for adoption, and therefore they are not easy to understand.

For the layout of the birth order of parents and children, most agreed to place children from the left to right by birth order. However, for the parents, the number who answered that “fathers are on the left” was larger. Many claimed that such a layout is easy to see.

### 3. DESIGN

We designed the symbols of family trees based on our investigation results (Figure 3).

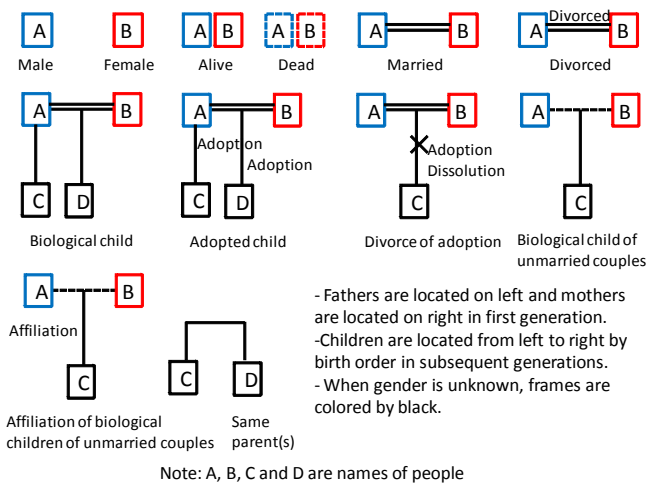


Figure 3. Basic design.

- (1) Gender is distinguished by colors (males/blue; females/red) and not by shapes. The person icons are square. When gender is unknown, the frames are colored black. The names of the person objects are annotated in the frames.
- (2) Solid lines are used for the frames of living person icons, and dashed lines are used for the frames of the dead.
- (3) A double solid line between couples indicates marriage.
- (4) “Divorced” is annotated above by a double line that indicates marriage.
- (5) A solid line from a parent or a line connecting parents to a child indicates a biological child.
- (6) “Adoption” is annotated next to a solid line that indicates the parent and adopted children relationship.
- (7) “Adoption dissolution” is annotated next to a solid line that indicates the dissolution of the parent and adopted children relationship, and a cross is marked on the line.
- (8) A dashed line indicates unmarried-couples who have children.

(9) When a father affiliates his child, “affiliation” is annotated on the father's side of a solid line that indicates a parent-child relationship.

(10) A horizontal line among children indicates that they have the same parent(s).

(11) Fathers are located on the left and mothers on the right in the first generation.

(12) Children are located from left to right by birth order without distinguishing between biological or adopted children. When birth dates are unknown, the sons are located from the left.

Figure 4 shows a kinship diagram in Figure 1 in our design.

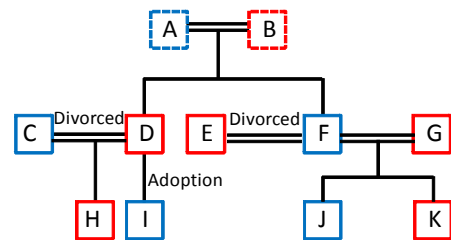


Figure 4. Design corresponding to kinship diagrams in Figure 1.

### 4. IMPLEMENTATION

#### 4.1 FamilyRetriever

We developed a system called FamilyRetriever that dynamically moves person objects with two features: a chronological display and a direct-line search function to explore family trees.

Figure 5 is an example screen of FamilyRetriever.

In the main window, users can display and move any person object with the following two functions:

- (a) Chronological display function: users can set dates either using a time slide bar or by direct selection. They can display objects by dates.
- (b) Direct-line search function: users can select a person and display spouses, ascendants, and descendants. Here users can see adoptive parents and adopted children. Users can change modes to display names of current and former spouses.

On the right hand side display of the system, the attribute information of a selected person is displayed and such related data as photos can be selected and displayed.

#### 4.2 Example

Japan has a family registration system called Koseki in which citizens are registered based on the parent-children relationship. A user obtained all the copies of the registration permitted by law. 166 people were input to the system. The eldest person was her great-great-grandmother born in 1840.

Figure 5 is an example in which the date was set as Oct. 2, 1911.

The user can view the quick history of a selected person, Yoshino Umeki, who is highlighted yellow, using the chronological display and moving the slide bar from her birth. She was born Yoshino Ochi in 1881 as the third child of Jitsuo Ochi and Yae Ochi. Her older sisters were already dead. She married Ayao

Umeki and changed her surname to Umeki, had a son, got divorced, changed her surname to Ochi again, remarried her ex-husband, changed her surname back to Umeki, gave birth to a daughter, had another son, and died in 1915. When the user selects an icon of the attribute information, a photo of her family of 100 years ago is displayed.

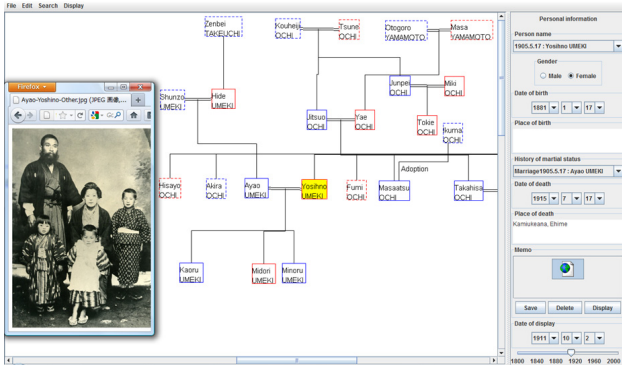


Figure 5. An example screen.

## 5. RELATED WORK AND DISCUSSION

FamilySearch [6] and Ancestor [7] are two well-known family retrieval systems. Most existing family tree systems have static displays. We have a dynamic display with movable person objects.

Typical family tree systems do not show gender, dead or alive, and so on. Some systems [3] show such information, but its design process is unknown. We have proposed a methodology to design the symbols for family trees and designed them based on questionnaire surveys.

There is little research on family trees in computer science. Wesson et al. [8] focused on the user interface for browsing family tree information. Park and Choe [9] presented a preliminary artwork of visualizing family trees as information visualization research. No system has a chronological direct-line search function. To the best of our knowledge, no research exists about what symbols to use for family trees.

Outside computer science, there are systems that deal with genealogical information based on their respective purposes. Kinship and genetic diagrams have been implemented on computers. Most have static displays but not dynamic displays with a chronological direct-line search function.

Shibata et al. [10] developed a system that displays the relationships between gods and goddesses in mythology. Sugito developed a tool for cultural anthropology that was also used in history. These tools were customized for their respective purposes.

Mcilvaine-Newsad [11] proposed a step-by-step methodology for documenting household composition and other changes by drawing timelines. They presented a document household timeline without investigations by questionnaires.

The purpose and objectives of our research are different. The primary objective is to develop family retrieval systems and design the symbols for family trees.

The following are our paper's main contributions.

First, we presented a concept of dynamic and chronological display for family retrieval systems. We implemented a prototype based on our approach.

Second, we proposed a methodology to design the symbols for family trees for family retrieval systems.

Third, we introduced appropriate symbols for computers for family retrieval systems including such biological and legal relationships as marriage and divorce, adoption and adoption dissolution, and affiliation based on questionnaire surveys. We found that understanding the meanings of traditional symbols is not easy.

## 6. CONCLUSIONS

We presented a family retrieval system that moves person objects and provides chronological display and direct-line search functions to understand family history and organize family information.

Based on questionnaires, we designed the symbols of person icons and links among icons, such as male or female, dead or alive, married or divorced, and adoption and adoption dissolution.

We developed a prototype system called FamilyRetriever based on our approach.

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