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The Arts in Psychotherapy 35 (2008) 49–59

THE ARTS IN PSYCHOTHERAPY

# Computer determination of placement in a drawing for art therapy assessments

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**Abstract**

Important elements for art therapy assessments include the placement of the subject matter of a drawing on the paper. The placement is classified into 1 of 10 categories, a usual and 9 unusual ones. Similar to other elements in a drawing such as the color, theme, line, shape, structural organization, etc., the determination of placement category encounters the problem of human raters' subjectivity. This paper delineates the development of a computer system to determine the placement category automatically and objectively, applying the digital image processing methods of color recognition and edge detection. The system divides the entire page into several regions and considers the distribution of edge pixels in each region as the criteria for the corresponding placement category. The proposed computer procedure can provide clear, accurate and quantitative information on the placement category. The information is also useful for the determination of space usage and the details of a drawing. The computer system is verified through case studies. It can become a useful tool and an aid for human experts' ratings in art therapy assessments.


*Keywords:* Art therapy assessments; Rating system; Placement category; Space usage; Computer system; Digital image processing

## Introduction

Important elements for art therapy assessments include, in addition to the color, theme, line, shape, structural organization, etc., in a drawing, the category of placement of the subject matter on the paper. The placement categories include a usual and nine unusual ones. A usual placement refers to an image drawn in a balanced manner on the whole paper, and unusual placement refers to an image drawn predominantly in some region of a paper. In this paper, the unusual placements are classified into nine categories depending on the region in which the image is predominantly drawn. Each of the nine categories may be used to give information about the emotional or psychological state, or social status of the drawer. The rating system of the Diagnostic Drawing Series (DDS) specifies the unusual placement as one of its 23 elements to be rated (Cohen, 1986/1994). In the DDS, placement is defined based on the region divided into grids vertically and horizontally. Three categories of unusual placement, upper (U), left (L), and right (R) are defined in the DDS: the image is drawn predominantly above the middle of the page (horizontal axis) or most of the image is drawn to the right or left of the vertical axis; particularly when the remainder of the page is blank.

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doi:10.1016/j.aip.2007.09.004

One should be cautious in interpreting a certain category of unusual placement as patients' emotional states or social status, since people and art are too complex, to interpret a single sign of an element in art assessment as substantial evidence of their characters (Cohen & Mills, 1994). A single sign may have different meanings depending on nationality, personal, cultural, social, and educational experiences.

However, a single sign can raise questions which must be addressed (Cohen & Mills, 1994). Several studies have reported that the psychological state and social status of the patient may appear as a certain category of unusual placement in a drawing, allowing its emotional meanings to be identified. Lev-Wiesel and Drori (2000) have analyzed the Draw A Person (DAP) drawings of elderly widows and wives based on projective hypotheses. Widows usually have fears about their physical safety and security, being alone, darkness, and victimization, along with the feelings of being unwelcome in the world of couples (Hammer & Piotrowski, 1997; Lopata, 1976, 1996). The size of drawings by widows tends to be smaller and the placement of their subject figures' heads lower than those in drawings by wives.

The placement of the drawing's subject at the center of the paper may indicate an appropriate control of the environment, while the placement at the upper-center may reflect an optimism regarding goals (Machover, 1949; Wanderer, 1997), haughtiness, or superiority to others (Buck, 1964) and at the bottom-center a sense of insecurity, inadequacy, and depression (Machover, 1949). We note that in Swensen (1957), Machover's hypotheses dealing with the 'placement' variable was not supported by later studies, and in Roback (1968), it was not 'generally' supported. Swensen (1968) reported nine positive studies supporting the hypotheses and six negatives and concluded that such findings should be accepted with caution. Compared with the fact that white patients' drawings typically show normal size (about 18 cm) and the upper-center category of placement, black patients' drawings tend to be smaller in size with a bottom-center category (Adler, 1970, 1971). The bottom category reflects the low self-image resulting from contraction of social role (Lorge, Tuckman, & Dunn, 1958).

However, in determining placement category, art therapists are often forced to proceed in their work on the basis of subjective observation, relying on professional judgment and individual experience. For example, placement category in one drawing could be classified as usual by some raters or a bottom-left category by others, as shown in the samples of this study.

These difficulties can be overcome by technologies of digital image processing, improving the quantification and objectification in the process. Kim, Bae, and Lee (2007) have developed a computer system to rate the color-related formal elements in art therapy assessments. Its approach is expected to bring about significant progress in the quantification and objectification of human decisions related to colors and also to reduce the human experts' subjectivity and inconsistent judgments and save time and effort in art therapy assessments.

The present paper delineates the development of a computer system to determine placement category in a drawing. The system uses the same methods as those used for blurring, clustering, transforming colors into standard colors and edge detection in analyzing color (Kim et al., 2007). Placement category is determined on the basis of the distribution of edges pixels, once the edge have been detected by color differentiation. When the number of edge pixels falling in a specified region is greater than the critical (threshold) value established as a criterion, the category of unusual placement corresponding to the region is decided.

The following section introduces methods for edge detection. We define placement categories based on the areas of regions and the numbers of edge pixels in regions and establish the criteria for placement categories. In the next section, we illustrate the process of decision through case studies. The system provides numerical information on placement categories and other characteristics such as space usage and details of a drawing. In the following section, we verify the usability and utility of the system using real sample drawings, and compare the system's decisions on placement categories with human experts' decisions. In the discussion section, we explain the flexibility of defining placement categories in terms of the criteria involving the division of the paper into regions and the critical number of pixels. We mention space usage as an element of computer rating. We also suggest an expert system approach to overcome the difficulties associated with the use of projective tools in the interpretation of placement categories.

## Methods for edge detection and definition of placement category

### *Methods for edge detection*

First we detect edges in a drawing where color changes using the same methods as those that have been used for color analysis for art therapy (Kim et al., 2007); the edge consists of pixels of which the color is different from that of