



Procedural Patchwork: Community-Focused Generative Design for Quilting

Jordan Graves
Georgia Institute of Technology
Atlanta, Georgia, USA
jordangraves@gatech.edu

Gillian Smith
Worcester Polytechnic Institute
Worcester, USA
gmsmith@wpi.edu

Karen Royer
Worcester Polytechnic Institute
Worcester, USA
kmroyer@wpi.edu

Anne Sullivan
Georgia Institute of Technology
Atlanta, Georgia, USA
unicorn@gatech.edu

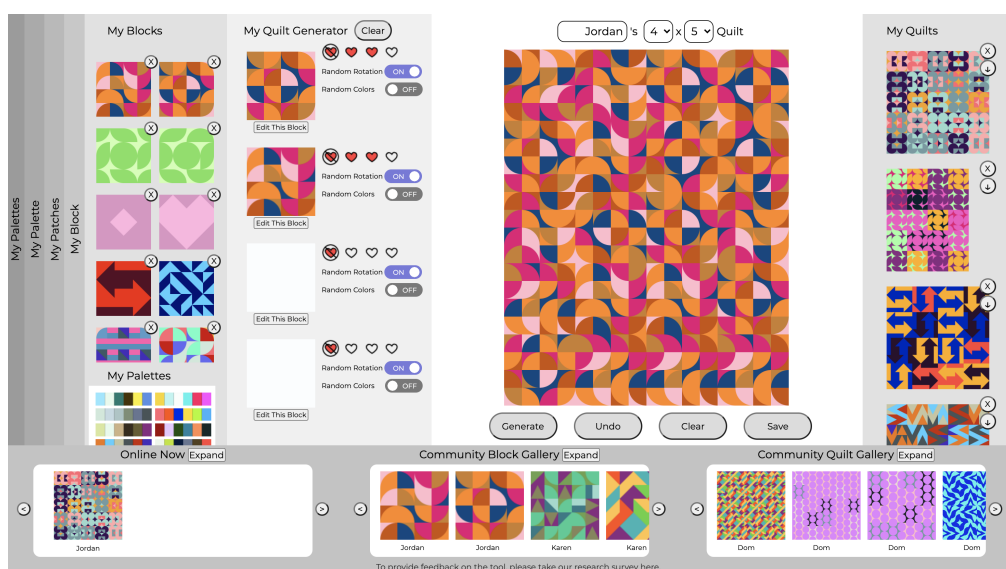


Figure 1: Code Crafters Generative Quilt Software. Current view shows the Quilt Generator.

ABSTRACT

We are developing quilt design generation software for Code Crafters workshops, which aim to broaden public awareness of computational thinking and build links between computer science and quilting. The software generates quilt designs, which will be manipulated and modified by workshop participants. Due to COVID, our workshops will be conducted remotely, so the software has been designed to increase the sense of community by providing opportunities for the types of social interactions that take place in colocated quilting workshops.

CCS CONCEPTS

• **Social and professional topics** → **Informal education; Adult education; Computing education.**

KEYWORDS

Design software, generative design, computational craft, quilting, adult education, computer science education, informal science learning

ACM Reference Format:

Jordan Graves, Karen Royer, Gillian Smith, and Anne Sullivan. 2021. Procedural Patchwork: Community-Focused Generative Design for Quilting. In *Creativity and Cognition (C&C '21)*, June 22, 23, 2021, Virtual Event, Italy. ACM, New York, NY, USA, 3 pages. <https://doi.org/10.1145/3450741.3466635>

1 INTRODUCTION

Code Crafters is a research project that investigates connections between quilting and computational thinking via design-based research to develop instructional workshops for an adult population of quilters. Through leveraging pre-existing social structures, skill

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).
C&C '21, June 22, 23, 2021, Virtual Event, Italy
© 2021 Copyright held by the owner/author(s).
ACM ISBN 978-1-4503-8376-9/21/06.
<https://doi.org/10.1145/3450741.3466635>

sets, and engagement in quilting, we aim to build a scaffold for improving adult engagement in computer science. We are developing the Code Crafters quilt design generator software which generates quilt designs for workshop participants to manipulate and modify.

Improved literacy in computational thinking (CT) is critical for navigating our increasingly computational society [7]. There are stark inequities in CT literacy in our society, with older adults, women, and people of color among the least represented among computing majors [4]. Textile arts practitioners, on the other hand, are highly diverse; quilters in particular are majority women, and come from a diverse range of backgrounds in terms of age, ethnicity, socioeconomic status, and education level [6]. Computational textiles in youth outreach have been successful in engaging more diverse audiences into computing [2]. Adults in textile arts communities already commonly use computers in relation to their craft, e.g. for social connections, sharing projects, and shopping for supplies. Code Crafters software and future workshops is designed with the goal of broadening public engagement in CT within quilting communities.

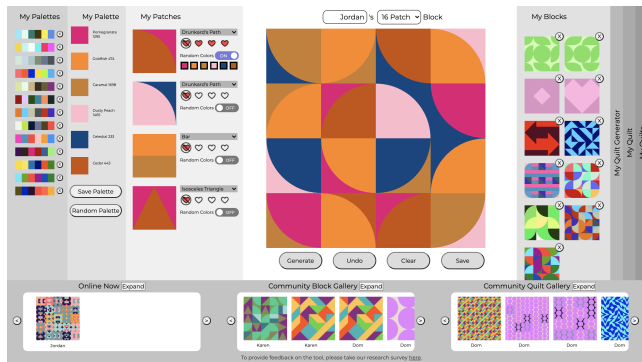


Figure 2: Code Crafters Generative Quilt Software. Current view shows the Block Generator.

2 SOFTWARE DESCRIPTION

The software we have designed for use in the workshops generates **palettes**, **blocks**, and **quilts**. The user is able to specify and modify constraints for the generator, as well as manipulate and change generated designs.

Our software generates block-based quilt designs, which are traditionally designs that are made up of smaller blocks, which are sewn together into rows and then joined to create a quilt top and quilt. Similarly, in our software, the user chooses which colors they want to use, specifies which types of provided *patches* they want to use in their *blocks*, and which *blocks* they in turn want to use in their *quilt* design. Because the quilts are made up of blocks, the software is designed to encourage block and palette generation first. Blocks that are saved can then be used in the quilt generation.

2.1 Community-Focus

Initially our workshops were planned to be held in person, and the software designed with this in mind. Due to the COVID-19 pandemic, our workshops will be held remotely but will still be

synchronous. This change has greatly influenced the design of the software. In-person quilt workshops are very social activities where participants can easily see what others are designing and sewing. This can encourage conversation as well as inspire and influence the quilts that participants design. The social aspect of quilting also parallels the perspective that computing is creative and collaborative [1][3].

While the software will be used in a remote synchronous workshop, it has been designed with community and sociability in mind. Supporting collaboration is a common design principle in creativity support tools [5]. While users are designing individual quilts, their saved designs are viewable to the entire community. These designs can be remixed and modified by the community. The software also displays what users are actively designing, mimicking the social aspects of in-person quilt workshops where participants are able to move around the room and see what others are sewing.

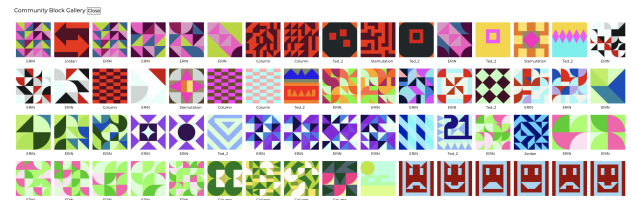


Figure 3: Blocks saved by users of the Code Crafters Generative Quilt Software.

2.2 Block Generator

To generate a block, the user first selects a palette to be used in the block. Palettes are made up of six colors, with colors matching Kona brand Cotton Solid Fabrics—a popular brand of solid fabrics among quilters, and the fabric line which contains the most number of colors available. Palettes can be software generated, modified, or created by the user. Saving a palette makes it available for future use, and the chosen palette also becomes part of the block data.

For block generation, our software lets users choose from five types of provided patches: Half-square Triangle (two triangles joined together on the diagonal to create a square), Bar (two rectangles joined to create a square), Drunkard's Path (a curved patch), Isosceles Triangle, or a single fabric Square. When a block is generated, patches are chosen from those specified by the user and arranged in equal numbers of rows and columns to form a block. In our software, blocks can be 1-patch, 4-patch, 9-patch, 16-patch, or 25-patch, as specified by the user.

The user can select up to four patch designs to be used in their block. A drop down lets users select which type of patch to use. Each patch can use one or two preselected colors from the palette, or the user can set the colors to be randomly chosen from the palette. If the user chooses to allow random colors, they may also choose which individual colors from the palette may appear in that patch, with the default being all colors allowed.

Heart icons are shown for each patch, and the user can use these to determine the probability for that patch to appear in the block. Additionally, users can specify if they want patches to stay in a

specific orientation, or allow the generator to add random rotations to the blocks.

After adjusting the settings for the generator, the user clicks the generate button to see newly generated blocks. These blocks can be manually adjusted—individual patches in the block can be clicked to rotate, or patches chosen by the user can be drag-and-dropped to replace another patch in the block.

2.3 Quilt Generator

Generating a quilt design is similar to generating a block. However, instead of patches as units, quilts are generated using blocks, each with a set of generation rules that can be determined by the user. The user chooses which blocks to include in the quilt, either from an individual's saved blocks or from the community library of blocks.

The frequency of each block can be specified by the user using the heart icons. Similar to patches, the user can also specify if they want the generator to use random colors and rotation. New palettes can be applied to each block in the generator by dragging and dropping saved palettes onto them. Generated quilt designs can also be directly modified by dragging a block design onto a block in the generated quilt design to replace it. Clicking on any block in the generated quilt will rotate it.

Like blocks, quilt designs can be saved for the user and added to the community library. Additionally, quilt designs may be downloaded as a png file onto the user's computer. Clicking on a saved quilt in the community library will open it in the quilt generator. When clicking on a community quilt, users can see in the generator which blocks were used, can generate an alternate, or modify the blocks and palettes used in the quilt generator.

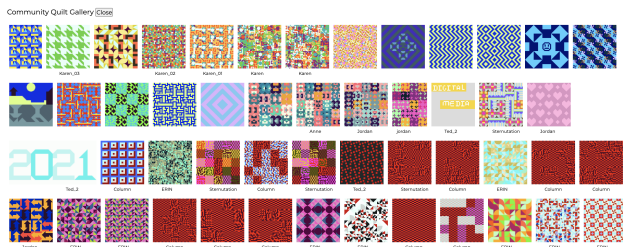


Figure 4: Quilts saved by users of the Code Crafters Generative Quilt Software.

3 WORKSHOPS AND FUTURE WORK

The Code Crafters Quilt Generator software has been developed to be used in workshops designed to answer questions about identity, attitude, and engagement in relation to computing and computer science, and how they change when taught about computer science in a way that aligns with their hobby. We hope to leverage the social, creative, and intergenerational practices of quilting to foster participant learning. Through participants using this software, we plan to investigate how generative design tools can be used to teach computational thinking in an informal media/arts workshop context. We will conduct surveys before and after the workshops to assess the success of our software and workshops. We are continuing to refine the Code Crafters quilt generator software through user testing to evaluate it as a design tool as well as a tool for remote collaboration.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant No. 1811233/1811130.

REFERENCES

- [1] Karen Brennan and Mitchel Resnick. 2012. New frameworks for studying and assessing the development of computational thinking. (2012), 25.
- [2] Leah Buechley, Mike Eisenberg, Jaime Catchen, and Ali Crockett. 2008. The LilyPad Arduino: Using Computational Textiles to Investigate Engagement, Aesthetics, and Diversity in Computer Science Education. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Florence, Italy) (CHI '08). Association for Computing Machinery, New York, NY, USA, 423–432. <https://doi.org/10.1145/1357054.1357123>
- [3] Yasmin B. Kafai. 2016. From Computational Thinking to Computational Participation in K–12 Education. *Commun. ACM* 59, 8 (July 2016), 26–27. <https://doi.org/10.1145/2955114>
- [4] Blanca Myers. 2018. Women and Minorities in Tech, By the Numbers. <https://www.wired.com/story/computer-science-graduates-diversity/>
- [5] Mitchel Resnick, Brad Myers, Kumiyo Nakakoji, Ben Shneiderman, Randy Pausch, and Mike Eisenberg. 2005. Design Principles for Tools to Support Creative Thinking. *Report of Workshop on Creativity Support Tools* 20 (01 2005).
- [6] Ellen Rushman. 2012. Modern quilting: DIY discourse. (2012). <https://digitalcommons.unl.edu/cehdsiss/142/>
- [7] Annette Vee. 2013. Understanding Computer Programming as a Literacy. *Literacy in Composition Studies* 1, 2 (October 2013), 42 – 64. <http://d-scholarship.pitt.edu/21695/>