# Creative Soft Circuits: Introducing Soft Circuits Kits As A Tool To Engage Children Into Educational Arts And Crafts

**Paola Guimerans** pguimerans@gmail.com
School of Art, Media and Technology, Parsons the New School for Design New York, NY, United States of America

**Abstract**

In this paper the author describes how a soft circuit kit, that she has been designing as an arts and crafts educational tool for children, provides new and alternative avenues for creative expression. Soft circuits are wiring options created using soft and flexible conductive materials, such as conductive fabrics, threads or paints in conjunction with simple electronic components.

These new wiring options eliminate the need for soldering, and enables the possibility to easily teach children hands-on activities about how to incorporate simple circuitry into a variety of materials such as cardboard and paper. The paper's author is an artist, teacher and practitioner, whose studies emphasize reflection relating to new tools and techniques for combining technology and art. She has been co-teaching the "Collaboration Studio: Soft Circuits" which focuses on an innovative way of introducing hardware design and electronics to artists and designers within an educational setting. Also, she is an active collaborator in the MFA Design + Technology program in the School of Art, Media and Technology at Parsons The New School for Design in New York.

Throughout this paper are some examples of how children could benefit from these engaging learning experiences using this interdisciplinary approach. This approach emphasizes the generative aspect of art expression, as well as a playcentric approach to understanding and utilizing electronics. At the conclusion of this paper is an outlined one-day workshop taught by the author during the Maker Faire New York 2011 at the New York Hall of Science in Queens, NY. The Maker Faire is an annual event created by Make magazine to celebrate arts, crafts, engineering, science projects and the Do-It-Yourself (DIY) mindset.

**Keywords**

Soft Circuits, Interdisciplinary Education Research, Do-it-yourself, STEAM, Childhood.

## Introducción

As democratization of technology continues to grow, novel pathways and directions to learn and tinker with electronics have appeared for young audiences. The rising community of instructional tutorials to create soft circuits or interactive textiles, the emergence of workshops and activities to learn circuitry by using technology as a material for creative expression - including both traditional and novel materials - and the desmystification of electronics as a consequence of the variety of toolkits available today all offer alternative opportunities for children to learn between disciplinary boundaries. While education research in this area has opened mostly for the interest to create an accesibile a low-barrier entry point to technologies, these practices also have been representing a supportive context for research on interdisciplinary perspectives from STEM to STEAM-style education.

By describing a soft circuit kit that has been designed as an art and crafts educational tool, this paper is intended to suggest new emerging hands-on activities as a context for informal learning

settings such as art museums or after-school programs. The author proposes an alternative approach for learning electronics that could impact on the research for new pedagogical spaces for children to work stimulating creative processes within artistic education. She outlines how the open source movement, new craft movement and the hacker/maker subculture-as a technology based extension of DIY culture- by making accesible technology also suggests new opportunities for future children's arts and crafts education.

## 1 New Materials for interdisciplinary learning

Recently integration of electronics and computation into material culture within democratization of technology have been bringing new creative perspectives to learn across disciplines targeted for children. Nowadays, wearable and physical computing, crafts, digital arts and games can be combined in challenging educational and playful activities. More than in previous generations new engaging hands-on learning interdisciplinary opportunities working with technology and crafts have been flourishing at the novice level.

Today, we have access to new wiring materials, such as conductive thread fabric, or inks -results from the impact studies to introduce computation into textiles– that make it easy to join simple electronic components. Soft circuits, also known as electronic textiles (e-textiles), have been termed electrical circuits made of these novels "soft" conductive materials. Since those materials are safe and do not need to be soldering, they have become a great alternative to teach children basic concepts of circuitry and play. Thus, by offering an intuitive integration into traditional materials such as paper, cardboard or fabrics, suggests an approchable new field for researching hands-on learning, computer science and physical computing practices, and also as this paper suggests, for possible interdisciplinary directions for children's arts and crafts practices working with electronics.

During the last years, Hi Low Tech group at MIT, as well the increasing community of hackers, makers and creative practitioners have been working hard to sustain and extend this new field by setting up open tutorials and prototyping projects. At High-Low Tech research group, graduate students have been documenting an online collection of useful tools, materials and *step-by-step* instruction tutorials and curriculum to promote soft circuits activities to expand technological self-efficacy . The aim of the group is to democratize engineering and scientific understanding by making accesible technology for educators. For those reasons, the website is open and has well documented tutorials, downloadable handouts, editable templates and also retail information and links to buy these novel materials. Also, the group director, Leah Buechley, designed LilyPad Arduino, a computational construction kit specifically developed for soft circuits e-textile creations, which also is connected with an online community for sharing e-textile projects called Lylipond. In this context, soft circuits have been highly effective resources to creatively engage new young audiences to experiment with electricity. However, eventhough the soft circuits research field is growing, there is still a lack of instructional materials and resources focused on impacting children and educators in the arena of craft education utilizing technology.

Not so long ago, the first and only experience with circuits used to be associated with the use of soldering or breadboards. Nowadays, there are a number of kits that have been developed commercially for the construction of electronic textiles or paper electronics. Educational kits use to be associated to traditional art and craft activities, but today we can buy user-friendly kits that include customizable templates for decoration or short narrative stories for stimulating childrens imagination that teach children how to make a light up. By offering a limited set of components and explain the process, these kits make technology easy and are great tools for interdisciplinary learning activities. However, there are some notable constraints such as pre-manufactured kits, which limited options for further exploration . As an alternative, there are low cost soft circuits kits that include just the materials to build the circuit . Since these kits are not pre-manufacturated they are great customizable tools for individual teaching and learning styles. Also, a great place for educators to start to reflect on soft circuit activtities is by combining a variety of traditional materials, having the chance to explore and decide the importance of what each discipline insists upon.

The author of this paper, as an art teacher and creative practitioner working at the intersection of art, design has observed this context of new possibilities for designing soft circuit kit as an arts and crafts educational tool for children. By sharing the position that electronics can be used for understanding tecnological material, she suggests that this cultural moment allows for more flexible and creative approaches for teaching and learning technology in a number of diverse fields. By beginning to consider electronics as an other material, she suggests new opportunities for exploration and learning with alternative art and crafts in educational settings.

## 2 Creative Soft Circuits Kit

Art and craft educational activities can positively enhance childrens' experiences by fostering creativity, but also building congnitive development and personal self-expression. This kit is intended to present a new pedagogical approach of introducing soft circuits to children, putting emphasis on tinkering with electronics for stimulating creative processes within artistic education. The author, as an artist teacher, proposed an activity focus on children's' development of creativity with the intention of capturing childrens' imagination for craft and drawing practices by adding electricity.

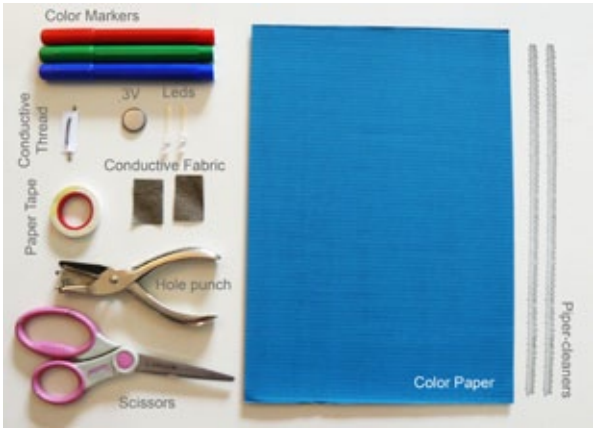


Figure 1. This educational soft circuit kit consists of: One color paper, Two Leds, Two piper-cleaners, Conductive thread, 3V batteries, Color markers,Paper tape, 2 pieces of conductive fabric. Tools are scissors and hole punch.

## 3 Workshop structure

The soft circuit kit was testing for the author at HTINK.org workshops during the Maker Faire New York 2011 . HTINK.org is an educational services cooperative focused on spreading technical learning and creative problem solving skills to as many people as possible. Their mission is to help promote STEM education through hand-on, constructivist approaches, with emphasis on physical computing, sustainable design, and digital fabrication .

For this activity, no previous electronic knowledge was required. The workshop started by a personal demostration of a finished model of a paper animal. The materials for the activities were given to the students in a kit. No circuit diagrams were in use.

Figures 2 and 3 and 4 . Tinkering and discovering how light-up an Led (left) drawing the animals face, tinkering with materials, crafting on their own papaper animal (right).

The author encourage children to tinker with the 3V batteries and leds to discover how to light up the color leds and understand how a simple circuit system works. She explained that those materials were for the animals eyes, and  encourage children to start to think about their animal drawing. Next, she explained step-by-step how to craft a pop-up animal and encourage participants to make the choice using scissors to design the face, body and develop the animals

shape. Also, she explained where to make the holes for making nots and where to tape the conductive thread and fabric. The only instruction participants got was to use their imagination and discover by playfully connecting the conductive materials and how to make the animal eyes light up.

Figure 5 and 6. Discovering how light-up an Led (left) drawing the animals face, tinkering with materials, crafting on their own (right)

When children completed their craft paper animal, they started to use color markers to draw. Some participants used glue for collage and paper decoration. Other children asked for extra color paper for drawing possible animals scenarios.

Figure 7. Selected artworks of children from the workshop

## Conclusion

The kit utilized during the workshop provided children with a limited set of materials that maked them comfortable to work with creatively by drawing and crafting. This allowed for self-expression while tinkering with electronics. Participants experienced excitement, interest, and motivation to add lights to their artwork by using their hands. The workshop-based setting provides an area for children to think about themselves as artists and crafts learners and also allows them to developed an identity as someone who knows how to use technology. Furthermore, a 1-2 hour activity session provides an engaging and positive learning experience for interdisciplinary activities in informal learning settings where children can learn electronics and work with their hands, which stimulates creative processes within artistic education.

This is the first step in this investigation. Next, the author will further explore new activities by approaching soft circuit kits as a tool for children to leverage their arts and craft skills by experimenting with electronics. There still lacks activities under this approach, but this limitation will be addressed in a future work.

**Acknowledgments**

I would like to thanks to Jon Santiago as well all his partners from HTINK.org and all workshop participants.

**Bibliographical references**

Atkinson, P (Ed.).Do-It-Yourself: Democracy and Design, Special Issue of the Journal of Design History, 19(1): 2006. ISSN 0952-4649

Ayres, C., Fanning,J.,Herron, J., Nicholas,A., Raffo,S., Simon,P., Yidi,A., : Archive of NSF/RISD Bridging STEM to STEAM Workshop. STEM to STEAM, 2011. [Consult. May 2012 –05-25]. Available at <URL: http://stemtosteam.org/archive/?page_id=428/ >.

Bandura, A. 1994. Self-efficacy. In Encyclopedia of Human Behavior (Vol. 4), Ramachaudran, V.S., Ed. Academic Press, 71-81.

Bdeir, A., (2009)"Electronics as material: Little Bits" MIT Media Lab, Eyebeam. In Proceeding of Tangible and Embedded Interaction.

Berzowska, J., Bromley, M.(2007) "Soft Computation Through Conductive Textiles", International Foundation of Fashion Technology Institutes Conference, 2007 (IFFTI '07)

Buechley, Leah, Nwanua Elumeze, and Michael Eisenberg. (2006) "Electronic/Computational Textiles and Children's Crafts". In Proceedings of Interaction Design and Children (IDC).Tampere, Finland: ACM.

Buechley, L, Hill, B., (2010). "LilyPad in the Wild: How Hardware's Long Tail is Supporting New Engineering and Design Communities" Proceedings of the Conference on Design of Interactive Systems. Aarhus, Denmark.

Buechley, L., Hendrix, S., and Eisenberg, M. (2009)." Paper, Paint, and Programs: First Steps Toward the Computational Sketchbook". In Proceedings of Tangible and Embedded Interaction (TEI), Cambridge, UK, February 2009, pp. 9-12.

Buechley, L., (2006) "A Construction Kit for Electronic Textiles". In Proceedings of the IEEE International Symposium on Wearable Computers (ISWC), Montreux, Switzerland, October, 2006.

Johnson, S., Thomas A., (2010) "Squishy Circuits: A Tangible Medium for Electronics Education"In proccedings CHI 2010.

Lovell, E.,A Soft Circuit Curriculum to Support Technological Self-Efficacy, MIT MS Thesis, 2011

Lovell, E.,Buechley L. , (2011) "LilyPond: An Online Community for Sharing E-Textile Projects". In Proccedings Creativity and Cognition 2011.

Moriwaki,M.,Brucker-Cohen,J.,Campbell,L.,Saavedra,J.,Stark,L.,Taylor,L., "Scrapyard Challenge Jr., Adapting an Art and Design Workshop to Support STEM to STEAM learning experiences", Published in the Proceedings of IEEE Integrated STEM Education Conference (ISEC 2012), Ewing, New Jersey, USA, March 9, 2012.

Qi, J. and Buechley, L. (2010). "Electronic popables: exploring paper-based computing through an interactive pop-up book". In Proceedings of the Fourth international Conference on Tangible, Embedded, and Embodied interaction .TEI '10. ACM, New York, NY, 121-12.

Thornton, A. (2011) "Being an Artist Teacher: A Liberating Identity?".International Journal of Art and Design Education", 30: 31-36.

Yasmin B. Kafai, Kylie A. Peppler, Quinn Burke, Michael Moore, Diane Glosson.(2010) "Fröbel's forgotten gift: textile construction kits as pathways into play, design and computation". IDC 2010: 214-217.