

DANCE: PHYSICS

Dancing Einstein

John Bohannon

I am satisfied with the mystery of life's eternity and with the awareness of—and glimpse into—the marvelous construction of the existing world together with the steadfast determination to comprehend a portion, be it ever so tiny, of the reason that manifests itself in nature. This is the basis of cosmic religiosity, and it appears to me that the most important function of art and science is to awaken this feeling among the receptive and keep it alive.

—Albert Einstein (*I*)

It was with a tingling sense of dread that I entered a London theater last month, as if slouching toward the doctor's office with the expectation of bad news. To mark the 100th anniversary of Albert Einstein's most productive year of work, as well as the 50th year since his death, the Institute of Physics in London commissioned a young choreographer named Mark Baldwin to take Einstein's theories as inspiration for a dance. *Constant Speed* is the offspring of this marriage of science and art.

Mixing science with art seems like a great idea. Ever on the lookout for unexplored fields of human experience to mine, many artists see science as a mother lode. And scientists—exasperated by the blank stares that usually greet their enthusiastic statements, such as “Doesn't it just blow your mind how polypeptides fold their way through zillions of possible permutations in microseconds?”—cast their lonely eyes to artists to bridge the gap. So why is it that the result is so often either emotionally sterile (bad art) or intellectually superficial (bad science)? Perhaps, like science and religion, the two endeavors deal in mutually exclusive currency: science transmits knowledge while art transmits emotion, and mixing them inevitably dilutes the power and elegance of both.

To his credit, Baldwin was undaunted by such pessimism. “What I discovered,” he says in the program notes, “is just how compatible dance and physics are.” Indeed, just because an experiment is a long shot doesn't mean it's not worth trying.

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Hypothesis. Einstein's scientific theories carry emotional content that can be transmitted through dance.

Materials and methods. The experiment was performed within a sound- and light-insulated chamber of 1.5×10^4 cubic meters tapering to a stage. In a lowered pit before the stage, an orchestra performed a sequence of musical notes assembled in 1905 by the Viennese composer Franz Lehár. Simultaneously, the Rambert Dance Company (11 women and 11 men) executed a sequence of movements created this year by Mark Baldwin. Light—in wavelengths ranging from ultraviolet to deep red—was projected onto the dancers and reflected to a target surface. The target was a three-tiered array of chairs, each occupied (on a good night) by an observer. The observers were self-selected but were subject to the stringent filter of a £20 to £35 admission price. Relative to the light, sound waves from the orchestra pit reached observers with a delay that could be regarded as negligible for the purpose of the experiment. The warping of space-time between stationary observers and moving dancers could also be disregarded.

Results. Upon seeing the first sortie of dancers flit across the stage in head-to-toe, frilly white frocks, this observer mistook them



for Woody Allen-esque spermatozoa. Although the dancers were adorably capricious, it was only with post hoc explanation that I realized that they represented pollen grains undergoing Brownian motion due to molecular collisions. (Einstein's 1905 model of the erratic jiggling of microscopic particles was used to prove the existence of atoms.)

After this uncertain start, the dance came into its own. With the arrival of a woman clad in undulating tutu and a blue puff ball sprouting from her crown—suggesting the dual nature of photons as particle and wave—we observers began to register rich emotional resonance. We giggled when a

low-energy dancer had to be carried off stage by others in a pithy nod at the photoelectric effect. We sighed with delight through a sexy pas de deux between, it seemed, an atom and his swooning electron. And we gasped when one dancer, in a casual display of athletic virtuosity, flung himself into the air while spinning on two axes as if generating a personal electromagnetic field.

Zooming from the quantum to the galactic, we were treated to a playful exploration of relativity. Successfully translating the intuition-boggling fact that time flows faster or slower depending on one's perspective, the dancers often moved at tempos wildly different from that of the music. Other clever winks at the underlying theory included a roving duet between men in purple stalked by those in red or blue, inspired no doubt by the shift in light's wavelength as one moves toward or away from an object. But not all references hit their mark. When a giant mirrored ball descended from above—to underscore the quantum nature of light, according to Baldwin—I thought only of *Saturday Night Fever*.

During the single section of Lehár's score in a minor key, a solo dancer, alone on the stage like a nucleus in its immense cage of space, enacted the conversion of matter into energy. I was impressed that such pathos could be injected into something as abstract as $E = mc^2$, projecting the somber thought of an atomic bomb into our minds without uttering a word.

Repaying in kind, we speechless observers erupted at the end into thundering applause.

Conclusions. To test whether Einstein's theories had anything to do with the artistic success of *Constant Speed*, consider this Gedankenexperiment. We observers see the very same performance again, but without any knowledge of its subject matter. Will we enjoy it as much? Certainly not. I conclude with relief that science, in the hands of capable artists like Baldwin and the Rambert Dance Company, can be wrought into cultural expressions of sublime beauty. Einstein would have been proud.

Note

1. Einstein referred to his satisfaction with “the mystery of life's eternity” on several occasions. This quotation is from an essay broadcast on Edward R. Murrow's “This I Believe” series on CBS Radio in 1954, the year before Einstein's death.

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