Tessella: Interactive Origami Light

Abstract
We present an interactive origami light that transforms its shape in the user’s hands and creates light patterns depending on the shape. Tessella, explores key themes of current Organic User Interface research. First, input and output are integrated in one object. Second, the form implies its function. Thirdly, it allows the user to discover its affordances and uses. Our work merges the physicality of tessellation with a tangible light experience, incorporating traditional craft and more recent soft-circuit techniques. The goal of this project is to create a playful, poetic interface that evokes users’ creativity through interaction.

Keywords
Organic interface, origami, tangible interaction, transformable structure, material exploration

ACM Classification Keywords
H5.2. [User Interfaces] Interaction Styles, Theory and Methods, User-centered Design.

Introduction
This paper presents an interactive tessellation structure that users can change its shape which creates different light patterns accordingly. The user interacts with it by touching and manipulating the shape [Figures 1]. Recently, a growing number of designers and researchers have been delving into new flexible, organic interfaces that invite users into the ubiquitous

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computing world with an intuitive and sensory-rich experience. The interactive origami light, *Tessella*, explores key themes of current Organic User Interface research. First, input and output are integrated in one. Second, the form implies its function [1]. Thirdly, it allows the user to discover its affordances and uses. *Tessella* is a collocated light and sensor matrix on a tessellation structure. The goal of this project is to create a playful, poetic interface that evokes users’ creativity through interaction.

**Organic/Flexible Interface**

Designers are often inspired by natural, organic qualities in the environment or from early practices, augmenting them with new technologies. We are also inspired by an uncrushable origami tessellation technique. Origami is defined for us as the transformation of a single sheet of fabric from a one-dimensional material into a three-dimensional material with additional physical characteristics. Origami tessellation technique enables us to create a flexible, transformable interface with electronic components. [Figure 1] In addition, the soft-circuit research community has built soft sensors and embedded actuators on flexible surfaces [2]. Our work merges the physicality of tessellation with a tangible light experience, incorporating traditional craft and more recent soft-circuit techniques. Users can create their own shapes and easily understand the functions of the piece by the affordances and their own experience.

**Implementation**

*Tessella* consists of two fabric layers: the main layer uses a heavy-weight nylon to hold the creases and the LED-matrix [Figure 2] and the sensor-matrix, the top layer uses a soft nylon to facilitate feedback to the user through touch and the transformation of light. The sensor matrix is triggered when a small conductive surface, sewn using conductive thread on each surface of the mountains of the bottom layer, touches the next conductive surface. The Arduino system can calculate the approximate curvature of the object through this process and control the intensity or patterns of the LED matrix.

![Figure 1. Tessella’s interaction](image1)

![Figure 2. LEDs and sensors matrix](image2)

In future, we would like to augment the work with new actuating materials and diffusive materials, enabling *Tessella* to alter its shape by itself.

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