SCIENCE AND CULTURE

Avant-garde outreach, with science rigor

Amber Dance, *Science Writer*

On a breezy, crisp evening in December 2015, about 70 party-goers, some bedecked in feathers and glitter, entered the legendary Carwash disco in London's West End. There they buckled packs containing accelerometers to their waists and danced for science.

Daniel Margulies, a neuroscientist at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig, Germany, and his postdoctorate Melissa Ellamil, were in the nightclub to study synchronous movement in a social context. The two hope the results, combined with future experiments using MRI scanners, will help them identify how different regions of a person's brain are connected to each other: what scientists refer to as the "connectome."

To help make their giant dance experiment a success, the researchers teamed up with a science outreach and events outfit called Guerilla Science. The organization's help was key. "It definitely was a bit more complicated than running a lab-based experiment," recalls Ellamil, grinning. They could never, for example, have mimicked the club environment with music and a few lights in a laboratory setting, notes Margulies. Still, they kept to the usual research protocols, getting their plan approved by an ethics committee at Durham University and having subjects provide informed consent both when they registered online, before the event, and when they arrived at the club.

It's one of several unusual and carefully orchestrated events Guerilla Science has organized in conjunction with scientist collaborators. Such avant-garde approaches may seem far afield from science research. But the group aims to maximize its impact by taking the science to members of the general public who frequent entertainment events and venues, part of an attempt to meet a common outreach challenge. "The key thing with science outreach is not to preach always to the converted," says Marcus du Sautoy, a mathematician and the professor for the public understanding of science at the University of Oxford.

Extraordinary Outreach

Founded in 2008 in London by five young science communicators, Guerilla Science also has a New York City branch. "Guerilla" alludes to the element of conducting science in unexpected locations, such as the disco or music festivals. "Think science by stealth," says director and cofounder Jen Wong. In addition to the disco experiment, their projects have included a "rat" maze sized for humans, a dinner party exploring the brain, and a "Mutant Circus," complete with fruit flies played by human performers as well as real *Drosophila*.

Past events by the outreach organization Guerilla Science include a dinner party exploring various aspects of the brain. Photograph by Rita Platts and image courtesy of Guerilla Science.

Guerilla Science is not alone in its attempts at outside-the-box outreach. In one case, scientists from the Instituto Gulbenkian de Ciência in Portugal conducted "meet and greets" with fans attending a Coldplay concert, an outreach effort described in *EMBO Reports* (1). Scientists in many locales have moved beyond the laboratory to science café discussions, informal chats, and performances in nontraditional venues.

Guerilla Science's founders have science degrees, and they always collaborate with scientists in hopes of achieving some level of scientific rigor. The founders even secured grants from the Wellcome Trust and the Simons Foundation to bring science outreach to underserved audiences: the people who don't typically go to museums, for example.

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"We want to move people with scientific ideas in the same way that if you go to theater or a film, your emotions are engaged," says Wong, who has degrees in natural sciences and the history and philosophy of science. Plus, Wong says, people attending music festivals are open to new ideas, especially if those ideas are packaged in a fun way. In the "Lab Rats" exhibit at the Glastonbury Festival in 2013, Guerilla Science offered a taste of the life of a laboratory animal. "Scientists" in rat masks and laboratory coats collected their human participants from a "holding pen" designed to look like a rat cage. Smell- and vision-based tests designed by Edward Bracey, a neuroscientist at the Medical Research Council National Institute for Medical Research in London, were administered, although no data were collected.

For the 2014 Brain Banquet, Guerilla Science collaborated with Headway East London, a charity that supports people with brain injuries and their families. As attendees wandered the passages of a former World War II bunker, they encountered rooms that explored a different element of the brain through art installations or interactive exhibits. Then they sat down to a five-course meal, accompanied by presentations from Margulies and other brain experts.

Making an Impression

It's difficult to track the impact of such events on attendees or society. Margarida Sardo, a science communication researcher at the University of the West of England in Bristol, has studied audience reactions to science-themed activities at leisure events taking place during 2009 and 2010, and again during 2014 and 2015 (2–4). At a Guerilla Science event at the 2009 Latitude Festival in Henham Park, United Kingdom, many attendees told her they enjoyed the science-based lectures and performances, and 74% reported they learned something new (2). Festival attendees, both children and adults, particularly enjoyed the opportunity to speak directly with scientists. "There's a lot of value from taking science to these informal venues," says Sardo.

The events can be rewarding for scientists, too, according to anecdotal evidence. One online survey of 19 scientists quizzed those involved in developing or presenting projects in the Einstein's Garden section of the Green Man Festival in Brecon Beatons, United Kingdom (5). Most respondents rated the impact of their involvement highly in categories such as "confidence in communicating science to the public." The author acknowledged, in her analysis, that scientists who make an effort to participate in such events are likely to be open to these kinds of benefits. "Nevertheless, it is remarkable that they attributed strong longer-term changes to their attitudes, confidence, and continued involvement in public engagement, to their participation in Einstein's Garden projects," she wrote (5).

Before a Guerilla Science event that took place at a disco, dancers were fitted with packs containing accelerometers that monitored their dancefloor moves. Photograph by Richard Eaton and image courtesy of Guerilla Science.

For neuroscientists Margulies and Ellamil, the reward for their work will be the publication of their initial observation study (a journal recently accepted it, they say). Based on the accelerometers in smartphones strapped to their dancers, the researchers measured movement in three dimensions, and identified songs when those movements were synchronized across several participants. They found that crowds on the dance floor tend to move in unison under two different conditions: first, during the songs everybody knows, such as popular tunes by well-known singers; and second, during music with a rhythm of 100–150 beats per minute. That's approximately the number of steps a person takes every minute while walking, so Ellamil thinks it was easy for dancers to move at the same speed.

Next, she and Margulies hope to link their disco findings with brain connectivity, although they'll have to return to a traditional laboratory set-up to do so. The researchers plan to put a new set of study participants in an MRI and play the same music set that had been played at Carwash. It wouldn't be surprising, Margulies says, if there were one specific pattern of brain activity that occurs during those times when a group of dancers sway as one.

1 Leão MJ, Castro S (2012) Science and rock. *EMBO Reports* 13(11):954. Available at embor.embopress.org/content/13/11/954.long. Accessed October 5, 2016.

2 Sardo AM (2009) *Latitude Evaluation Report. Project Report* (Univ of the West of England, Bristol, UK).

3 Bultitude K, Sardo AM (2012) Leisure and pleasure: Science events in unusual locations. *Int J Sci Educ* 34(18):2775–2795.

4 Sardo AM, Grand A (2016) Science in culture: Audiences' perspective on engaging with science at a summer festival. *Sci Commun* 38(2):251–260.

5 Dowell E (2014) Einstein's Garden 2009–2014: Unexpected encounters with science. *Journal of Science Communication* 13(4):C06.