Tactile Art through Technological Means

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1. ABSTRACT

Digital modeling used in conjunction with 3D printing and Computer Numerical Control (CNC) machining offers new opportunities for tactile art catered toward blind and visually impaired (BVI) audiences. The possibilities of combining tactile relief, tactile diagrams, tactile line-work, and braille into 2.5D and 3D art objects presents new artistic possibilities to create bodies of artwork and exhibitions that are widely and directly accessible to BVI audiences.[1] This is in contrast to current accessibility efforts within the museum setting where the primary focus has been to augment existing artworks with descriptions and tactile representations[2]. It is my goal to create an exhibition of artwork in which each original artwork is fully accessible to BVI audiences, rather than mediated through representations or descriptions. In this essay, I present two working prototypes and discuss the role of digital technologies in their creation.

Author Keywords

Braille, BVI, accessibility, tactile, CNC, 3D printing.

2. INTRODUCTION

The aim of this work is to explore the possibilities of technological modes of art creation and how technology might be used to help create unique artworks that address the accessibility of art to BVI audiences. Through new experimental modes of working dimensionally with braille in 3D modeling and 3D printing, and through applying proven techniques based on the Americans with Disabilities Act (ADA) signage standards to the process of tactile creative image making, I aim to create a repertoire of techniques that expand the tactile accessibility of my artwork.

3. REQUIREMENTS

Because of its proclivity for mathematical precision, digital 3D modeling presents the opportunity to work with braille in unique and under-explored ways.[3] Braille is a fixed size with a fixed spacing between characters, but within these parameters I am attempting to create legible phrases that dimensionally wrap around objects and/or diverge from the straight and horizontally parallel conventions of braille text. This shaped braille serves as a design element while simultaneously functioning as text.

Text functioning as dynamic design is commonplace for digital and 2D applications for sighted audiences, but aesthetic design is under-utilized in the realm of braille.[4] By working with braille as an aesthetic element and simultaneously as a connotative element, I am attempting to make art which is equally accessible to both sighted and BVI audiences.

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[1] Nessim, Barbara. "Gallery Artworks." *Leonardo* 31, no. 5 (1998): 447. doi:10.2307/1576610.

[2] Reichinger, Andreas, Helena Carrizosa, Joanna Wood, Svenja Schoder, and Christian Low. "Pictures in Your Mind: Using Interactive Gesture-Controlled Reliefs to Explore Art." *ACM Transactions on Accessible Computing,* 11, no. 2 (March 2018): 2-21.

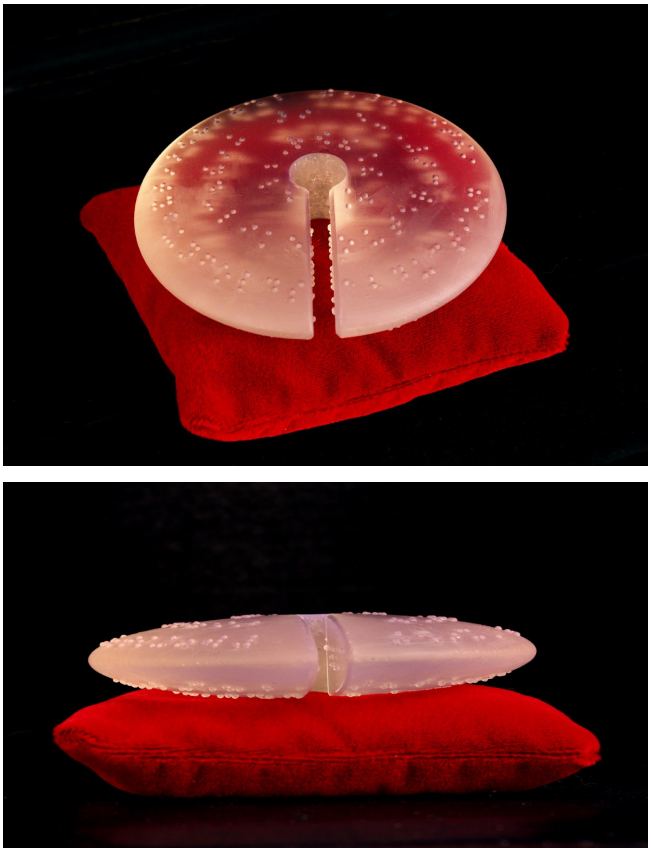
[3] Torr, Donald. "Computer-Supported Braille Applications." *American Annals of the Deaf* 124, no. 5 (1979): 691-95.

[4] Milner, John, and Kirill Sokolov. "Constructivist Graphic Design in the U.S.S.R. between 1917 and the Present." *Leonardo* 12, no. 4 (1979): 275-82. doi:10.2307/1573888.
Pasquariello, Lisa. "Ed Ruscha and the Language That He Used." *October* 111 (2005): 81-106.

Von Blum, Paul. "New Visions, New Viewers, New Vehicles: Twentieth-Century Developments in North American Political Art." *Leonardo* 26, no. 5 (1993): 459-66. doi:10.2307/1576044.

Gillick, Liam. "Peasant Uprisings in Seventeenth-Century France, Russia and China Barbara Kruger and the De-lamination of Signs." *Afterall: A Journal of Art, Context and Enquiry*, no. 5 (2002): 40-45.

In order to test my prototypes, I plan to ask BVI individuals their opinion about the prototype art objects and about their legibility. Any concerns and suggestions about design and legibility will be taken into consideration when making further iterations of this project. For example, the circular braille featured on *Unlegible Faberge Ovum* [**1]** runs in two different directions on each face of the piece. Because a circular object has no explicit top and bottom or left and right, I tried to present the text in two ways.[**4]** I will let BVI audiences voice their opinion on which option is more legible and intuitively accessible, or if either option is acceptably legible and intuitively accessible. Similarly, the legibility of 2.5D braille following curved paths featured in *Alternative Safe Space* [**2**] will be evaluated for legibility and design concerns. Once the acceptable parameters for working with unconventional braille text have been sussed with several BVI individuals, I can proceed with further artworks and have a better idea of the design problems from a BVI individual's perspective.



1. Hunter Stabler, Unlegible Faberge Ovum, 2018 3D printed resin, 4.25 inches x 4.25 inches x 1.5 inches

2. Hunter Stabler, Alternative Safe Space, 2018 CNC milled Colorcore plastic with inset clear acryllic and stainless steel balls, 8 inches x 9 inches x .25 inches

The ADA standards for braille allow for a dot of 0.059 inches (1.5 mm) to 0.063 inches (1.6mm) in diameter and a height of 0.025 inches (0.6 mm) to 0.037 inches (0.9 mm)**[3].** This can be accomplished in a few ways with the digital fabrication processes I am using. Within 3D printing the braille dots can be modeled in a 3D modeling program with a round dome or a domed dot. The braille dots can also be created with 1/16 inch balls recessed halfway into holes drilled by a CNC machine as seen in figure 2. These 1/16 balls can be made of a variety of materials and come in a variety of colors. With this CNC method, existing objects can be drilled to accept the 1/16 inch braille dots. It is also noteworthy that recessed method of friction fitting balls can be utilized with the 3D printing process as well. Recesses can digitally modeled to accept the 1/16 inch balls can be and then 3D printed. The braille dot spheres can then be added to the 3D printed model after it is printed.

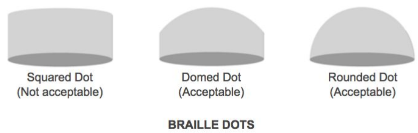
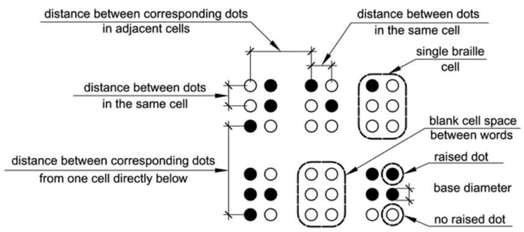


TABLE *11B*-703.3.1
BRAILLE DIMENSIONS

MEASUREMENT RANGE	MINIMUM IN INCHES MAXIMUM IN INCHES
Dot base diameter	0.059 (1.5 mm) to 0.063 (1.6mm)
Distance between two dots in the same cell[1]	*0.100 (2.5 mm)*
Distance between corresponding dots in adjacent cells[1]	*0.300 (7.6 mm)*
Dot height	0.025 (0.6 mm) to 0.037 (0.9 mm)
Distance between corresponding dots from one cell directly below[1]	0.395 (10 mm) to 0.400 (10.2 mm)

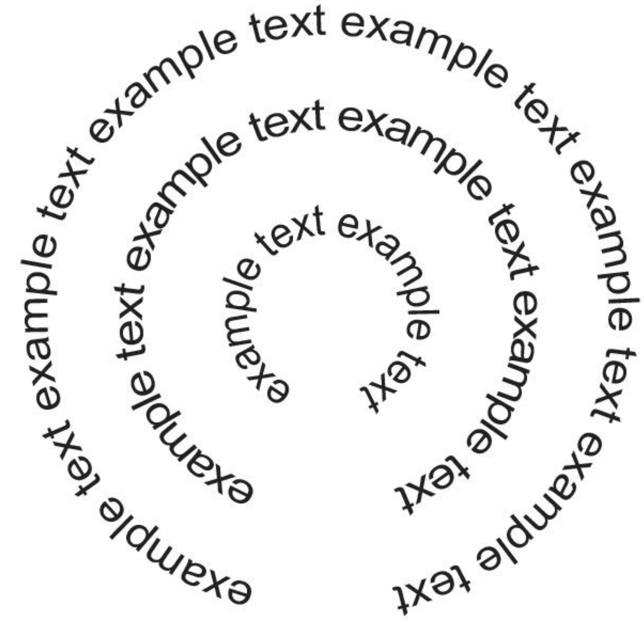
1. Measured center to center.

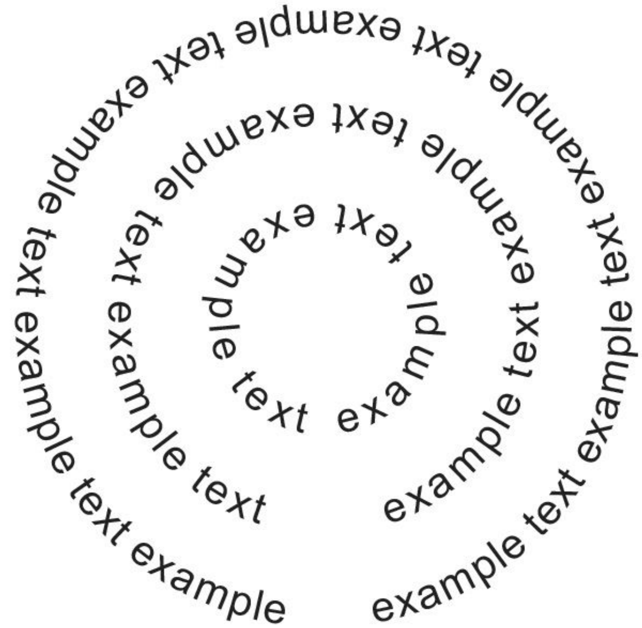


3. ADA Standards for Accessible Design (ADAS) for Braille dimensions

4. Conclusion

The techniques discussed herein outline a series of tools that can be used to create artworks that provide a directly accessible experience of art objects to BVI audiences. Digital modeling and digital fabrication techniques allow for this possibility where as it would be extraordinarily difficult to accomplish similar results manually.[5] As we strive as a society to make our shared spaces more accessible to individuals with disabilities, it is my goal to create a body of artwork with BVI accessibility as a primary concern.





4. examples of text running in clockwise and counterclockwise to illustrate the two fashions in which braille is used on each face of *Unlegible Faberge Ovum*

[5] Hasper, Eric, Rogier A. Windhorst, Terri Hedgpeth, Leanne Van Tuyl, Ashleigh Gonzales, Britta Martinez, Hongyu Yu, Zoltan Farkas, and Debra P. Baluch. "Methods for Creating and Evaluating 3D Tactile Images to Teach STEM Courses to the Visually Impaired." *Journal of College Science Teaching* 44, no. 6 (2015): 92-99.

5. REFERENCES

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