

Photochromic Carpet: Playful Floor Canvas with Color-Changing Footprints

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Abstract. Natural environments record their past and reveal usage in subtle cues such as erosion and footprints. In modern society of concrete cities and dynamic touch screens, this richness is lost.

We present a large size interactive floor display that captures visitors' footsteps in playful prints to make a modern environment into a canvas of past activities. The implementation consists of a carpet coated with color changing ink and shoes that activate color changes. Each step a visitor makes results in a dynamic print that slowly fades away.

Keywords: color changing material, interactive floor display.

1 Introduction

In the classic fairy tale, Hansel and Gretel safely return home by tracing back their path using a trail of pebbles. Natural environments capture history in various ways from valleys carved out by rivers to the broken twigs that trackers use to locate animals. Man-made products depict their most frequent used functionally in wear, such as chipped off paint or the greasiness of buttons. However, in modern society of concrete buildings and dynamic touchscreen interfaces, these environmental clues of use are lost. With the photochromic carpet, we aim to re-introduce the concept of subtle recording of history in the environment and visualize patterns-of-use that interact with the user in a ludic way.

The system consists of a large floor painted with passive, mono-stable color changing ink that is excited by footsteps of custom indoor shoes with build-in LEDs. Wearing the shoes, users leave trails of dynamic generated patterns. The patterns persist for minutes and invite users to use the carpet as an expressive canvas. Using smart materials in the floor, and the shoe as an activation medium, the system easily scales to very large surfaces, without the limitation of installing a camera-projector system or sensor networks.

Our current demonstration serves no other purpose than an experiential prototype. Through exhibits we aim to gather user feedback for future applications in schools and hospitals.



Fig. 1. The carpet is made from photochromic material that temporarily becomes dark purple under UV radiation. As shown, near UV LED embedded in shoes activate the color change long enough to create playful patterns.

2 Related Work

Our effort spans two different research areas: projects that aim to enrich human interaction with physical objects and projects that augment shoes and floors for sports, entertainment and as user interface.

The History Table Cloth by Gaver et.al. [2] consists of a table top embedded with electroluminescent material. The table senses objects placed on the table and lights up around the objects for hours visualizing the flow of objects. They so investigate digital technologies that aim to engage their users in playful open-ended interactions rather than functional. Like wise, in “Material Traces“ Rosner et.al. [7] discuss the practice of materiality and implications for HCI, illustrated by a number of provocative ideas, such as paint that traces rodent movement in the house. These projects relate to our aim, but ideas are prototyped on objects. In contrast, the technology proposed in this demonstration makes these concepts experiential on large scale environments and includes a practical way of realization. In computer entertainment interactive floors are made popular with dance dance revolution [4] in which a floor functions as a input device for a dancing game. Various interactive floors have been proposed. For instance, the magic floor [5] aims to capture user motion, however require complex sensor networks. Other projects take reverse approach by embedding the sensor technology in the shoe rather than environment. Expressive footwear [6] embeds sensors in various ways to capture sport and dance performance.

An early example of a floor as input and output medium is the artwork Boundary Functions by Scott Snibbe [9]. Using a webcam and projector setup, visitor activity is captured and graphics are projected accordingly. To address the limitations of resolution and occlusion, the multitoe floor [1] aims to build a floor with multitouch displays. In that way they explore various interaction techniques activated by feet rather than by fingers. However, current display and projector technologies have various shortcomings when applying for large surface, high resolution or daylight applications. Using mono-stable color changing materials solves these issues by exploiting the persistence of image as a physical frame buffer. In that way, no digital representation is involved in the process of