Shape-changing LineFORM may belong to interface future

November 11 2015, by Nancy Owano

LineFORM from the Tangible Media Group at MIT Media Lab is the result of its creators asking questions. What if we have a shape-changing material that consists of a Line? Using such material, how will

interactions with computers or tools change?

They designed a shape-changing interface and described it in their research paper, "LineFORM: Actuated curve interfaces for display, interaction and constraints." Ken Nakagaki, Sean Follmer and Hiroshi Ishii make up the team.

"Lines have several interesting characteristics from the perspective of interaction design: abstractness of data representation; a variety of inherent interactions / affordances; and constraints as boundaries or borderlines," they said.

"By utilizing such aspects of lines together with the added capability of shape-shifting, we present various applications in different scenarios."

The video of their work demonstrates a variety of shape changes. These include body constraints and data manipulation, to investigate the design space of line-based, shape-changing interfaces. In their concept, the material can also reshape itself into telephone mode. A smart wristband gives the user haptic feedback.

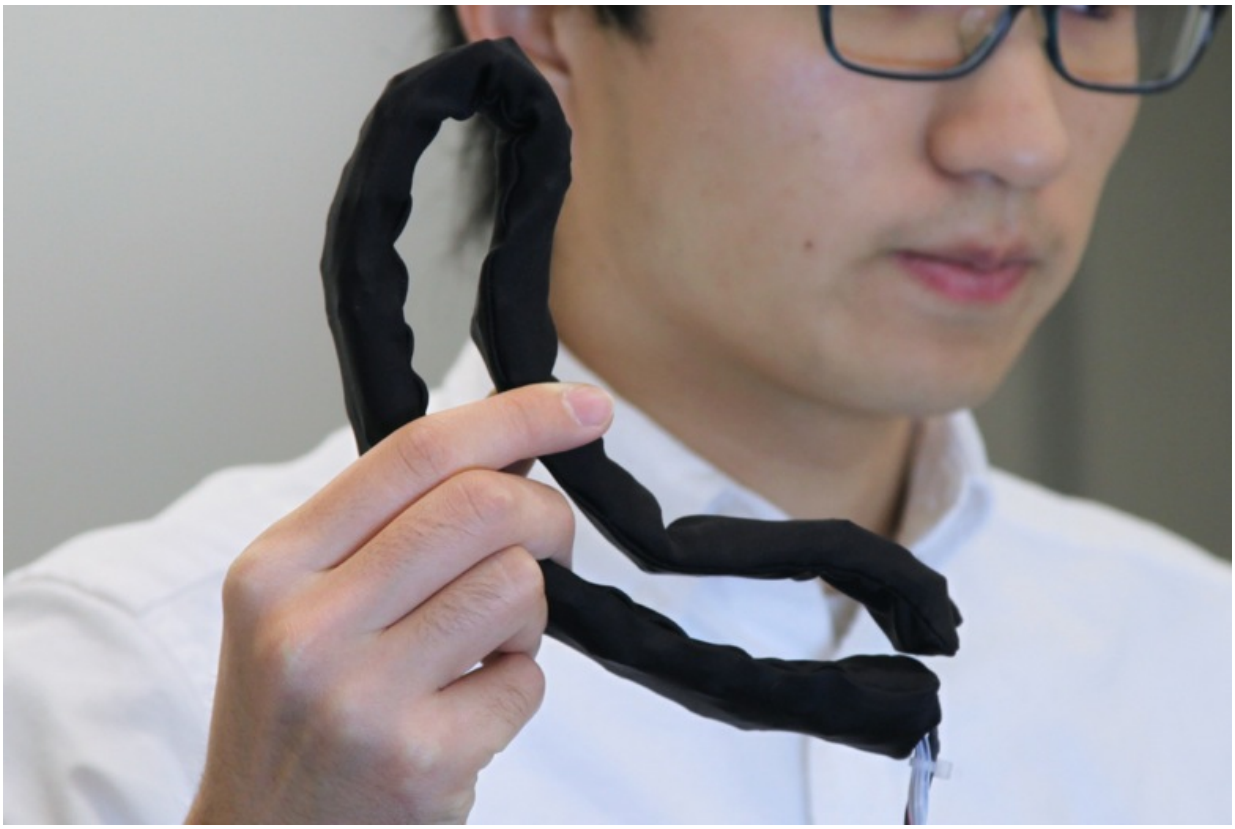
Engadget referred to LineFORM as a "serpentine robot." It involves a linear series of actuators, wrote Aaron Souppouris, which can move independently or together to arrange itself in new shapes.

They said in their paper that "The overall design of the system involves three parts. There is a series of connected servo motors. It has an Arduino Mega microcontroller for motor control and sensing. It has a Mac OS computer running custom applications written in processing that control LineFORM."

Their paper is an accepted TOCHI (ACM Transactions on Computer-

Human Interaction) paper for the ACM Symposium on User Interface Software and Technology (UIST) from November 8 to 11 in Charlotte, NC.

The authors are exploring this concept because they see a future where devices in the nature of their LineFORM would be paired with flexible displays. They see the concept as "next generation mobile devices." As for the range of functions: Their concept could be used to display complex information, provide affordances on demand for different tasks and constrain user interaction.



"We have shown that a relatively small number of actuators can be used to achieve an expressive display, and these systems may be easier to prototype than other form factors of high resolution shape display."

Where do they go from here? They hope their work will be of interest to researchers. "Our hope is that this work will motivate others to further explore the space of actuated curve interfaces, from novel actuators to new interaction techniques."

On that note and practically speaking, Kelsey Campbell-Dollaghan in

Gizmodo said, "they imagine Lineform could replace a lot of the hardware we need for interacting with the world today–the keyboards, the phones, the cables, and so on–acting like a plug-and-play interface that could transform based on how you need to interact at a given moment."

In the bigger picture, the Tangible Media Group has a clear focus on which technology path they will follow as they continue their innovative research: "From the three approaches in design research: technology-driven, needs-driven, and vision-driven, we focus on the vision-driven approach due to its lifespan."

They said they know technologies become obsolete in ~1 year, users' needs change quickly and dramatically in ~10 years. "However, we believe that a clear vision can last beyond our lifespan. While we might need to wait decades before atom hackers (like material scientists or self-organizing nano-robot engineers) can invent the necessary enabling technologies for Radical Atoms, we strongly believe the exploration of interaction design should begin from today."

More information: tangible.media.mit.edu/project/lineform/

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