Rotate an image, another one appears (w/ Video)

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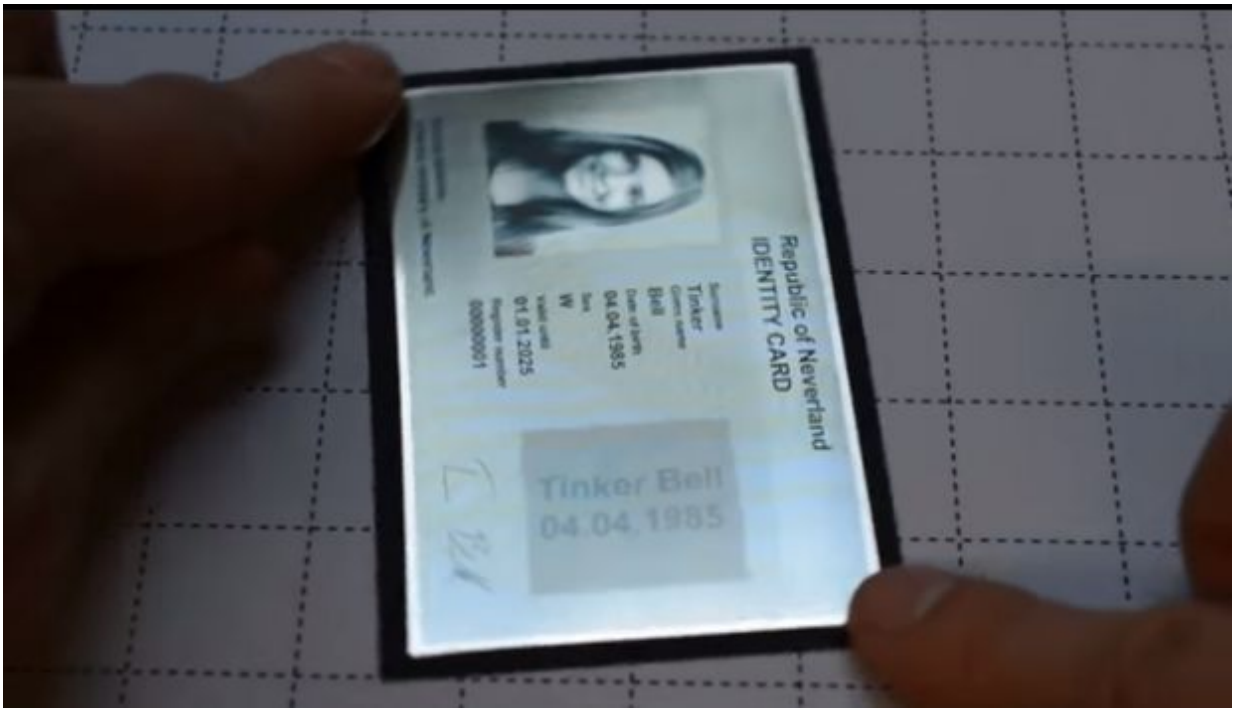

Hidden elements can now be placed into an inkjet printed image, thanks to EPFL software. These hidden elements become visible by simply rotating the print.

Hide an image within an image. EPFL scientists have developed a

printing algorithm that does just that onto metallic sheets. Two images are printed together using an inkjet printer so that only one image can be seen at a time from a given angle.

The technique could one day be used as a security element in passports and printed money to prevent counterfeit.

Roger Hersch holds a printed image of a colourful butterfly. He then turns the print 90 degrees to reveal an entirely new image, the Mona Lisa. "Elements can only be seen upon rotation, " says Hersch of EPFL's Peripheral Systems Laboratory. "This rotation effect has never been done before."

Messages have been hidden in documents for over two millennia, starting with the chemical properties of substances from lemon juice to bodily fluids. Modern techniques use the fluorescence of substances under ultraviolet light, the precision of nanoparticle printing or even engineered bacteria that glow under certain circumstances. Printing is part of that game.

Printers spray ink as tiny dots into precise patterns, a standard technique called halftoning. Different patterns of cyan, magenta and yellow dots produce a wide range of colours.

When the halftone is printed along lines onto metallic sheets, the researchers noticed that the resulting colour depends on the viewing angle. This is because incoming light traversing the ink lines cast shadows onto the metallic surface. Ink lines perpendicular to the incoming light create a large shadow and appear as "strong colors". Ink lines parallel to the incoming light do not induce a shadow and appear as "weak colors". When the print is rotated by 90 degrees, strong colors become weak and weak colors become strong.

This effect would not be noticeable on paper. Unlike the mirror properties of a metallic sheet, paper diffuses light in many directions and gets rid of directional shadows.

Based on these observations, the researchers developed both a mathematical model and associated software that predict the colours that will be observed from different viewing angles. Currently, the software supports standard inkjet prints onto metallic sheets.

Their algorithm essentially superposes two images during the printing process, creating a print with visible and hidden elements. By changing the viewing angle, and hence the way light casts shadows, hidden elements literally come to light.

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