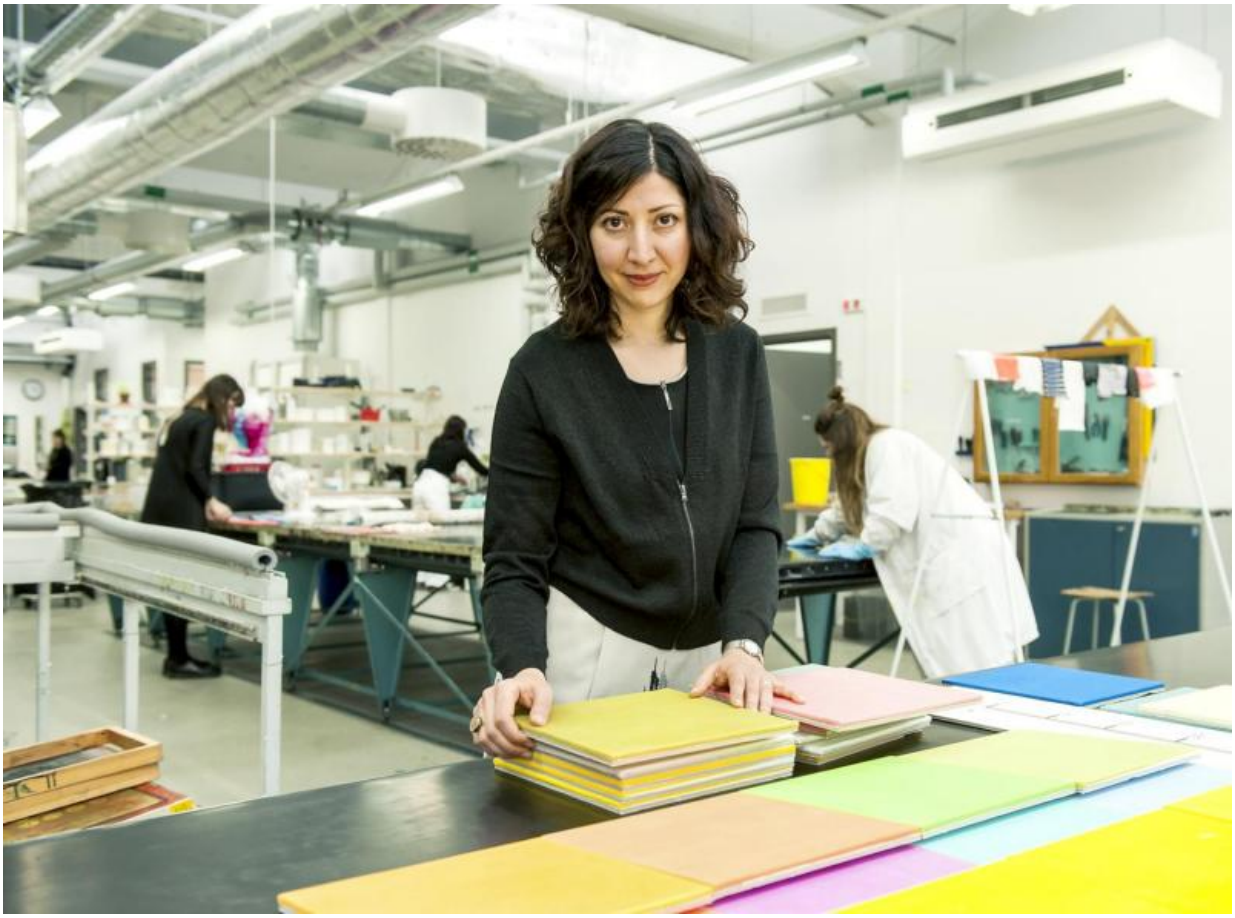
New patterns emerge when the temperature changes

March 14 2017



Credit: Marjan Kooroshnia labbet

Imagine a single-coloured piece of cloth that suddenly displays a colourful pattern when the ambient temperature changes. Upon further

temperature change, a completely different pattern shows up.

Doctoral student Marjan Kooroshnia at the University of Borås has developed methods that enable just such changes. They are now on display at the Textile Museum, in Borås, Sweden.

"My research was conducted by undertaking a series of design experiments using leuco dye-based thermochromic inks, which resulted in various working methods and two pedagogical tools in the context of textile design," she says. "Now I hope that other designers and researchers can further develop these methods. In my research, I have also prepared two educational aids that can facilitate communication regarding, understanding of, and design with thermochromic inks, but still we need to have both terminologies and a thermochromic colour system in order to understand how thermochromic inks behave in relation to other static pigments and varies temperatures."

Tested different temperatures

Marjan Kooroshnia began her research on already existing descriptions of leuco dye-based thermochromic inks; below their activation temperature they are coloured, and above their activation temperature they are clear or have a light hue. In addition, they are usually blended with static pigments, allowing them to change from one colour to another.

"I wanted to explore the design properties and potentials of thermochromic inks when used on textiles, and to facilitate improved understanding and design of dynamic surface patterns in the context of textile design. I started each experiment by asking a series of 'what if…?' questions and testing them in practice. In total, I have done six series of experiments. What if multiple colours could be concealed or revealed at once?"

After a lot of testing in the printing lab, she managed to mix the inks so that they looked similar when they were in a non-heated state and they change to different colours as result of increasing temperature.

Then, she explored thermochromic inks with different activation temperatures in order to create a wide spectrum of colours that would appear at different temperatures. She used thermochromic inks with activation temperatures of 27, 37 and 47°C to create a dynamic pattern that colour changing effects that appear in sequence due to increasing temperature; for example, the pattern has one colour at 27°C, another colour at 37°C and another colour at 47°C.

"For each series of experiments, I designed a screen-printed pattern to show how a designer can use these colour mixtures in designing a dynamic surface pattern."

Exhibition with samples

In connection with her doctoral defence on 14 March at 10:00, there will be an exhibition opening at the Textile Museum in Borås, Sweden, where there are lots of examples to see and learn from. Visitors can warm up the fabric samples and see colour changing effects using hairdryers.

Marjan Kooroshnia has also created two educational tools that can facilitate communication regarding, understanding of, and design with thermochromic inks. One consists of different colour swatches printed with static pigment that can be placed along an artificial thermometer. Another is thermochromic colour sample spectra where thermochromic colour transitions are demonstrated step by step from non-heated, to heated, and back to a cooled state. In addition, she has begun to create a thermochromic colour system, which will be used to teach and study thermochromic inks. So far, one suggestion for the system in a shape of pyramid works the best, but it needs further development.

"I see the result of my research as a young tree," says Marjan Kooroshnia. "Now I will leave it to other designers and researchers to grow it. It may grow well in a soil of computer science with a sun light of electronic or in a soil of fashion design. It will be very interesting to see what happens.

More information: "On textile printing with thermochromic inks." hb.diva-portal.org/smash/recor … sf?pid=diva2:1074393

Provided by University of Borås

Citation: New patterns emerge when the temperature changes (2017, March 14) retrieved 23 April 2024 from https://phys.org/news/2017-03-patterns-emerge-temperature.html

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