

metamoCrochet: Augmenting Crocheting with Bi-stable Color Changing Inks

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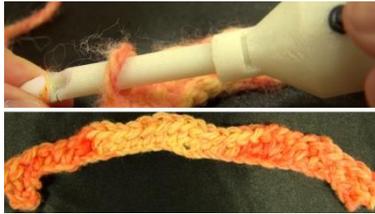


Figure 1. *metamoCrochet*.

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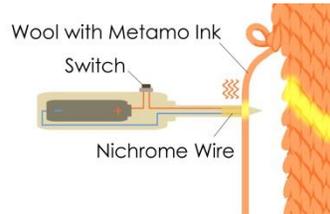


Figure 2. *System Design*.

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Figure 3. *Examples of Crafts*.

1. Introduction

Crochet is a handcraft that uses wool and a crochet hook to create cloth or three-dimensional objects, and to this day it has been enjoyed by many people. When changing the color of the wool while crocheting, it is common to integrate an additional color of yarn. However, adding wool every time you switch the color is time-consuming and it may affect the shape of the work itself. Therefore, we propose *metamoCrochet* which is a method that dynamically changes the color of the wool while knitting. By utilizing thermochromic wool and a crochet hook that generates heat at the tip, users can seamlessly change the color of wool (Fig 1). It will save the user's trouble of adding wool and enable the user to crochet in his or her intended patterns of colors. Moreover, controlling the wool's color according to unconscious factors such as emotional or environmental transitions can establish a novel expression that embeds information in crocheted work.

There has been research, such as *ShaderPrinter* [Saakes et al. 2012], that utilizes thermochromic ink to change the color or pattern of an object by controlling the applied heat. In contrast, this research utilizes the material of wool to enable interactive fabrication in manual work. Moreover, *Spyn* [Rosner et al. 2010] is a system that records the manual process of knitting as digital data, such as video or audio, in order to give away knitted work with the data of its manual process. However in our research we propose a system that converts the manual process of crocheting to the wools' color. Though the shade of color is vaguer than digital data, in this system the information of the manual process is blended into the work, accordingly becoming the design itself.

2. *metamoCrochet*

One of the technical contributions from our research in *metamoCrochet* is the development of its interface. This system consists of colored wool dyed with *Metamo Ink* and a crochet hook device. Since *Metamo Ink* completely fades at 65 degrees Celsius or more, the color of the wool will gradually fade when heated, revealing the wool's original color. In order to dynamically switch the color of the yarn, we have developed a crochet hook device with nichrome wire attached to the tip of the hook and a built-in circuit for controlling the heat generation (Fig 2). As described later on, a switch is attached to the handle of the device to allow the user to manually control the heat, and it can

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also be controlled by other sensors. Moreover, by adjusting the temperature and duration of time the heat is applied, the user can freely crochet in his or her desired gradation pattern which is difficult to achieve with regular wool.

As for the other technical contribution, we propose two applications for this system. In the first application the user can voluntarily change the color while crocheting. When the switch on the device is pressed the tip of the crochet hook generates heat and warms the wool, enabling the user to change the color of the wool seamlessly without any interruption of adding wool (Fig 3). Based on the background that a lot of time and thought is put into crocheted work and that they are commonly given away as presents, we propose a second application that reflects the user's emotions or surrounding environment in the color of the work. For example, we can monitor the user's heart rate, body temperature, ambient temperature or time and change the color of the wool that is being crocheted, once the acquired data surpasses a determined threshold. By attaching the necessary sensors to the crochet hook, the user can crochet while automatically embedding his or her preferred information into the work. The user's state is reflected in the finished work as a pattern of color. When it is given away as a gift, the recipient can imagine that process which will extend means of communication/expression in handcrafts.

3. Future Works

Currently the gradual change of the wool's color is limited between 2 colors. However, we are considering conducting further experiments with other materials that can change color, and developing a system that can portray a variety of colors with one ball of wool. Though we used a crochet hook in order to accurately change the color of a single stitch this time, we will consider adopting a wider range of methods for knitting. Furthermore, by conducting user tests at workshops, we will assess how the system will affect the user's process of crocheting and the crocheted work's role in communication as a gift/the possibility of its expressions.

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