

into the microphones, triggering short sections of this sound when one of the neurons “fires.” The neuronal network is driven by a noisy signal that keeps the system “buoyant” and has an additional algorithmic plasticity code that changes network connection strengths according to causal firing between the neurons, mimicking simple learning. When the neurons fire, their corresponding LED lights also light up, causing cascades of firing events to create a scattering of light and recorded live sound across the speaker network.

The patterns of lights and sounds triggered across the network occur in *polychronous* groups [4], in which the imaginary and the memorial are linked with sensory perception and the collective dynamics of the spiking neurons. Subgroups of neurons become *polychronized* (causal firing together in a group but not at the same time), and it is the pattern of the firing subgroup that represents the signal pattern for the initial stimulation. Izhikevich’s idea introduces simple memory into this scenario by suggesting that the re-firing of the polychronized group of neurons evokes the original stimulus within our imagination.

## References and Notes

1. Y. Wei and A. Koulakov, “Long-Term Memory Stabilized by Noise-Induced Rehearsal” (2012); <arxiv.org/abs/1205.7085v1> (Retrieved 19 July 2012).
2. H. Bergson, *Matter and Memory* (New York: Zone Books, 1988).
3. Jane Grant, John Matthias, and Nick Ryan, *The Fragmented Orchestra* (2008); <www.thefragmentedorchestra.com>.
4. E.M. Izhikevich, “Polychronization: Computation with Spikes,” *Neural Computation* **18** (2006) pp. 245–282.
5. E.M. Izhikevich, *IEEE Transactions on Neural Network* **14**, No. 1469 (2003).

---

Manuscript received 2 January 2013.

*Jane Grant is an artist and academic. She is Associate Professor in Digital Arts at Plymouth University in the U.K. and co-director of the Art and Sound Research Group.*

*John Matthias is a musician, composer and physicist and is Associate Professor in Sonic Arts at Plymouth University, U.K. and co-director of the Art and Sound Research Group.*

## SOLAR WORK #2: A SOLAR-POWERED SOUND ARTWORK

Mike Blow (artist), Sonic Art Research Unit, Richard Hamilton Building, Oxford Brookes University, Headington Campus, Headington Hill, Oxford OX3 0BP, U.K.  
E-mail: <mike@evolutionaryart.co.uk>.

*Documentation of the work can be found at <www.evolutionaryart.co.uk/solar2.php>.*

### ABSTRACT

This paper describes the concept and realization of *Solar Work #2*, an outdoor, solar-powered sound artwork that responds to the sun, creating a field of small sounds and drawing visitors into the physical and sonic landscape.

*This work is miles wide and miles high and takes me right into the sound of the world.*

—Visitor comment

*Solar Work #2* arose from my desire to explore the relationship of a sound art piece to the sonic and visual landscape, with the goal of creating long-term compositions that would reflect changes in the weather and challenge visitors’ concepts of “natural” and “artificial.” The idea of using solar power came from my interest in placing autonomous units outdoors in places where it would be difficult to use conventional power. I wanted to free electronic sound work from its reliance on the grid or batteries and extend the range of potential sites open to artists. It also arose from a dissatisfaction with the tangles of cables and constant battery changing usually associated with electronic sound pieces. Additionally, the project was an investigation of what is possible in terms of autonomous sound pieces using current solar technology.

Sonic art powered by solar energy has some precedent. In the late 1970s, Fluxus artist Joe Jones started creating solar-powered kinetic work, culminating in *Solar Orchestra* in 1982 [1]. Alvin Lucier’s *Solar Sounder I* (1979) was designed to explicitly reflect the seasons and revolution of the Earth, and Lucier hated the idea of the piece being changed by human interference [2]. Felix Hess used solar-powered oscillator circuits driving piezo discs in an installation called *How Light Is Changed into Sound* in 1996 [3], and more recently Craig Colorusso created *Sun Boxes*, a collection of 20 sound-producing boxes each powered with a solar array [4].

Long-term weather-driven compositions found expression in Max Eastley’s aeolian instruments [5] and Jem Finer’s *Score for a Hole in the Ground* [6], an interesting example of a permanent outdoor work designed to reflect, sonically and visually, the environment in which it is situated.

In the version described here, *Solar Work #2* consists of seven brass gramophone horns hung in trees roughly 20 m apart, in a line across the landscape (Fig. 1). The line is oriented so as to roughly mirror the sun’s path across the sky (Fig. 2). Each horn is connected by wire to an oscillator circuit and a photovoltaic (PV) cell mounted on a nearby branch, emitting sound that varies in speed and pitch—between a drone, a cicada-like chirp and a siren-like oscillation—with the amount of sunlight. The piece uses piezo disc sounders and simple square wave oscillators [7] and draws very little current; as such, it will work even under overcast conditions, although the sound will be quieter. The volume of the sounds was carefully considered so as not to drown out the sounds of the environment. In bright sunlight it is just possible to discern the sounds from two horns when standing between them.

After many trials, I decided that the optimal system for each unit was two channels, with each of two oscillators in series and each feeding a piezo disc attached to one side of a balsa wood resonator. Along with variations in the circuit’s supply voltage due to the amount of light falling on the PV cell, the oscillators also incorporated a semi-random mixture of component values and photocells. This combination gave a wide variety of pitches and rhythms in changing light. I sourced the brass horns housing the resonators from India (as a custom order from a company that manufactures reproduction gramophones) and hung them in the trees using brass picture wire.

The piece reflects the chaotic nature of the weather; the chance events and indeterminacy inherent in this process are embraced as part of the nature of the work. The sound of *Solar Work #2* can be considered a durational performance [8], an open-ended, long-term composition, in that it will continue for as long as its components last, and each day can be considered a small “movement” in the overall musical structure. In fact, the composition would reflect changes in the weather over years due

**Fig. 1. Mike Blow, *Solar Work #2*, sound installation, 1 March 2012. One of the gramophone horns, with wires leading to the oscillator circuit and PV cell. (© Mike Blow.)**



to global warming or other climate changes, and can be thought of as a sonification of weather data, as the sound produced responds immediately to weather conditions.

Each visitor's experience of the piece will differ and will be co-created at the intersection of the work, the environmental conditions and his or her own movement. Indeed, the environment is so vital that the work cannot exist without it. Several visitors commented that the sound of the piece led their ear into the sounds of the environment, and as such the dimensions of the work can expand beyond the material and sonic boundaries of the horns to the limits of hearing and sight of the visitor.

#### References and Notes

1. K. Friedman, ed., *The Fluxus Reader* (New York: Academy Editions, 1998) p. 61; <www.scribd.com/doc/55437481/PDF-Fluxus-Reader-Whole-Book-Large-File-36MB>.
2. A. Lucier and A. Margolis, "Conversation with Alvin Lucier," *Perspectives of New Music* 20, No. 1/2 (1982) pp. 50–58.
3. F. Hess and B. Schulz, *Felix Hess: Light as Air* (Heidelberg: Kehrer, 2001) pp. 48–53.
4. C. Colorusso (2012); <www.sun-boxes.com>. Accessed 15 October 2012.
5. T. Gibbs, *The Fundamentals of Sonic Art & Sound Design* (Lausanne: AVA, 2007) pp. 48–53.
6. J. Finer et al., *Score for a Hole in the Ground* (UK: Stour Valley Arts, 2008). See also Jem Finer, "Contributor's Notes on *Score for a Hole in the Ground*," LMJ23 CD, *Leonardo Music Journal* 20 (2010).
7. N. Collins, *Handmade Electronic Music* (New York: Routledge, 2006) pp. 129–133.

8. Durational work is notable for its aspirations. As David Toop, writing about Jem Finer's durational work *Longplayer*, points out, "In the face of human barbarity, short-term greed and destructiveness, [*Longplayer*] is a benign creation built to last." D. Toop, "Glimmers of Light": essay in Finer [6] pp. 13–19.

Manuscript received 2 January 2013.

*Mike Blow's work concerns audiovisual relationships and evoking a deeper consciousness of site and physical objects using sound. He is especially interested in using gaps between the seen and heard to engage the imagination and in open-ended work that is completed by chance events such as the weather or the actions of visitors. Blow is currently completing a Ph.D. in the Sonic Art Research Unit at Oxford Brookes University, U.K. and holds a lectureship in Interaction Design at Plymouth University, U.K.*

**Fig. 2. Aerial view of the installation site of *Solar Work #2*, 27 April 2012. Dots show the location of each horn. (© Mike Blow)**

