The authors report on their artistic research project TRaNsMOGRiFiER and highlight musician-specific approaches to creating with technology that privilege the sharing of tools and practical knowledge. The use of fictional narratives as a catalyst for instrument-building and art-making is at the forefront of the discussion. By rethinking DIY/maker culture with an emphasis on collaboration and collective creativity, the authors highlight the tension between the production of fixed media output and practices that resist encapsulation. TRaNsMOGRiFiER underscores the benefits of hands-on learning and presents a collaborative artistic platform with a focus on open-ended processes and ongoing change.

The TRaNsMOGRiFiER project is a week-long installation, durational performance, instrument and fiction conceived by Peter Bussigel and John R. Ferguson. It is also a curated space for collaboration, experimentation and learning that encourages unpredictable music and collective art-making using randomly acquired objects. The frame for this project comes from Bill Watterson’s 1985–1995 comic strip Calvin and Hobbes [1]; of particular interest is the March 1987 sequence that begins with Calvin inventing a transmogrifier (Fig. 1), a device he claims can be used to “turn one thing into another” [2]. Calvin’s transmogrifier is an upside-down cardboard box, sometimes drawn with a “destination” dial on the side, but only Calvin and Hobbes can see the results.

TRaNsMOGRiFiER builds on Calvin’s imaginative approach to a cardboard box, extending it to a gallery context, to the various performances contained within the gallery and to the project documentation and archive. The use of cardboard boxes is a deliberate attempt to highlight the potential of these uncelebrated containers for improvisation and also informs our underlying hypothesis that all objects are open to reanimation, reconfiguration and reuse; all it takes is time, space, a few tools and a bit of imagination. TRaNsMOGRiFiER adheres to broad definitions of what it is to transmogrify something or someone, i.e. “to change or alter greatly and often with grotesque or humorous effect” [3]. Taking Calvin’s transmogrifier as both catalyst and starting point, this project celebrates the cardboard box as a whimsical container, while also foregrounding reanimation and play as a method for supporting creative possibility and learning technical skills.

WHAT IS TRaNsMOGRiFiER?

As well as being an instrument, TRaNsMOGRiFiER is a temporary space for collective experimentation and sound-making. Objects donated by the public are subject to transmogrification—an unpredictable process that involves collective improvisation, found materials, cardboard, electronics and hot glue. Overnight, each object is transformed, documented and then displayed on a pedestal. An owner can pick up their object in transmogrified form (henceforth: objectTR) the day following exhibition. There is no charge, but in all cases, transmogrification is irreversible.

Undergirding the fiction of the TRaNsMOGRiFiER is reanimation, the process of breathing new life into objects that have been offered and discarded. In Reanimating the Readymade, Bussigel, Moore and Smallwood draw from Karen Barad’s agential realism in writing, “Sound work that treats objects as agents, voices, materials, and/or language, gets at the fundamental messiness of our relationship with the things we make, use, and discard” [4], going on to suggest that sound provides a playful and open-ended medium to refigure our relationship to everyday objects. Using ready-made or unpredictably acquired objects subtly invites us to approach our materials as vital and lively actors, to work with their contexts and histories. This technique encourages collaboration and storytelling—defects become starting points, basic functionality becomes wonderful and simple interventions become profound. By embracing transmogrification as a strategy to explore experimental instrument-building and musical/artistic collaboration, we hope to push beyond...
predetermined behavior, received wisdom and self-imposed limitations.

The TRaNsMOGrIfiER system has six main elements: (1) rotating capacitor trees and a large wall-mounted network that functions as a room-sized electromechanical instrument/sound installation; (2) a cardboard drop-off and pick-up area with simple instructions; (3) a gallery space that presents new objects every 24 hours for the duration of the project; (4) a rotating sculpture, "the eye," that watches over all activities; (5) a workshop/maker space that evolves with the installation; and (6) a Polaroid wall and online archive that documents objects. While many of the elements are active throughout the day, the process of transmogrification occurs at night and is an open-ended ritual performed with invited participants in a closed-gallery scenario, i.e. the gallery is open to the public during the day but is closed to the public at night.

CAPACITOR TREES
In the fictional narrative presented by TRaNsMOGrIfiER, the capacitor trees (Fig. 2) are the central transmogrification processor, or brain, capable of changing any object into any other object, at least in theory. In practice, the capacitor trees are part of a motorized mechanical (un)sequencing system that appears to have grown out of a cardboard box. Various lengths of music wire with capacitors and light-emitting diodes (LEDs) soldered to one end are spread out like spokes on a wheel, resulting in tree-like forms. Each capacitor tree is soldered to the shaft of a motor, which causes the tree to rotate. Electronic energy is fed to the capacitors via magnetically coupled music wire; the integrity of this somewhat flimsy rotating structure and the overall electronic continuity of the circuit is maintained using neodymium magnets (also known as "buckyballs") [6].

As each capacitor tree rotates, the leg of individual com-
ponents briefly brush a hanging length of exposed stranded wire that connects to one of six oscillators. Although the capacitor trees feature a handful of LEDs to visually highlight the liveness of the circuit, capacitors are by far the most common component, and the size/capacity of each capacitor sets the pitch range of each oscillator. The result is a musical instrument that highlights some of the construction processes and electronic circuits that are central to TRaNsMOGrifier.

The capacitor trees serve to orient participants and audience members to the aesthetic universe of transmogrification and help to frame the systems as playful, precarious and functionally wonderful.

The sound-world associated with each capacitor tree is a somewhat off-kilter rhythmic pulse; although motor speed is usually constant, the spacing of individual components on each tree defines the rhythmical placement of each sound within the timing of each rotation. The magnetic coupling of the various capacitor trees means they tend to affect one another physically, as there is some horizontal movement and side-to-side sway, which can cause timing fluctuations. When multiple capacitor trees rotate simultaneously, they produce a rich outcome that is both sonically and visually engaging.

Each capacitor tree is activated by an individual timer, and only rarely are all six running together; throughout each day there is significant variation in sonic density—from silence to a single pulse to a polyrhythmic cacophony. We call this an (un)sequencing system because motor speeds are randomly applied, and their activation is crudely timed, i.e. there is no overall synchronization or “master clock,” so a perception of constantly evolving rhythms and pulses emerges.

**THE NETWORK**

The wire that touches the component legs on the capacitor trees is connected to a wall-mounted circuit that extends the full length of the gallery via bare copper wire (Fig. 3). The brain of the system, a single integrated circuit (IC), is suspended like a spider in a web. This IC is a CMOS 40106 Hex Schmitt-Trigger configured as a six-voice synthesizer; each voice is amplified by an individual amplifier IC (LM386) and loudspeaker [7], all suspended from the wall by the same bare copper wire that carries the electronic signals. Photocells utilized as feedback resistors control the specific frequency of each oscillator; the system is thus sensitive to light, which varies throughout the day due to fluctuations in sunlight. Figure 4 shows an electronics schematic for a single capacitor tree, oscillator and amplifier, i.e. all the sound-making elements, but motors and motor controllers have been omitted for clarity. This circuit is also a simple and effective way of adding responsive sound to objects, and we frequently use this to work with participants who then embed similar circuits in their own transmogrifications.

The TRaNsMOGrifier capacitor trees and network highlight the creative potential of simple electromechanical systems and place a particular emphasis on physical rotation and sonic repetition and evolution. The use of raw electronic components, long lengths of bare copper wire and hand-soldered interconnections foregrounds the role of each component and the nature of a hand-built system in a highly visible and sculptural manner. The rotating capacitor trees and network may be considered an autonomous experimental electronic instrument. However, with the capacitor trees emerging from a cardboard box and the network being suspended from a wall via a mess of copper wire, the mystery of how and why it all works, as well as the exposed visual aesthetic, is also a key catalyst for the fictional narrative that underpins the project.

**“THE EYE”**

A large aluminum structure is suspended from the ceiling and rotates very slowly. An LED creates a glow from within; this affords an eye-like appearance (Fig. 5). It is worth noting that the etymological root of the word transmogrify has been linked to the notion of an “evil eye” [8]. Relatedly, the sense of being watched during a transmogrification session is all too common, as the fish-tank-like attraction of many people working late at night in a gallery with a glass wall is reinforced by a camera that also relays a video feed of the transmogrification process to the outside world. This potentially raises issues around surveillance and the visibility of process versus product, which are beyond the scope of this
However, although the fictional narrative of a machine that can be used to "turn one thing into another" [9] is at the foreground, this conceptual framing is contradicted on a nightly basis, as the camera and glass walls offer a constant window into the chaotic transmogrification process.

THE GALLERY IN FLUX

The entrance to the gallery features a drop-off and pick-up area as well as donation instructions and a "transmogrification is irreversible" warning. This area consists of cardboard boxes of various sizes secured to the wall and arranged as partitioned shelves, with vacant spaces open to the gallery so that donated objects can be clearly displayed. The central section of the gallery features a number of pedestals that have deliberately been constructed to present items at unusual heights, i.e. the smallest is only a few inches tall while the largest reaches more than seven feet. The pedestals each feature an overhanging incandescent bulb for illumination and are used to present objects in a pseudo-"high-art" manner. The contents of each pedestal change daily. Owners pick up their objects the day after they have been displayed or donate them for use in the closing performance. The back third of the gallery contains two large workshop tables and a large cardboard structure that mirrors the partitioned shelving of the drop-off area and serves as housing for all the tools, electronic components and other necessary paraphernalia (Fig. 6). All transmogrification occurs in this workspace, which evolves significantly from one day to the next.

By actively reconsidering the fixed objects one often finds in galleries and opening the gallery up to the various activities of musicians, makers, sculptors and tinkerers, TRaNSMOGriFiER draws on open-ended play and invites active participation. Decades of performance installations have worked to intervene in the embedded power structures of institutionally sanctioned gallery spaces, and TRaNSMOGriFiER’s cardboard boxes and responsive capacitor trees invite visitors to get lost in the play of it all. The workshop, an overwhelming mess of collected materials, is the backdrop for an animated and surreal gallery setting. Sound, ever-evolving, is adept at unsettling the functional clarity of institutional spaces, and the noisy, pointillistic patterning of the capacitor trees encourages audience members to explore the chaotic nature of a room-sized composition that shifts sonically throughout the day and transforms each evening.

COOPERATIVE EXPERIMENTALISM, OR A CARDBOARD FRAMEWORK AS AN EXCUSE TO MAKE THINGS TOGETHER?

The Maker Movement is a do-it-yourself (DIY) culture in which makers, hackers and tinkerers are not satisfied with letting Silicon Valley determine how we use technology but want to do it themselves on their own terms. The practice of making has been described by Breaux as "the process of creating something outside of traditional manufacturing
The accessibility and affordability of new open technologies, and the use of digital manufacturing, have resulted in the maker movement being described as "the new industrial revolution" [11]. Chippewa notes that "democratization of means—the increased access to technologies since the 1990s—has had a remarkable, positive effect on the development of the broader community of makers" [12], yet despite such claims there is little understanding of which cooperative practices are effective.

Brown, Ferguson and Bennett have coined the term "cooperative experimentalism" to highlight how adopting "an approach to making that privileges sharing of tools and knowledge might be a useful strategy in the development of handmade electronic music instruments and associated live performance practices" [13]. Online mechanisms such as GitHub, Instructables, Reddit and patchstorage.com are perhaps an obvious nexus for such endeavors, but maker/hacker spaces offer a more practical, embodied and hands-on community-centric experience.

We suggest that TRaNsMOGrifiER highlights approaches to making that privilege the sharing of tools and practical knowledge; collaboration and collective creativity is at the foreground, but idiosyncratic individual contributions are also celebrated. By starting with a cardboard box, we frame this collective creativity as ephemeral and playful; cooperative experimentalism focuses on communication of ideas and sharing of methods rather than a perfect or "well-produced" product. Relatedly, the "gallery show" is not reliant on a single object or careful curation but exists as an animated and often noisy dialogue between recently transmogrified objects—\textsuperscript{TM}—the results of cooperative experimentalism.

\textbf{OBJECTS IN, OBJECTS\textsuperscript{TM} OUT}

Despite the fictional narrative at the foreground of the project, TRaNsMOGrifiER is quite clearly people-powered. Objects left in the drop-off area by the public are subject to an improvised process that involves hand tools, found materials, cardboard, electronics and hot glue. Participants are invited to engage with the fictional narrative as a strategy to explore the creative potential within donated objects, beyond any expectation of self-expression or "having an idea how to get started." The modification of found objects is one agenda, but these are usually sound-making or sound-reactive, and a variety of improvised performances take place during each transmogrification. With a third of the gallery functioning as a low-tech maker space (low-cost electronics, hand tools, hot glue), TRaNsMOGrifiER introduces participants to simple sound-making and light-flashing circuits using CMOS 40106 (Hex Schmitt-Trigger) ICs, basic motor control and a variety of pragmatic approaches toward the new objects arriving daily to be transmogrified for exhibition, collection and performance. TRaNsMOGrifiER might therefore be seen as an alternative maker space of sorts; rather than realizing pre-established ideas, participants grapple with "found" objects, with an emphasis on spontaneity.

Figure 7 shows a few examples of objects\textsuperscript{TM}: A broken guitar is reanimated by a piece of felt attached to a small hobby motor. The light-sensitive synthesizer circuit described above is used to give new voice to a shampoo bottle and an old toy accordion (photocells in the lid of the bottle and folds of the accordion). On the bottom left, a motorized boomerang and a toy wooden snake combine to spin and chaotically crash into reverberant springs. A bowler hat has become an audiovisual sequencer and, lastly, a speaker has been repurposed to periodically disturb a pile of aquarium pebbles. Most of these objects bear the marks of experimental and DIY practices—tape, glue and exposed wires. They are tests and second attempts, often humorous and sometimes a little dangerous. At first glance, it is clear that these objects are not meant to last. And, in keeping with the process of transmogrification as outlined by Calvin and Hobbes, they resist a fixed or definitive form.

As a process of sonic experimentation with an object that has been playfully offered by the public, transmogrification becomes a mode of rich dialogue. Participants navigate not only the aesthetics and affordances of an object but also the history and the gesture that brought the object into the gallery. This process is a feedback loop, and participants find themselves reanimating as well, shifting personal perspec-
tives and value systems to figure out both what each object wants to become and how the fiction, the cardboard box, is asking them to play with the object. TRaNsMOGriFiER ends with an improvised performance (Fig. 8) that activates the capacitor trees and light-sensitive network and explores a number of objects. Any remaining objects are donated to the audience at the end of the performance.

CONCLUSION

This article reports on TRaNsMOGriFiER, a week-long installation, durational performance and instrument that invites audience members and participants to engage with a fictional narrative based on Bill Watterson’s Calvin and Hobbes. Calvin’s transmogrifier is deployed as a conceptual jumping-off point to practically explore experimental instrument-building and musical/artistic collaboration in an imaginative manner. The benefit of learning by doing is at the forefront of the project, and large-scale, inclusive artistic platforms that celebrate sound are highlighted.

The fictional narrative provides a frame that recasts objects as material agents with untapped potential rather than as static products, and this reanimation asks participants to shift their perspectives as well. Notions of authorship and fixity are replaced by skill-sharing and open-ended play, a shift encapsulated by the term “cooperative experimentalism,” which rethinks maker space culture to focus on process and change rather than virtuosity and product. The overall goal is to remember that objects (and ideas) are open to reanimation and reconfiguration. By placing objects on pedestals and then performing concerts with them before returning the objects to the community that donated them, we hope to highlight the value of creative reuse and encourage musical experimentation with and through technology.

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6 For further background, see https://en.wikipedia.org/wiki/Neodymium_magnet_toys (accessed 30 December 2019).
9 Calvin and Hobbes Wiki [2].

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