THE RAINBOW TECHNIQUE: AN INNOVATIVE APPROACH TO THE ARTISTIC PRESENTATION OF 3D COMPUTED TOMOGRAPHY

Kai-hung Fung, 19A Ngan Sing Mansion, Taikoo Shing, Hong Kong, China. E-mail: <khfung@ha.org.hk>.

Received 20 September 2005. Accepted for publication by Roger F. Malina.

Pointillism is a painting style that uses many tiny brush strokes or dots with brilliant colors to form an image [1]. Its most representative artist is Georges Seurat (1859–1891) of the Neo-Impressionist period. His famous painting A Sunday Afternoon on the Island of the Grande Jatte (1884–1886) is a prime example of pointillism [2].

Inspired by pointillism, I have conceived a new method of visual representation using lines instead of dots as the basic image elements for portraying 3D space. Each line itself is made up of a rainbow of colors. This form of representation can be realized in 3D computed tomography (CT) through selection of appropriate settings in commercially available software. I call this method the “rainbow technique.”

I used a 16-slice multi-detector CT scanner [3] for data acquisition. Actual data derived from human subjects as a result of CT scanning for medical purposes was utilized. Three-dimensional reconstruction was performed using a dedicated medical workstation with direct volume-rendered 3D software in color [4]. The “rainbow technique” utilizes a unique property of CT: 3D reconstruction builds on a stack of thin image slices fed into an appropriate 3D software program. A critical setting can be chosen so that the surface rendering of the 3D object starts to break up into contour lines representing individual slices. This critical setting depends on the window level and window width of the CT image that is optimized for the CT density value of the selected anatomical structure under study. The resolution setting is also critical in producing this effect. The effect is adjusted interactively in virtual reality. A rainbow color spectrum applied to the image at this critical setting using a spike algorithm gives rise to a striking display of colorful bands forming the 3D object (Color Plate A).

The rainbow technique enhances the artistic quality of 3D CT as a tool for creation of visual art. Like pointillism, it adds brilliance and color to the resultant image. The contour line effect is an artifact of 3D CT, and I turn this characteristic to good use. The effect emphasizes form and enhances sharpness and perspective. Given the appropriate setting, a “Venetian blind effect” is obtained, allowing objects both outside and inside an enclosed 3D space to be clearly seen in sharp contour. Objects with densities outside the optimum range for rainbow formation will be displayed in normal 3D rendering, adding scope to creativity by combining the two forms of representation.

References and Notes

3. The device used was a 16-slice multi-detector CT model Aquilion TXS 101A M16 made by Toshiba Medical Systems of Japan.
4. The software was Vitrea ® 2 version 3.4 by Vital Images, Inc. of Plymouth, MA.
WEB SITE AESTHETICS: THE SEARCH FOR PREFERENCE FACTORS

Muzeyyen Pandir, User Lab, Birmingham Institute of Art and Design, University of Central England, Gosta Green, Birmingham, B4 7DX, U.K.
E-mail: <muzeyyen.pandir@uce.ac.uk>.

John Knight, User Lab, Birmingham Institute of Art and Design, University of Central England, Gosta Green, Birmingham, B4 7DX, U.K.
E-mail: <john.knight@uce.ac.uk>.

Received 7 January 2005. Accepted for publication by Roger F. Malina.

Aesthetics has been dominated by intellectual speculation rather than empirical investigation. Aristotle’s aesthetics judgments, which have dominated the Western world’s aesthetics studies, were based on subjective judgments of beauty [1]. It was generally believed that beauty could not be measured. Berlyne rejected this idea. He conducted psychological experiments with people in order to reach an objective understanding of art [2,3] from subjects’ responses to paintings, visual patterns and sound sequences. Berlyne claimed that there was an appreciable degree of consistency among aesthetic responses of differing individuals [4].

Berlyne formed an aesthetic theory suggesting that the preference for any stimulus is related to its arousal potential. He proposed the most important factors of arousal potential as being structural properties of stimuli. These properties include complexity, novelty and ambiguity [5] and Berlyne called these properties collative variables. His theory argues that there is an inverted-U relationship between preference and arousal potential. This means that increases in arousal potential increase aesthetic pleasure. As arousal potential increases, however, it reaches an uncomfortable level and peaks, and pleasure starts to decline. Conversely, the theory suggests that stimuli with moderate arousal potential are the most pleasurable.

We conducted a pilot study to investigate aesthetic preference of web sites by applying Berlyne’s aesthetic theory. The experiment focused on judgments of the appearance of the web sites. Twelve subjects ranked 12 web sites in terms of their complexity, pleasingness and interest. In addition, they rationalized their choices through verbal reports.

Overall, the results of the experiment do not support the inverted-U relationship between perceived complexity and aesthetic pleasure that Berlyne suggested. However, his thesis concerning moderately complex stimulus was supported: Simple and moderately complex web sites were preferred. The least-liked web sites were those with high degrees of complexity.

We observed that subjective factors played a significant role in preference, in comparison to structural factors. Subjects often justified their preferences in terms of their personal interests and lifestyle. For example, web sites that featured subjects’ personal interests and tastes, such as outdoor pursuits or retro styling, were preferred. The primacy of content in determining aesthetic responses resonates with previous studies [5]. Semantic factors also affected preference. Some web sites were disliked because their meanings were not understood or because their messages were disliked. This finding echoes those reported by Martindale et al. [6].

The agreement among the judgments was statistically calculated. These results showed that there was agreement on perceived and objective measures of complexity. Pleasure judgments were similarly analyzed and levels of disagreement were calculated. Once again, the results highlight individual differences in subjects’ preferences as well as the difficulty of analyzing subjectivity with empirical methods. In addition, previous studies showed that differing aesthetic responses pertained to demographic factors such as age, gender, education and religious background [7] and to social differences such as lifestyle [8]. Despite these limitations, the findings were helpful for web designers and led to consideration of the differences between interactive and traditional media. Such research provides a pragmatic and novel way of considering design and understanding users.

The findings for interest judgments do not support Berlyne’s theory [9]. They show a negative correlation between complexity and interest. According to these results, the most interesting web sites were simple ones. Moreover, in the verbal reports, a relationship between interestingness and curiosity was observed. Subjects mentioned that in the simple (the least complex) web sites, a lack of information made them curious and inspired them to explore the site in depth.

Berlyne [10] observed a link between curiosity and uncertainty and suggested that curiosity was a form of motivation to learn more about a source of uncertainty. However, people may not be curious about everything of which they do not have sufficient knowledge. There needs to be another factor for curiosity, other than uncertainty. The findings suggest that interest may play such a role.

In contrast to Berlyne and his collative variables, this study suggests the importance of individual differences in determining the aesthetic responses. Individual differences include physiological differences as well as cultural and social factors such as fashion. Different tastes and personal inclinations reveal preferences for different web sites, and this leads to a lack of agreement on what is pleasing. The study suggests the efficacy of experimental aesthetic methods as a pragmatic design tool, but also their limitations in understanding subjectivity.

References
4. Berlyne [3].
Screen combines familiar game mechanics with virtual-reality technology to create an experience of bodily interaction with text. The language of the text together with the uncanny experience of touching words creates an experience that does not mesh easily with the usual ways of thinking about game-play or VR.

Screen is a collaboration with Andrew McClain, Shawn Greenlee, Robert Coover, Josh Carroll and Sascha Becker that was created in the Brown University immersive virtual-reality chamber (Cave), as part of a research project in spatial hypertext writing [1]. Brown’s VR chamber is similar to the University of Illinois’s CAVE—a virtual environment that shows 3D images while allowing users to continue to see their own bodies and does not require users to wear encumbering equipment (such as head-mounted displays, which are essentially blindfolds with televisions inside) [2]. Brown’s Cave is an 8-ft cube, missing its top and one side, and its walls and floor are projection screens. A projector pointed at each screen alternately projects images meant for the user’s left and right eyes. The user wears shutter glasses that alternately occlude the left and right eyes in synchronization with the projectors. The result is stereo VR—3D vision of computer-generated imagery—combined with the physical presence of the people and objects in the Cave.

The initial experience of Screen can be disorienting for those familiar with VR. Rather than make the walls “disappear,” we project flat images onto the same plane as the walls, reinforcing their presence. The images we project are not of colorful shapes but of white text on a black background. This text at first appears in an introduction that fades in and out on the walls and then forms three traditional paragraphs, each nearly filling one of the walls. Each of these paragraphs is a character’s moment of memory that gives rise to the virtual experience of touch. Each wall is read aloud after it appears. When the last has been read there is a pause, and then a word peels itself from one of the walls and flies toward the reader. If the reader does nothing, the word circles near her. Soon another word peels away, and then another, at an increasing pace, flocking around the reader. The reader can intervene in this process by batting at words with her hand. When a word is struck a sound is heard, and the word flies back toward a wall, perhaps breaking apart in the process. If a struck word is the only word off the walls, it, or part of it, will return to the space it left empty. However, if more than one word is off the walls, then a struck word may return to a different space.

Once the number of words off the walls passes a certain threshold—something that, with the increasing pace of peeling, only very active engagement can long delay—all the remaining words come free of the walls, swirl around the reader, and then collapse into the center of the Cave (Color Plate B No. 1). A final, “closing” text is then heard. In addition to creating a new form of bodily interaction with text, Screen creates three reading experiences—beginning with the familiar, stable, page-like text on the walls, followed by the word-by-word reading of peeled and struck text (where attention is focused) and then the more peripheral awareness of the arrangements of flocking words and the new (often neologistic) text being assembled on the walls. Screen was first presented in 2003 as part of the Boston Cyberarts Festival, and in 2004 it was included in “ALT+CTRL: A Festival of Independent and Alternative Games” at the Beall Center for Art and Technology, University of California, Irvine. A new version, built with G3D on Brown’s Linux cluster, is in process.

References
Archiving, Collecting, Documenting and Conserving the Media Arts

Throughout the 20th century, and certainly at an increasing pace since the 1960s, new art forms that feature technological components have been throwing traditional conservation and documentation practices into upheaval. These works of art are many and varied. They may be analog or digital, mechanical, and/or electronic; they are often multimedia based and include a variety of components, such as mechanical parts, software, electronic systems, varied electronic media formats, etc. Museums, which are charged with preserving and providing access to these works, often find themselves without adequate resources and must make do with methods and means that are poorly adapted to a growing number of artistic practices.

Guest Editors Jean Gagnon and Alain Depocas from the Daniel Langlois Foundation (Montreal) invite researchers, scholars, artists and others to submit articles for publication in a new special section in Leonardo concerned with documenting and conserving the media arts heritage. This new section is the journal’s contribution to a larger research alliance bringing together museums, universities and organizations from Canada, the U.S.A. and Europe with funding from the Social Sciences and Humanities Research Council of Canada (SSHRC) and the Daniel Langlois Foundation.

For the next 3 years, this section in Leonardo will publish articles and reports arising out of the alliance’s ongoing research. We wish to invite authors concerned about this constellation of problems to propose articles to Leonardo. We welcome articles under the following three programmatic headings:

- documentation
- cataloging
- conservation

Interested authors please contact:

Jean Gagnon and Alain Depocas
Leonardo Guest Editors
Fondation Daniel Langlois
3530, boul. Saint-Laurent
Montréal (Québec)
H2X 2V1 Canada
E-mail: <jgagnon@fondation-langlois.org>; <adepocas@fondation-langlois.org>.