Jill Scott defines a creative incubator as a warm physical space and a psychological environment conducive to a growing collaboration between art and science practitioners and theorists. This incubator can already be found inside interspatial zones that encourage creative experiment building and the sharing of findings in disciplinary-specific technology. She suggests that an increase in creative collaboration, “lateral thinking” [1], “tacit interactions” [2] and “situated” know-how-transfer [3] may encourage this incubator to grow. She uses specific examples from science and art research from Australia and overseas to cross-correlate this creative incubator in four different interspatial zones.

First is the biology lab zone where an incubator is used to regulate temperature, air circulation, oxygen levels and humidity: controlling the conditions that can help a premature life to grow, change or survive. Here artists are working with incubators to recreate life forms or bio-mimic the growth of life and study behavior. Second, theoretical physicists refer to the incubator as a research factory of talents, a zone that advances knowledge about the production of matter and energy [4]. Here artists can collaborate, sonify or visualize the invisible and explore particle interaction. However, a third zone in Scott’s creative incubator list has feminist, sociological and educational connotations, and here artists and designers often work with citizen scientists and social scientists to take research and technology out for public communities to learn from, use and be empowered by. A final interspatial zone collaboration focuses on evolution and ecology, where many macroconnotations of incubators are apparent, like our catastrophic realities of ocean quality and animal welfare. Here the Anthropocene portrays the whole Earth as one big incubator, one in which the humans are doing the warming! [5] Here holistic and symbiont behaviors are already inspiring new communicative interpretations.

Scott’s version of the creative incubator incorporates all these interpretations, but foremost it is an active concept of mutual understanding for discussion and practice, not only of new inventions and discoveries but also those matters that are unformed and in-process, difficult to describe even in the language of one’s “home” discipline. In this creative incubator participants could aim to share goals, perspectives and values about culture and society as well as promote community consciousness. Certainly, as our “natural” environments become more complex and less sustainable, there is an increasing need to join this as a “commons network” wherein we can redesign representations of the “artificial” and collaborate on new “wet” experiments that explore how our sensory processes can cope with increasing complexities. “Creative Incubators for a Common Culture” could create a new methodology with its own logic or a series of energetic subsystems that can remove boundaries between culture and society for more public engagement. Rather than being focused on self-interest or mass media motivations, they are places where experts meet with nonexperts to share ideas about impacts for the common good and discuss ethics with future generations.

What kinds of artists, social scientists and scientists are willing to blur conventional boundaries and familiar practices to participate in such a creative incubator? Scott suggests these incubators might be only for those of us who can think critically, creatively AND laterally.

References and Notes

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ART-SCIENCE COLLABORATION ON THE ACOUSTIC PROPERTIES OF DIRECT METAL 3D PRINTING

Anton Hasell and Daniel East

As a recipient of the ANAT Synapse Residency at CSIRO’s Lab22—additive manufacturing research into direct metal 3D printing—artist Anton Hasell, familiar with traditional bell foundry technology, collaborated with Daniel East, head of Lab22, to research 3D direct metal printing technologies to understand the acoustic outcome of printed musical bells in comparison with cast musical bells.

As director of Australian Bell P/L, the company commissioned to create the Federation Bells Carillon in Birrarung Marr Park, Melbourne (www.federationbells.com), Hasell collaborated with many people, including musician Neil McLachlan and engineers Josef Tomas and Behezad Keramti Nigjeh, to invent new bell designs, including the harmonic bell, central to the centenary of Federation bell projects undertaken between 1998 and 2002.

In 2015 Australian Bell was commissioned by the Long Now Foundation to invent a “difference-tone” bell design for the 10,000-Year Clock project to be installed inside a mountain in West Texas. He worked with engineer Ryan Adams using the Finite Element Analysis software ReShape (developed by Tomas) to optimize a bell profile to a partial frequency array necessary to generate a difference-tone pitch in the ear of a listener. The virtual model was 3D-printed in plastic as a foundry pattern from which a silicon bronze bell was cast using resin sandcasting processes.

While the cast bell did not sound a difference-tone (a psychoacoustic pitch an octave below the lowest partial frequency in the bell, its fundamental), careful tuning of the test bell enabled the discovery of a profile that did sound a difference-tone when rung. Ten of these newly designed bells were cast and tuned by Hasell in a musical scale for the Clock project.

With the blessing of Danny Hillis, designer of the 10,000-Year Clock, East and Hasell used the Australian Bell–invented “difference-tone” bell design, with its known profile and frequency array as traditionally cast in silicon bronze, for their research project on the acoustics of printed bells. They printed bells in titanium at CSIRO, Melbourne, and had bells printed in stainless steel/bronze composite metals at the Exone Company’s 3D-printing laboratory in the United States.

Using the CSIRO E-Beam Arcam A1 printer, two bells at different scales were printed in titanium from metal powder. Both produced difference-tone pitches when rung. Two Exone 3D print bells, one in a 316 stainless steel powder infused with a tin bronze to form a composite metal, and the other in a 420 stainless steel powder/tin bronze composite metal, also sounded difference-tones when rung.

The results showed that if the bell profile is preserved through the printing process, the partial frequency array of that profile remains intact. Naturally, the differing elasticity between the metal alloy of each bell produced differing pitches for bells at the same scale.

While cost and scale limitation inhibits the use of direct metal 3D printing for bells at present, our findings suggest that, as this technology escapes those constraints, it is a manufacturing process offering a promising future for new musical bell design and bell production.

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Genuine interdisciplinary collaboration between the arts and sciences can be complex. Andrew Barry, Georgina Born and Gisa Wèszkalnys characterize the emergent field of art-science as an intersection where “practice runs ahead of theory” [1]. Harriet Hawkins urges researchers “to build critical reflections across disciplines that not only spark deeper conversation but that also induce a desire for interdisciplinary rigor” [2]. To advance art-science research, it is crucial that artists and scientists critically reflect on their collaborative processes.

This paper contributes to this dialogue by presenting the challenges encountered in the art-science research project Material Science, Slow Textiles & Ecological Futures (MSSTEF). The project was initiated by artists Agnieszka Golda and Jo Law to build on their 2017 Visiting Research Fellowship at the Museum of Applied Arts & Sciences, Australia. Their fellowship investigated traditional slow textile techniques in the Museum’s Asian Textiles collection [3] such as metallic thread embroidery, to locate new ways to embed conductive materials into fabric. Golda and Law invited materials scientist Sepidar Sayyar and climate scientist Helen McGregor to further their research. MSSTEF investigates how the incorporation of innovative materials such as conductive graphene and low-energy electronic devices, slow textiles techniques and climate data into original artworks can communicate the stories of our changing climate to inspire meaningful actions. The result was Spinning World—an immersive and interactive installation exhibited at Sydney’s Powerhouse Museum, which received over 26,000 visitors [4]. The exhibition consisted of three e-textile works: a large hand-stenciled wall hanging depicting a coral-scape with hand-embroidered speakers that played an underwater sound recording of the Great Barrier Reef, a second animated wall hanging created using hand-fashioned electromagnets, and two lengths of touch-sensitive screen-printed graphene wall hanging created using hand-fashioned electromagnets, and two lengths of touch-sensitive screen-printed graphene and low-energy electronic devices, slow textiles techniques and climate data into original artworks can communicate the stories of our changing climate to inspire meaningful actions. The result was Spinning World—an immersive and interactive installation exhibited at Sydney’s Powerhouse Museum, which received over 26,000 visitors [4]. 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