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A KFD web database system with an object-based image retrieval for family art therapy assessments

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ABSTRACT

In this paper, we apply the DataBase Management System (DBMS) to Kinetic Family Drawing (KFD), which is a widely used assessment tool in family art therapy. We developed a prototype of the KFD Web database for managing large amounts of KFD assessment data, and supporting an efficient KFD assessment process by analyzing the requirements of family art therapists. We also devised and implemented a novel object-based image retrieval algorithm by using high-level features that are recognizable by humans in the context of the KFD Web database system. Consequently, a family art therapist can more consistently and objectively assess family problems by referencing the existing assessment content that was obtained with object-based image retrieval and a systematic knowledge management system in the KFD Web database system. We explain the proposed system's functions, and illustrate using case studies of object-based image retrieval. Our proposed system can be used as a useful supplementary tool, and it will aid humans in KFD sessions.

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Introduction

Family art therapy is built upon art therapy theory in conjunction with family system theory (Landgarten, 1987), and the latter emphasizes the influence that family members have upon one another (Bowen, 1978). Consistent with the family systems perspective, the goal of family art therapy is to provide families the opportunity to illustrate their family history, and with using the illustrations, they will discover a new alternative for ending their problems. Riley and Malchiodi (2003, pp. 102–103) asserted that the main goal of using art in family therapy is to help families become "open to broader perspectives, and to support a change in redundant, dysfunctional patterns of behavior" through art. By observing patterns of family behaviors, the therapists learn about family members' relationships with one another and about the system of which they are a part. Riley and Malchiodi believe that therapists are able to gather more data by using art as a technique rather than using verbal interviews alone.

Kinetic Family Drawing (KFD) that was developed by Burns and Kaufman (1970, 1972) is the most frequently used assessment tool in the field of family art therapy. In KFD, a child is asked: "draw everyone in your family, including you, doing something, some types of action". The KFD allows the therapist to get a meaningful glimpse of the child's view of the dynamic relationships among family members, and of the child's adaptive and defensive responses to the forces and actions of various family members. According to Burns (Burns, 1982; Burns & Kaufman, 1970, 1972), the KFD allows us to see the self as it is reflected and expressed in the family; it enables the child to depict the family as a functioning, active unit, and it allows the therapist to see the child's impressions of these interactions among family members (Handler & Habenicht, 1994).

Image data sketched by the patient and the assessment data that is conducted by the family art therapist are not systematically managed in current family art therapy sessions. Moreover, conducting KFD offline may be restricted by time and space, and each family art therapist may differently interpret the same picture depending on the personal subjectivity and the experience of the family art therapist. Betts stated that the House-Tree-Person draw, the Draw-A-Person and the KFD, which are known as psychological projective tests, all have highly questionable validity (Betts,

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2006). The reason why most psychologists no longer use such tests may be the complexity of people and art. The causal relationships between the characteristics of drawings, personal traits and environments, and psychological symptoms can be complicated, diverse and even conflicting, such that art therapists and psychologists are often forced to proceed with their work on the basis of subjective and rather uncertain knowledge, relying on professional observation and judgment rather than any theory or existing method (Kim, 2008). Accordingly, we recommend applying current computer technologies to address the aforementioned problems.

Very few studies have been conducted for using computer technologies with the KFD, but interesting studies have recently been reported in the field of general art therapy. In an effort to apply computer graphics to art therapy, Hartwich and Brandecker (1997) directed clients to draw with using a tool such as Adobe Photoshop (Adobe Creative Team, 2004), and then they examined the responses. This attempt showed the innovative use, although on a limited level, of computer technology applications in art therapy. Kim, Kim, Lee, Lee, and Yoo (2006) developed an expert system for art therapy. This system is capable of processing drawn characteristics, psychological symptoms, individual environments and psychological disorders, and it is expected to achieve significant progress in systemizing the knowledge of art therapy. Kim, Ryu, Hwang, and Kim (2006) improved the system by increasing its capacity of maintenance consistency, reliability evaluation and machine learning. Kim, Yoo, and Kim (2007) presented a framework for the expert system knowledge base in art therapy. Kim, Bae, and Lee (2007) applied the technologies available in the field of digital image processing to develop a computer system for automatically rating two elements, number of colors and the list of colors used, as well as the area of each color painted, the number of clusters, the length of edges, etc. Kim (2008) delineated the development of a computer system that judges both the main color and the placement category in a drawing by applying the available methods in the field of digital image processing.

Unlike the abovementioned studies, the focus of this paper is applying DataBase Management System (DBMS) (Silberschatz, Korth, & Sudarshan, 2006) to the KFD. We propose a prototype for a KFD Web database for managing large amounts of KFD assessment data, and for achieving an efficient KFD assessment process by analyzing the requirements of family art therapists. The proposed system is divided into a client module and a family art therapist module. First, the client module provides a familiar drawing board to enable the client to easily draw online. In the KFD, the time and the order of drawing pictures are especially important observations for assessing family problems. Therefore, the proposed system stores the client's drawing process in a database, so that the family art therapists can replay the whole sketching process when they perform a KFD assessment. This function is helpful because it offers more detailed and efficient problem assessment by offering replaying and reviewing the order of a drawing and/or scenes that the family art therapist may miss in the assessment process. Second, the family art therapist module is comprised of an assessment support module, a search module and a knowledge search module with the object-based image retrieval: (1) The assessment support module provides the assessment form of Burns and Kaufman. Moreover, the distance between family members, the size of the family member and the location of family member (important factors that reflect family relations) can be automatically calculated with simple mouse operation. (2) The search module provides the family art therapist with the search function for the KFD data and the assessment's contents; furthermore, it enables treatment follow-up and it confirms the client's treatment results. (3) The knowledge search module accumulates KFD related knowledge in a database, and then it makes this knowledge available for assessment. Moreover, the accumulated data can be referred to, since similar image retrieval enables referring to the existing assessment summary, which is easily performed through object-based image retrieval during the assessment. Consequently, consistency and objectivity can be more or less elaborative in the process of KFD assessment.

Traditional image retrieval methods are keyword-based, content-based and object-based methods: (1) Keyword-based image retrieval requires that a human assigns a subject keyword to the image, and then retrieval is conducted by using this keyword. Keywords that well express the images should be stored in a database in advance. Retrieval may be difficult if the users do not know the keywords that were established for the corresponding images (Baxter & Anderson, 1996). (2) Content-based image retrieval is the extraction of low-level features; including shape; color and texture from the image (Do & Vetterli, 2002; Huang, kumar, Mitra, & Zabih, 1997; Saykol, Gudukbay, & Ulusoy, 2005; Zhang & Lu, 2002); however; it has a disadvantage because low-level features are different from the characteristics that humans can recognize. (3) Object-based image retrieval is the use of high-level features that humans can recognize such as expressing the locations of objects and images with using a character string (Huang & Jean, 1994); and comparing objects by expressing them with a graph (Bilodeau & Bergevin, 2003). Object-based image retrieval is now being actively researched.

In this paper, we also propose a novel object-based image retrieval algorithm that expresses the location, the size and the distance of objects as numerical meta-data in the context of the KFD, and this is accomplished in the KFD Web Database System. The objects and their relations are expressed in an image, and the images are then searched and compared by using a reciprocal of the Euclidean distance as a similarity measure. Our proposed method achieves the retrieval of most similar images that are stored in the KFD database by using the location of family members, the size of a family member and the distance between family members with basic mouse operation. The assessment results and the image search data are provided to the family art therapist in real time. Thus, family art therapists can more objectively and consistently assess problems by retrieving and referencing the existing assessment contents.

This paper is organized as follows. In Section 2, we introduce the proposed KFD Web database system. In Section 3, we describe a novel object-based image retrieval system in the KFD, and we present retrieval cases. In Section 4, we present our discussion and the conclusion.

The KFD Web database system

Table 1 describes the development environment of the KFD Web database system. MySQL 5.0 is used as a database and the MVC pattern-based system is built by using JSP and JavaBean for easy system expansion. Fig. 1 shows the overall architecture of KFD Web database system.

The client module

The client module is implemented for drawing pictures by using a drawing board, as is shown in Fig. 2a. Since capturing the entire

Table 1
The development environment of the KFD Web database system.

Items	Specification
CPU	Pentium4 3.4 GHz
RAM	1024 MB
OS	WindowsXP Professional
Database	MySQL 5.0
Web server	Apach Tomcat 5.x
Development tools	EditPlus2, VisualStudio 6.0, Eclipse Sdk 3.x

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