Thermochromic Paints: Introducing Reactive Materials to Teach Visual Artist with a No Technical-Education Color Theory to Animate Painting and Illustrations

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1. Introduction

The democratization of technology and its opportunities introduced an expansion of innovation for education towards new experimental curriculum and methodologies for artists and designers in an educational setting [1].
The DIY movement, open *source* and hacker culture has revived inventive practices. Crafts, soft computation, electronics textiles and online resources for knowledge exchange [2,3,4,5] introduce new basic techniques and novel materials such as conductive thread, fabric, and inks into the development of electronic and creative interactive interfaces on paper or fabric. The open nature of these practices promotes accessible and understandable approaches to building and learning electronics for non-practitioners who can now easily explore new ways to express their ideas by using electronic pieces, which, in the past, required more skills and time. Furthermore, the surge of new tools, electronic kits and platforms [6,7,8] that target artists and designers has opened the interest of creating intermediary steps between learning electronics and micro controller programming, and by teaching workshops that scaffold in creative ways the link between the physical and digital practices.
As fine artists and educators working at the intersection of art, design, and technology, we observed in this context new possibilities of introducing new experimental curriculum and methodologies for visual artists within an educational setting. In this paper, we present an innovative way of introducing thermochromic paints workshop to graduate students at MIA (Illustration and Animation Master at IPCA) to explain color theory as a bridge to introduce basic electronics concepts to make interactive *do-it-yourself* basic animations in their paintings or illustrations.

2. Illustration and Animation

MIA graduates in Illustration and Animation will be able to explore new paradigms of visual products and its development by adopting an interventionist stance in terms of new technologies and new creative industries dedicated to the image of R & D regional. The preparation technology itself should be promoted through an outreach effort between businesses, artists and designers in the region with the institution that promotes the training through seminars, study tours, project development and academic curricular and / or professionals. The master's degree in Illustration and Animation intends to form multi-faceted professional, who along with training and aesthetic plastic and have a thorough preparation in the area of technology and entrepreneurship.
The competencies to be acquired by students in programs in Illustration and Animation will have skills in the following areas:
1. Drawings in its various forms – plastic and illustrative, in policy areas such as editorial illustration, scientific, info graphic and child present in the media, in communication design and illustration of the author.
2. Computational tools, including the use of digital illustration and animation-dimensional (2D) and three
-dimensional (3D) present in the design of communication, multimedia and audiovisual, covering the professions of animation director, art direction, the gaming industry and digital sound designer, among others.
It is in this environment that the authors propose the Interactive Painting Techniques and Electronic workshop as key trends to elevate students to new explorative learning activities at the intersection of art, design, and technology.

3. Workshop: Interactive Painting Techniques

The workshops activities are designed by Paola Guimerans for students at MIA (Illustration and Animation Master at IPCA). The author outlines the workshop-based methodology they used as an entry point to visual artists; to learn basic skills and electronics concepts that include combining reactive paints with traditional art techniques. During the activity, students are encourage to create interactive drawings or illustrations.
Participants have an initial introduction and demonstration of handcrafted techniques on how to create an interactive *do-it-yourself* basic animation on paper by combining electronics with conductive materials and mixing reactive paints with a traditional art techniques.

Images from left to right: Fig.1) Students understanding the technique Fig.2) One student using conductive paint in one drawing. Fig.3) Other student tinkering with conductive thread, copper tape and the 6V battery.

Students were introduced to color theory supported by circuit diagrams to understand how to work with thermochromic paints. Students then proceeded to sketch their illustration or drawing and conceptualized for the interactivity.

During the activity, students were encouraged to explore different painting techniques and processes. The materials for the activities were given to the students in a kit that included primary color of thermochromic paints, conductive thread and paint, two pieces of copper tape, 6V battery, regular tape, and white paper. Students were asked to bring their own personal art supplies such as watercolor, acrylic, makers, brushes, etc. to work with.
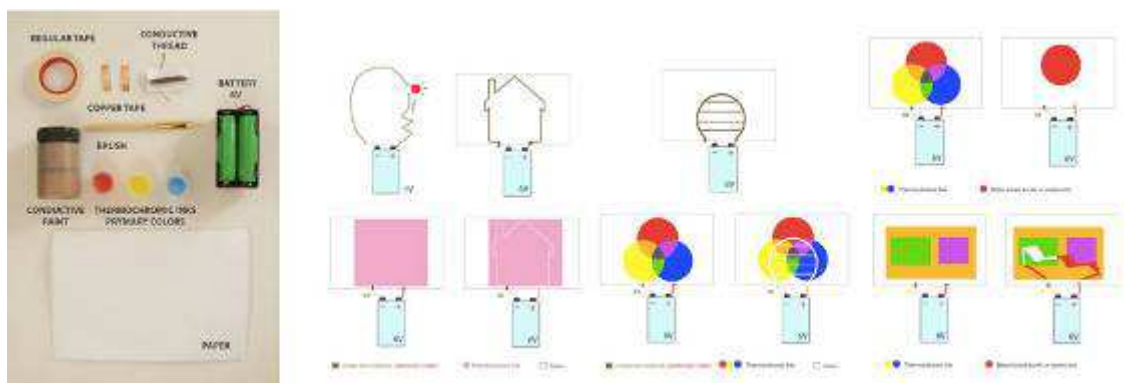
Images from left to right: Fig.1) Kit given to the students with the materials Fig.2) Basic Circuit. Fig.3) Color Theory circuits

The goal of the workshop is to explore color theory using thermochromic paints to familiarize students with new available materials and introduce them to electronics and simple circuitry concepts. These basic skills and circuit concepts will allow students to explore further electronics and to think about incorporating interactivity into their work.

Studio Supporting Web Documents
http://paolaguimerans.com/arteworkshops

4. Example of Students: Results
Below are selected works of students from this activity session.

Examples of students from left to right: Fig.1) Alexia Zacone. Fig.2) Mariana Teixeira.

One participant explored the use of blue reactive paint over watercolor to create an animation on the face of their illustration. Another student mixed different reactive colors on her painting to create an animation of the appearing and disappearing wolfs under a tree. Both students used the conductive thread and copper tape.

Examples of students from left to right: Fig.1) Miguel Sousa. Fig.2) Marco Costa. Fig.3) Ana Fernandes.

The images on the left show the process of the student. Sketches before making the interactive painting and the final one combining the thermocormic paints and electronics. Another student example of the use of a background with watercolor and thermocormic paints that disappear due to heat and allows the balloon to pop-up. The images on the right represent a participant's use of the blue thermocormic paints to create an animation on the face of the character.

Examples of students: Fig .1) Jose Machado.

This student's illustration is a good example of the application of color theory combining watercolor and reactive inks. The heat causes the thermocromic paint used in color clothes to disappear revealing the character undressed.

5. Conclusions

1. The workshop setting for teaching visual artists interactive painting techniques and electronics provides an area that allows them to think about interactivity and have access to materials and basic concepts of electronics.

2. The kit utilized during the workshop provides a limited set of materials that makes them comfortable to be more involved visually and creatively.

3. Visual artists explore colors theory with reactive painting in a comfortable setting that allows an introduction to basic concepts of electronics.

4. Activities that would allow improvements in the future so that students start to learn computation and build more complex animations on their drawings or illustrations.

This is the first step in this investigation. Next, we will further explore new directions with applying new methodologies and tools for creative possibilities in the realm of fine arts practices. Our target audience is centered around students and the creative people working at the intersection of art, design and technology. As both authors share the position that technology is a "material for design" [9] we point towards new curricular activities and learning opportunities that are engaging and provide a low-barrier space to work with new technologies. In the future, we aim to expand this approach to all kind of audiences interested in exploring new expressions of interactive activities, for instance, games.[10]

Additionally, as researchers, artists, educators and contemporary practitioners in this area, we are *encouraged to contribute to the change of our evolving* culture like Cole, we believe:

"The Artist Teacher Scheme posits a professional who operates unselfconsciously and confidently as both artist and as teacher; a person who does not see 'artist' and 'teacher' as mutually exclusive concepts. That is to say, someone who is her/ himself a learner, an experimenter, someone who wants to find out, test, discover, wonder, figure out alongside pupils." [11] (Cole, I.2010).

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