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A computer system to rate the color-related formal elements in art therapy assessments

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Abstract

The authors consider the colors used in a drawing to be one of the most important factors in art therapy assessments. This paper delineates the development of a computer system designed to rate several color-related elements, including the number and list of the colors used, elements common in art therapy assessments. We propose other possible elements such as the number of clusters for each color, the area of each color, and the length of edges where one color changes to another. These elements can provide useful information on patients, but their accuracy and objective ratings have been hard to obtain by human raters. We devise computer methods of color recognition and edge detection. The proposed color recognition procedure adopts the National Bureau Standard's criterion for distance between colors in the *HVC* (Hue, Value, Chroma) color space. The edge detection procedure applies blurring, clustering, and transformation to a standard color. The system can provide more accurate, detailed, objective, and new rating scales related to color. It can also reduce the time and effort of human raters. The proposed system is verified through case studies, application to an existing rating system, and analysis of sample results.

Keywords: Art therapy; Art assessment; Computer system; Rating scale; Color recognition; Edge detection

Introduction

Color in art therapy assessments

Art therapy assessments have been widely accepted as an effective tool to provide valuable information on patient evaluation. Color is one of the most important factors in art assessments. Lowenfeld and Brittain (1982) asserted that color becomes significant to children for the first time at about 5–7 years of age, followed by the next stage at 9 years of age as the child begins to use color to represent specific objects. The child is able to respond with specific emotions to different colors by the age of 14. Milne and Greenway (1999) demonstrated the hypothesis statistically that males and females differ in their use of color in drawings; in addition, older males tend to use fewer colors than younger males, whereas no similar divergence is shown in females.

Colors not only have a physiological impact on human thought processes and behavior (Steinhardt, 1977), but may also have a subconscious psychological impact beyond people's conscious awareness (Kreitler & Kreitler, 1980). Colors are perceived to be closely related to emotions (Hollins, Horrocks, & Sinason, 1998; Malchiodi, 1998). How people react to and use color can provide important diagnostic information regarding their current emotional status (Lev-Wiesel & Daphna-Tekoha, 2000). Although colors do not mean the same thing to everyone, emotions attributed

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to red are often thought of as violence, passion, aggression, and anger; yellow, hospitality; brown, timidity (Hammer, 1953, 1969; Klepsch & Logie, 1982; Precker, 1950). Moreover, the therapeutic value of color has long been recognized (Ghaffurian, 1995). Rorschach (1951) regarded color as providing a means through which people can reveal emotion. There are reports that child victims of severe sexual abuse (Malchiodi, 1990) and depressed patients (Gantt & Tabone, 1998; Wadeson, 1980) tend to use only one or two colors in their drawings. The victims of trauma express their psychological pain, anxiety, fear, sorrow, loneliness, and hopelessness by selecting colors. Children who experienced natural disaster such as earthquakes, hurricanes, and plane crashes tend to use a limited number of colors, not more than two or three, mostly consisting of black, white, and sometimes red (Gregorian, Azarian, DeMaria, & McDonald, 1996).

Color-related elements

Most art therapy assessments include various color-related elements in their rating systems. For example, the Descriptive Assessment of Psychiatric Artwork (DAPA) developed by Hacking (1999) includes list of colors and intensity; the rating system of the Diagnostic Drawing Series (DDS) by Cohen (1986/1994) incorporates color type, blending, and idiosyncratic color; and the Formal Elements Art Therapy Scale (FEATS) rating system (Gannt & Tabone, 1998) of the Person Picking an Apple from a Tree (PPAT) by Gannt (1990) focuses on prominence of color and color fit. While these are elements directly color-related, there are other elements indirectly color-related, such as area, space, details, elaboration, placement, emotional tone, etc. In this paper we propose several color-related elements which can be rated by computer. Some of them provide useful information on patients that have been hard to obtain by human raters. Others are new elements that this paper proposes for the first time.

Color-related elements can certainly be rated by human raters, but this involves the problem of subjectivity of rating art, a limitation inherent to all art therapy assessments. The raters are often compelled to proceed in their work on the basis of subjective and rather uncertain knowledge, relying on professional observation and judgment. It has been pointed out that, even when raters were provided with concrete descriptors for ratings of all levels of each of the scales, they likely rated aspects of drawings differently simply because they liked certain drawing better than others (White, Wallace, & Huffman, 2004). All ratings of elements of the DAPA, the DDS rating system, and the FEATS are more or less subjective and their rating results may differ depending on the reviewers. Also many rating systems are based on the dichotomous scale, such as "yes" or "no" type, or the interval scale, such as Likert type, which cannot provide sufficient information and, as Leavitt and Schimmel (1991) pointed out, has a serious limitation on the sensitivity of the assessment. Therefore, we need to develop methods which can provide more detailed scales. Another problem is that the rating requires considerable time and effort of raters. For example, the rating system DAPA (Hacking, 1999) normally takes 5–20 min per drawing. This would prove cumbersome in circumstances where dozens or even hundreds of drawings would need to be rated.

Furthermore, there are various color-related elements that give valuable information on patients but can be rated only cursorily by human raters so that they produce information of little use. This kind of elements includes, for example, number of clusters for each color, area painted of each color, length of edges, etc. A cluster refers a contiguous area painted with the same color, not separated by different colors. Conversely, by a computer's capability, new color-related elements can be proposed as a potential to give valuable information to supplement existing rating systems.

A computer system

New technologies can overcome the difficulties of subjectivity, inconsistency, time and effort consumption of human raters, and development of new scales by using computer automation or expert system with artificial intelligence. The present paper describes the development of a computer system that analyzes the colors in a drawing, and thus rates various color-related elements in art assessments. First, the 'noise' of a drawing is removed by blurring and clustering (Bartkowiak & Domanski, 1995; Wan & Kuo, 1998; Ye, Gao, & Zeng, 2003). Noise, a term in digital image processing (Gonzalez & Woods, 2002), means unintended 'touch' or 'non-touch' of drawing material, which occurs when the thickness of the tips of crayons causes the drawer to color in unintended space or not fill in the intended space for coloring. Next, the system detects the colors used and transforms them into standard colors. Thus, the number and list of colors used, and the number of clusters for each color are readily obtained. Finally, using the numbers of pixels and clusters of each color, other useful quantitative ratings of elements can be obtained, including the empty space, the areas of each color, and the length of the edges where the color change occurs.