

REVIEW

R&D: DANIEL AKST



# Can Japanese Paper Art Revolutionize Rooftop Solar?

**PLANTS ARE** phototropic for a good reason: Tilting toward the sun helps them to soak up more energy.

If the solar panels on the rooftops of many American homes could also follow the sun, they would produce a lot more energy, too. Motorized tracking systems that adjust the panels as needed can improve energy collection by 20% to 40%, according to scientists at the University of Michigan.

But getting rooftop solar panels to move requires costly equipment that is usually too heavy and bulky for residential roofs—a shame, because about 85% of U.S. solar installations are mounted atop people's homes. That is why the Michigan scientists, working with a paper artist who is expert in the Japanese art of kirigami, have come up with a way to orient solar cells toward the sun without reorienting the large, heavy solar panels on which they rest.

Kirigami is much like origami but involves cutting as well as folding. The artist, University of Michigan lecturer Matthew Shlian, showed the scientists how to cut precise, repeating patterns in paper. The scientists used this skill (along with a carbon-dioxide laser) to cut patterns into Kapton, a versatile, flexible plastic that can withstand temperature swings.

At rest, the cut Kapton looks like it contains rows of dashes. But when it is pulled, the sliced material opens up into a kind of geometric mesh. And this pulling causes the strips making up the mesh to rotate, roughly in proportion to the amount of force being exerted. Yet the rotation produces little additional thickness in the material.

The scientists also fabricated thin, flexible, crystalline gallium arsenide photovoltaic cells that could be affixed to the Kapton. So when the underlying plastic was tugged and rotated, the solar cells rotated right along with it.

The beauty of this, the scientists say, is that the rotation could occur within a relatively flat space. That means solar panels equipped with such flexi-

ble solar arrays would be able to orient themselves toward the sun throughout the day while the panels themselves remained fixed—avoiding the need for heavy equipment and dodging the hazards of heavy winds. The production of such units, the authors write, would be cost-effective. “In practical use,” says Max Shtein, one of the scientists, “we could imagine a panel sitting on someone's roof, with these shapes being stretched underneath a cover glass.”

The tugging needed to twist the new solar device into position during the day would take some energy. But Dr. Shtein, an electrical engineer by training, says that relatively little force would be required—possibly from a small motor that wouldn't use much power. A more elegant solution, he says, would be to rely more directly on the sun, perhaps by building in a metal component or gel pouch that would expand and contract as its temperature changes.

Dr. Shtein notes that the Michigan experiment focused on the daily, morning-until-dusk adjustments that would be most useful in wringing more energy from solar panels. Less frequent seasonal adjustments could also boost energy gains, at least somewhat, and the scientists have come up with some designs for building this into solar panels as well, he says.

As the price of solar power falls, it could be used more widely—and the gains from rotating solar cells might someday be multiplied by many additional users. “The total amount of electricity being generated by residential rooftops does not yet exceed that generated by solar farms,” says Dr. Shtein. “However, the residential rooftop market is growing and has lots of room left to grow still, so that's potentially an exciting segment to target.”

*“Dynamic kirigami structures for integrated solar tracking,” Aaron Lamoureux, Kyusang Lee, Matthew Shlian, Stephen R. Forrest and Max Shtein, Nature Communications (Sept. 8)*

WORD ON THE STREET: BEN ZIMMER

# Wanted: ‘Authentic’ Would-Be Presidents



**AS OBSERVERS** sized up the Republican presidential candidates at Wednesday's debate at the Reagan Presidential Library, one word kept coming up as a kind of a yardstick for their performances: Were they “authentic”?

On Twitter, the word often appeared in the running commentary of debate-viewers. “Whoa, first authentic moment of emotion from Jeb Bush in the entire campaign: ‘My brother kept us safe,’ ” tweeted Steven Mazie, who writes about the Supreme Court for the Economist.

Meanwhile, Aaron Gardner, a communications consultant and former managing editor of conservative blog RedState.com, was concerned about Sen. Ted Cruz: “I don't know what it is, maybe he is too prepared, but Cruz doesn't sound authentic,” Mr. Gardner noted.

Going into the debate, pundits spoke of an “authenticity” gap on such venues as CBS's “Face the Nation”: Outsiders Donald Trump and Ben Carson had it, while the professional politicians lagging in the polls seemed to lack it. On the Democratic side, Hillary Clinton has had her own struggles to appear “authentic”—especially compared to her main rival, Sen. Bernie Sanders, as well as Vice President Joe Biden, who may be considering a presidential run.

“Authenticity” has become a major buzzword of the campaign season, representing the culmination of a decadeslong political trend. “Before the latter half of the 20th century, the question of whether a candidate was ‘authentic’ was rarely raised,” wrote Kathleen Hall Jamieson and Paul Waldman in their 2004 book, “The Press Effect.”

That all started to change with the 1976 election of Jimmy Carter, who had campaigned as a genuine, average guy, according to Erica J.

Seifert, author of “The Politics of Authenticity in Presidential Campaigns.” “By 2008, it was a dominant theme in political television and print media,” she writes.

Along the way, such politicians as Ronald Reagan, Bill Clinton and George W. Bush scored major “authenticity” points. Reagan's authenticity transcended his background in the world of movies. Even as a Hollywood actor, he was seen as the real deal, since he always seemed to play one role: Ronald Reagan. “Because he acts himself, we know he is authentic,” commented Garry Wills in his 1987 book, “Reagan's America.”

While we routinely judge politicians to be “authentic” or “inauthentic,” these words have become attached to people rather than to objects relatively recently in their history. The roots of “authentic” lie in the Greek “authentikos,” meaning “original” or “primary,” and in its early use in English, the word described genuine articles rather than false imitations.

But what we call “authentic” underwent a rapid transformation in the 20th century. A hundred years ago, the most typical nouns to follow “authentic” were “information” and “history,” according to the Google Books Ngram Viewer, an online tool that tracks word usage patterns based on the texts of millions of digitized books. By the 1980s, “authentic” most often modified “voice” and “self,” as the word became associated with a more human kind of genuineness.

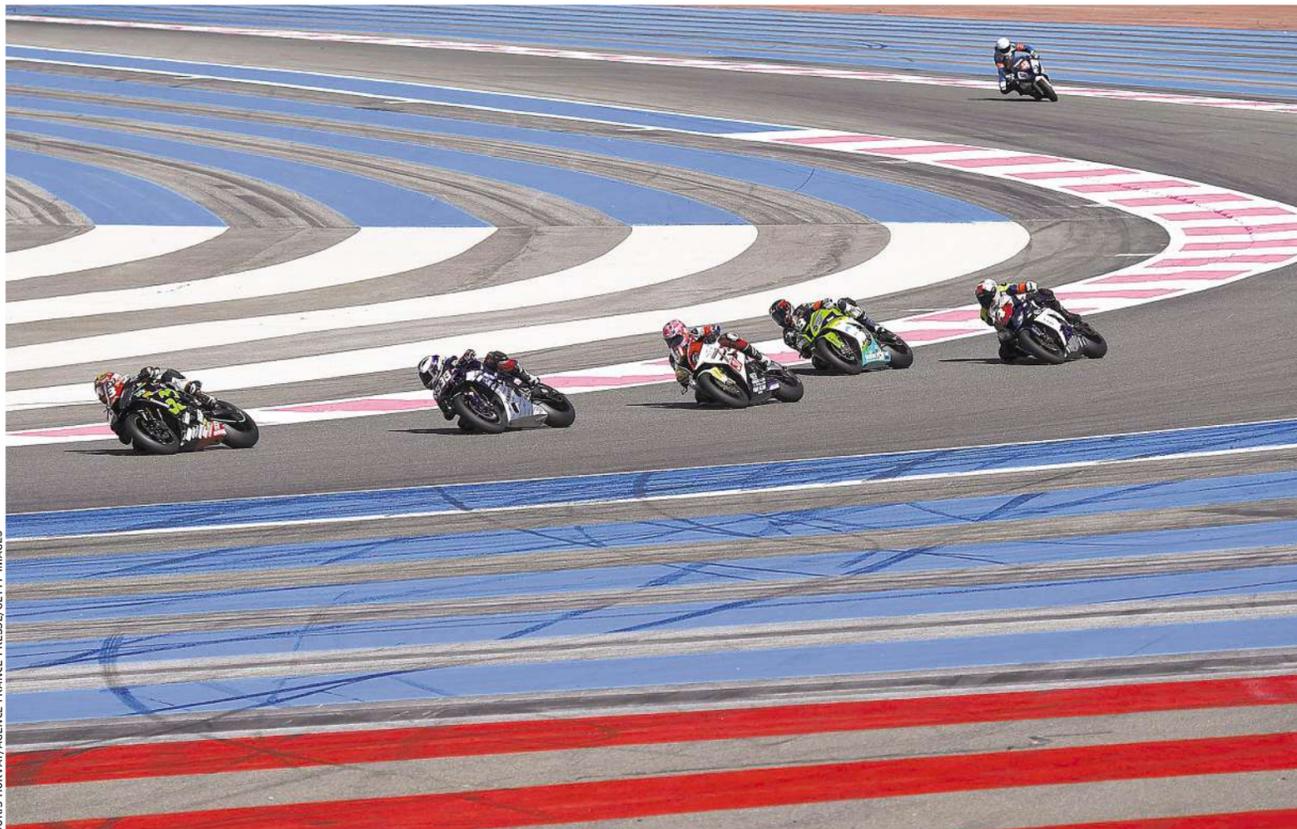
“Authenticity” thus came to stand for the honest expression of one's “true” inner self—or at least, in the realm of political image-making, the ability to appear emotionally sincere. As the old theatrical saying goes, the main thing is honesty; if you can fake that, you've got it made.

**One book traces the trend back to Jimmy Carter.**



News Quiz has moved to C13. This week's solutions: 1.A, 2.B, 3.D, 4.C, 5.D, 6.A, 7.C

PHOTO OF THE WEEK



**Lean In** Riders negotiate a curve Friday during a qualifying session for the 79th Bol d'Or 24-hour motorbike race, Le Castellet, France.

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