DIVERSE DISCIPLINES, ONE COMMUNITY
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SeeingScience

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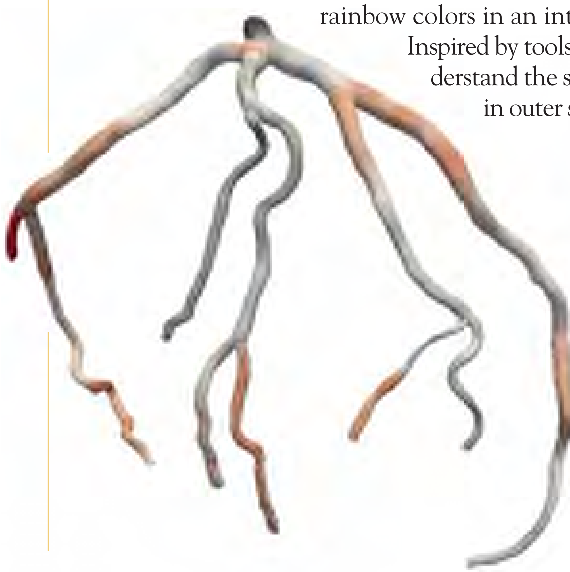
Busting Assumptions about Rainbows and 3-D Images

To diagnose heart disease noninvasively, scientists combine 3-D visualizations of the heart and blood vessels (reconstructed from CT scans) with computer simulations of blood flow. Typically, a palette of rainbow colors is used to help identify areas of low shear stress—trouble spots of low friction or stagnant blood flow that weaken vessel walls—a good indicator of disease progression. But 3-D rainbows aren't as useful as our instincts suggest, says **Michelle Borkin**, a PhD candidate in applied physics at Harvard University.

After observing and interviewing cardiologists, Borkin realized that interacting with and rotating 3-D images took time and sometimes meant interrupting a procedure. And research into the psychology of visualization suggests that humans do not read rainbow colors in an intuitive way.

Inspired by tools she had used to understand the structures of nebulae in outer space, Borkin developed software called HemoVis that visualizes simulated blood flow in two dimensions, splays or "butterflies" vessels open in a tree diagram, and colors the areas of low shear stress in gradations from red to gray. In a test of the software, the 2-D visualizations (compared with 3-D) led to much more accurate and efficient diagnoses by 21 medical students; the same was true for the red/gray palette when compared to rainbow. "At a single glance," Borkin says, "they get a quick and accurate diagnosis." The work was published in *IEEE Transactions on Visualization and Computer Graphics*.

"This paper shows that making smart choices about how you display your data in dimensionality and color not only can help doctors see the data better and help them make discoveries," Borkin says, "but might also save lives." □



An arterial system that would previously have been reconstructed in 3-D (left) is instead deconstructed into 2-D and shown at right with each branch separated from the main vessel. Branching points and relationships between branches are also displayed. Areas shaded red represent diseased areas as indicated by low shear stress measured in computer simulations of blood flow. Courtesy of Michelle Borkin.