Broadening Participation and Issues of Inclusion and Accessibility in Making

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ABSTRACT
The Maker movement and the broader "Do-It-Yourself" (DIY) culture celebrate innovation, creativity, and community engagement experienced through the open-ended processes of making. Within the Maker movement, there exists a wide array of genres of Making, ranging from cooking to sewing to woodcrafts and robotics. However, public gatherings of the Maker movement (such as Maker Faires) often attract a more homogeneous audience than the population at large. This session examines strategies for broadening participation in the Maker Community, exploring technologies and activities that are explicitly designed to engage more diverse audiences in Making. In particular we look to how inclusion and participation for younger children is developed through Squishy Circuits, e-Textiles, Scratch, and Makey Makey.

Categories and Subject Descriptors
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Scratch, Makey Makey, Squishy Circuits, e-Textiles.

1. INTRODUCTION
Mitchell Resnick frames the capacity for young children to gain access to the various genres of Making with the idea of creating a space of learning that is comprised of low floors, wide walls, and high ceilings. In terms of initial accessibility for children, low floors for easy entry are the ways in which learning tools and concepts are framed to simplify the concepts and processes. This simplified framing encourages immediate access, and continued participation. Wide walls allow children the room to explore new ideas, and roam freely in their explorations. Wide walls allow children the freedom to engage in play as they explore their learning environment. And high ceilings are needed to make room for the children's growth as they develop, and advance their skills. High ceilings are an indication of unlimited potential and provide encouragement to take each set of developed skills to the next level through the next iteration.

Scratch, Makey Makey, Squishy Circuits, and e-Textiles are examples of tools that epitomize this framing of Low Floors, Wide Walls, and High Ceilings. They are tools that have been designed, tested, and refined to allow for the greater inclusion of a broader participatory audience, and particularly that of children, into the digital, and physical computing environment of Maker culture and learning environments. In our discussion, we go into greater depth on each of these examples and discuss the implications for broadening participation and larger issues of inclusion and accessibility in Making.

2. Scratch
The Scratch programming language, developed by Mitchell Resnick and his team at MIT, allows children easier access to learning the principles of programming. Released in 2006, it is utilized extensively in both traditional school environments, as well as in informal learning spaces such as the Computer Club where it was first tested. Programming in Scratch is a process of connecting Graphical User Interface (GUI) drag and drop blocks into a work window. There are eight different types of blocks: Motion, Control, Looks, Sensing, Sound, Operators, Pen, and Variables which work in concert through their various commands. As a GUI programming environment the focus is taken away from needing to be syntactically correct in the programming process. This utilization of a GUI is intended to encourage a more playful process of developing programming literacy, by allowing for the programmer to move quickly through iterations of their building of the program.

With Scratch, young people can program their own interactive stories, animations, games, music, and art -- then share their creations with one another online. In the process, young people learn important mathematical and computational ideas, while also learning to think creatively, reason systematically, and work collaboratively. Scratch is designed to make the activity of programming more tinkerable, more meaningful, and more social -- and thus appeal to broader, more diverse audiences than traditional programming languages. Scratch builds on youth interests in popular culture, social media, and expressive communication.

3. MaKey MaKey
Makey Makey is an object interface board developed parallel to, and intended to work in concert with Scratch. Makey Makey consists of a PCB that has all of the inputs that it takes to operate a computer keyboard, and a usb port that allows for the Makey Makey board to be connected to a computer. This feature allows for any keyboard command operation to be conducted through the Makey Makey board directly, but more importantly the board allows for the connection of any conductive object to run keyboard operations by connecting the objects directly to the Makey Makey board. A common example of this is the connection of bananas to the Makey Makey board, which then

trigger piano notes to be played through a virtual piano developed in Scratch.

4. Squishy Circuits

Squishy Circuits, developed by AnnMarie Thomas, director of Maker Ed Initiative, is a set of DC powered motors, LEDs, piezo buzzers, and battery, that all interconnect through circuits made with play dough. Included with the kit is a recipe to make both conductive, and resistive paly dough, as well as instructions for various circuit-building projects. The goal of Squishy Circuits is to design tools and activities that provide more intuitive and playful ways for kids of all ages to create circuits and explore electronics -- in particular, through the use of play dough. This approach has allowed even young children to engage in learning about circuits by grounding making in materials that are well aligned to children's play.

5. E-Textiles

Finally, we turn to a complementary approach to learning about circuits and computation through electronic textiles (or e-textiles). E-textiles are articles of clothing, home furnishings, or architectures that include embedded computational and electronic elements. They also serve to illustrate that electronics can be soft, colorful, approachable, and beautiful. This work serves as a compelling example of how new materials can be a disrupter of the oblique gender representations in electronics, sparking perhaps the first ever female-dominated electronics hobbyist community around e-textiles.

6. CAPACITIES FOR INCLUSION

With the use of each of these tools in the learning environment we have seen capacity for allowing access to a broader audience of younger children. In one particular case the two-year-old child of one of the authors can often be heard running around the house constantly asking for the Makey Makey board to be set up so that he can make music by eating pizza, and smacking bananas. This example is clearly at the far end of the spectrum of the age range some of these tools have been designed for, and could hardly be considered as any kind of empirical evidence, but it is at a minimum a testament to the design of these tools to capture and engage even the youngest of children.