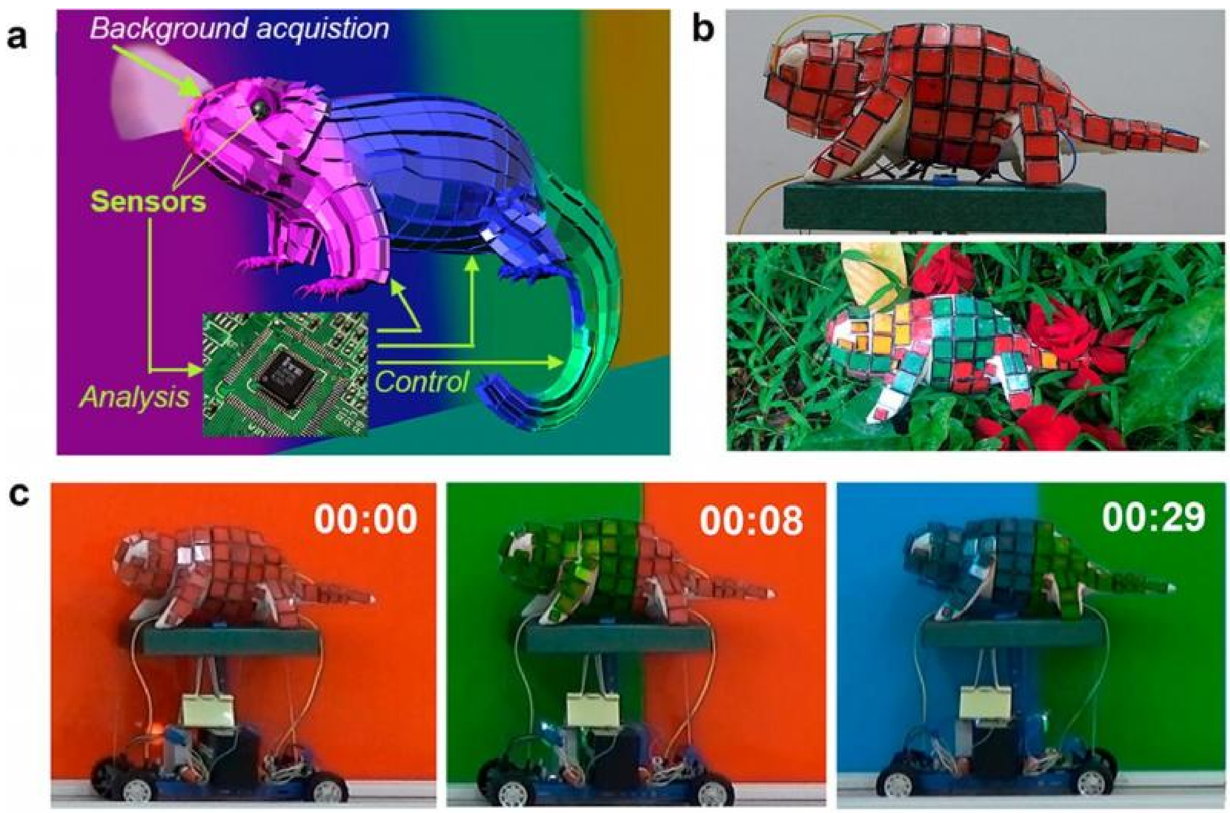
Mechanical chameleon blends with color backgrounds (w/ Video)

February 6 2016, by Nancy Owano



Mechanical Chameleon through Dynamic Real-Time Plasmonic Tuning. Credit: *ACS Nano* (2016). DOI: 10.1021/acsnano.5b07472

Name one intense research area and you will not go wrong in choosing camouflage. *ACS Nano* has published "Mechanical Chameleon through Dynamic Real-Time Plasmonic Tuning."

The paper will interest those who recognize the challenges ahead in improving ways of hiding and ways of blending in with the environment.

The authors are from China and Georgia Institute of Technology (Atlanta, Georgia).

As they said in their paper, "Optical invisibility represents one of the greatest challenges in military and biomimetic research." From the earlier days of pattern painting and on toward approaches for the invisibility cloak, explorations continue.

These researchers are on a path which permits real-time light manipulation readily match-able to the color setting in an environment.

A video on their work shows the chameleon rolling past three colors and changing its color accordingly. The "chameleon" actually is a 3D-printed model covered in plasmonic displays.

The authors discussed what they had fabricated: "a biomimetic mechanical chameleon and an active matrix display with dynamic color rendering covering almost the entire visible region."

Adam Westlake in *SlashGear* found their work impressive enough. "The future of color-changing body armor may be here," he said, in the form of this chameleon-shaped robot.

They summarized what they accomplished, saying "we have achieved reversible full-color plasmonic cells/display by electrochemically controlling the structure of a Au/Ag core–shell nanodome array and successfully integrated these cells onto a mechanical chameleon, which can blend automatically with colored backgrounds."

Westlake said the plasmonic displays can produce colors and rapidly change between them by detecting the background with light sensors and he wrote about their approach:

Displays are made from small sheets of glass with a grid of holes measuring 50 nanometers wide. The team coated the sheets in gold, creating small domes in each hole, followed by another layer electrolyte gel with silver ions.

"Plasmons, or ripples of electrons, are said to be created when light hits the gold domes, which in turn determines its properties of reflection and absorption," wrote Westlake. "Different colors are produced when an electric field is connected, altering how many silver ions stick to the gold. Sensors were then added that can detect the light and color of the surroundings, and then adjust the electric field to change colors as needed."

The authors said their mechanical chameleon can perform against backgrounds with only three primary colors (red, green, and blue). At the same time, though, they said their technology can also interface with a complex environment and provide a new approach for artificial active camouflage.

"This application is readily approachable by using more technically advanced autonomous systems, which can be addressed by using a highly integrated machine vision system that can capture and simulate the entire color patterns of the environment and then drive the color-changing process in individual cells, fully merging the mechanical chameleon with the surroundings."

More information: Guoping Wang et al. Mechanical Chameleon through Dynamic Real-Time Plasmonic Tuning, *ACS Nano* (2016). DOI: 10.1021/acsnano.5b07472

Abstract
The development of camouflage methods, often through a general resemblance to the background, has recently become a subject of intense research. However, an artificial, active camouflage that provides fast response to color change in the full-visible range for rapid background matching remains a daunting challenge. To this end, we report a method, based on the combination of bimetallic nanodot arrays and electrochemical bias, to allow for plasmonic modulation. Importantly, our approach permits real-time light manipulation readily matchable to the color setting in a given environment. We utilize this capability to fabricate a biomimetic mechanical chameleon and an active matrix display with dynamic color rendering covering almost the entire visible region.

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