SCIENCE AND CULTURE

Math Dance

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A typical performance by dancers Karl Schaffer and Erik Stern begins with a handshake. However, it's not simple: the two men fail to connect, missing hands and falling past each other, over and over, in a variety of ways. When they do finally grasp hands, they have to face the opposite problem: they're unable to disconnect, despite turning, spinning, and prying.

That greeting is more than just a vaudevillian routine. The sequence resonates with core ideas in the mathematical field of combinatorics, which is concerned with different ways to combine objects in the same set according to certain rules. In this case, the set includes the two dancers; the rule is to shake hands. With only those parameters, the dance shows a variety of possibilities, symmetries, and structures.

Dance, says Schaffer, "is particularly conducive to mathematics inquiry and thinking." He should know. Schaffer teaches mathematics at DeAnza College in Cupertino, California. Since their first performance in 1991—*Two Guys Dancing About Math*—he and Stern, a dance teacher at Weber State University in Ogden, Utah, have been choreographing and performing dance pieces based on mathematical ideas.

As founding members of the Dr. Schaffer and Mr. Stern Dance Ensemble, they and their company have performed for hundreds of thousands of people, including at children's festivals and the Kennedy Center in Washington, DC. Their shows have titles like *The Secret Life of Squares*.

Schaffer and Stern have also designed ways to integrate ideas of dance and math in the classroom. The two men have run educational Math Dance workshops around the world, creating games and situations where students (sometimes math teachers) solve movement problems according to preestablished constraints. In dance as in math—as in most games—participants apply specific, predetermined rules to a set of objects.

Stern says dance is a particularly effective way to engage students in the mathematical study of symmetry, which is easier to see than to do on paper. He and Schaffer refrain from using mathematical jargon during class—never using the phrase "group theory," for example—and instead let the students discover the possibilities on their own.

"You can certainly see the idea of symmetry groups in dance," says Schaffer. "It's constantly there; it's all about symmetry groups. Group theory is all about how bodies move in relation to each other in space."

"If everyone choreographs using planar symmetries while they're working on their projects, you can see who is getting the symmetry," says Stern.

Dance, say both men, makes math both social and creative. The intersection of mathematics and choreography allows students to join a deep and mathematical conversation.

"The connections between mathematics and dance are the heart of the matter," says Schaffer. "I often look at the mathematical as simply one of the sets of metaphors with which we can construct artistic work."

Schaffer and Stern will be performing and leading workshops in the Northeast this fall, including a performance at the University of Buffalo in September. In October, they're presenting at the annual conference of the National Dance Education Organization in Miami, Florida.

Erik Stern and Karl Schaffer perform, choreograph, and educate at the intersection of mathematics and modern dance. Image courtesy of Hazen Imaging.

For more about Math Dance, visit http://mathdance.org.