Physical Glitch Music

A Brutalist Noise Ensemble

MO H. ZAREEI WITH **DALE A. CARNEGIE** AND **AJAY KAPUR**

ABSTRACT

This article introduces an ensemble of mechatronic sound-sculptures designed and developed to realize glitch music outside of computers; the sculptures instead create glitches mechanically, physically and visibly. A brief description of the three different instrument types forming the ensemble is followed by a discussion of how the sound-sculptures employ a Brutalist "anti-beauty" approach in terms of both design and ideology.

If Luigi Russolo impregnated the pure world of musical sound with industrial noise, then glitch music, according to Caleb Kelly, "combined the clean world of the digital with a dirty, detritus-driven sound" [1]. From Russolo and his noise machines to current laptop-producers of glitch music, organizers of sound, for more than a century now, have been keeping abreast of the available technologies of the day in order to explore new sonic territories and push the boundaries of music and sound art. Russolo's claim with regard to the connection between "the evolution of music" and "the multiplication of machines" [2] can be observed succinctly in the transformation of glitch music itself, from Christian Marclay's experiments with turntables to Yasunao Tone's damaged CDs and Nicolas Collins's modified CD players [3] to Carsten Nicolai's laptop-produced glitch. In all these instances, some undesired sonic by-products of technological developments, as Greg Hainge describes, are integrated "into an aesthetic construct, as primary content" [4]. Inspired by works of contemporary digital glitch music, I created a mechatronic noise ensemble, which I discuss here, to feed off of unwanted sonic byproducts of the technological world that occur in the physical realm (rather than in the digital).

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PHYSICAL GLITCH

Along with rapid developments in the fields of mechatronics and robotics over the past few decades, the number of works of sound art and music that incorporate these systems has significantly increased [5]. Regardless of the specific apparatus they employ, a large number of these works are rather deterministic systems, inspired by some already existing musical instruments whose goal is to achieve a certain musical output. In other words, such works can be perceived as mechatronic versions of conventional musical instruments, with automated, modified or extended capabilities, for example, with perhaps a machine substituting for a human performer in the action of plucking a guitar string. Here, the inherent actuation noise of the mechatronic components raises an issue and needs to be overcome, through either various dampening techniques or amplification of the musical instrument's sound. Therefore, in cases of mechatronic versions of conventional instruments, while the technological medium provides the means to achieve a desirable sound, it simultaneously introduces into the transmitting musical signal an undesirable noise that has to be attenuated.

Accordingly, if "a glitch is that which betrays the fidelity of the musical work" [6], then the inbuilt noise of the mechatronic machines is the physically generated counterpart of the skipping CD or speaker distortion in the realm of digital sound.

From the viewpoint of those interested in glitch, however, this otherwise undesired noise can open a door to new sonic material and be transformed from a subordinate byproduct into the primary content of an aesthetic construct. With this in mind, the installations of Zimoun and Pe Lang are remarkable examples where mechatronic components are employed in the creation of a less conventionally "musical" sonic output to aestheticize mechanically produced noise [7]. In the majority of their works, these artists create a series of identical noise-generating units, each of which incorporates a mechatronic component to actuate an external nonmusical object, such as steel wires, cotton balls or cardboard boxes. Using the term "prepared" in reference to the electromechanical components in the titles of their pieces (e.g. prepared motors), these artists emblematically emphasize their unconventional approaches in the employment of mechatronics, in contrast to those works in which machines are used to mechanize a conventional musical instrument [8].

In an attempt to validate the idea of mechatronic machines and their mechanically produced noise as aesthetic elements, I designed and developed a series of mechatronic sound-sculptures. In my ensemble, the basic components of mechatronic systems are removed from the context in which they are tools that help run a machine (or a musical instrument), and their sound is perceived as a sheer unsolicited by-product (noise or glitch); instead they are turned into a medium for sonic expression. This contextual transmutation is accomplished through an apparatus that combines mechatronic techniques with microcontroller programming to regulate their noise rhythmically and timbrally, thereby "musicalizing" them. As Jacques Attali argues, the only thing that all kinds of music have in common "is the principle of giving form to noise in accordance with changing syntactic structures" [9].

Fig. 1. Mo H. Zareei, *Rasper*, mechatronic sound-sculpture, electronics, metal, plastic (transparent enclosure dimensions: 6 × 50 × 6 cm), 2013. Sound is generated when a contact is made between the spring steel (attached to the solenoid) and the rotating disk (mounted on the DC motor). (© Mo H. Zareei)

THE NOISE ENSEMBLE

The noise ensemble is composed of 10 sound-sculptures grouped in three different types: *Rasper* (×4), *Rippler* (×2) and *Mutor* (×4). Each type varies in terms of parts, mechanisms and sonic quality. All three types are driven by the same custom-designed driver board and controlled using microcontroller programming [10].

Rasper [11], the first sound-sculpture in the series, is composed of a DC motor attached to a disk, a piece of spring steel connected to a solenoid and an LED strip, all held together in a clear acrylic enclosure (Fig. 1). *Rasper*'s sound-generating mechanism is somewhat inspired by the mechanism used in a number of Russolo's noise intoners [12]: Russolo's crank has been replaced with a motor; the lever with a solenoid; and the vibrating material, i.e. the metal string, has been replaced with spring steel. As the solenoid pushes out, the motor spins the disk. Sound is generated when the sharp edge of the spring steel touches the rotating disk. Changes in speed of rotation result in changes in the timbre and frequency of the sound. *Rasper*'s LED strip is driven by the same signal as the solenoid. Therefore, every noise pulse is reflected visually with an accompanying burst of light.

Although the dominant sonic output of *Rasper* is caused by the contact between the spring steel and the disk, the solenoid's actuation noise and the buzzing of the motor are also components of the resulting sound. Both of these were sources of inspiration for the design and construction of my succeeding sound-sculptures. *Rippler*'s sound-generating mechanism is based on amplification of the solenoid's actuation noise through a thin sheet of steel [13]. I designed two models of the instrument. Both models are composed of a steel sheet in a clear acrylic frame: the steel sheet of the first model is positioned vertically, in the second model it is positioned horizontally. The resulting direction of the actuation relates to the orientation of the sheet. In the vertical model a single solenoid is attached to the sheet at the top; in the horizontal model, two solenoids are attached, one at each end of the sheet (Fig. 2). When the signal is applied, the solenoid causes the sheet to vibrate. The actuation noise of the solenoids is amplified through a series of pulses caused by the movements of the sheet. In both models, the top of the frame holds a rectangular acrylic tube, enclosing a strip of cold white LEDs. As in the previous instruments, light and sound are synchronous: whenever the sound-sculpture produces noise, there is an accompanying burst of light.

Lastly, *Mutor* [14] has no external actuated object, and therefore its sonic focus is instead the noise of the mechatronic component itself, i.e. the motor, which is housed in a clear acrylic box with a pivoting door. While the primary source of sound here is the buzzing of the motor—the speed of which can be controlled, creating variations in the buzzing frequency and sound—a solenoid mounted on the pivoting door can open and close it, further coloring the sound by varying the timbre and amplitude (Fig. 3). As in the other sound-sculptures discussed, an LED panel mounted on the back of the box provides visual representation of the modulations in sound: As the solenoid pushes out and opens the door, the LED panel lights up the entire box.

Regardless of their different sound-generating components and procedures, all of the sound-sculptures in the ensemble follow the same sense of direction in aesthetic, design and ideology: that of a Brutalistic mindset.

THE BRUTALIST APPROACH

Brutalism (also known as New Brutalism) is a movement in architecture that, according to Reyner Banham, is defined by three key features: memorability as an image, clear exhibition of the structure and valuation of the materials "as found" [15]. Brutalist buildings are often recognizable through their austere geometries and repeated modules, as well as their monolithic look and full exposure of parts and materials. For instance, Hunstanton School, designed by Alison and Peter Smithson, an early example of Brutalist architecture,

> *appears* to be made of glass, brick, steel and concrete, and is in fact made of glass, brick, steel, and concrete. Water and electricity do not come out of unexplained holes in the wall, but are delivered to the point of use by visible pipes and manifest conduits [16].

Correspondingly, the mechatronic sound-sculptures presented here abide by these principles. While their primary purpose is to generate sound, they do this in a physical manner. Therefore, their bodily appearance as *sculpture* is of great importance and has been thoughtfully taken into account. In order to further emphasize their visual attributes, I have designed the pieces so that every single aural event is highlighted in synchronous beams of light, which serves to tightly couple the auditory and visual elements of the work. On the other hand, their entire sound-generating mechanisms and every constituent part are fully exposed in clear enclosures. In these transparent structures, DC motors and actuators, normally hidden inside the black boxes of our machines, are relocated to the foreground in a bare and reductionist style: as found (Fig. 4).

The essence of Brutalism, for the Smithsons, is in fact rooted in ethics rather than in aesthetics and style; however, for Banham, it is a mixture of both. In this ensemble, the Brutalist ethical influence has, with each subsequent sound-sculpture, assumed a more central role. In *Rasper*, I have placed the mechatronic components as exposed as possible, in combination with other materials to serve purposes somehow extraneous to their inherent quality. In *Rippler,* I simplified the mechanism for the purpose of emphasizing one of the mechatronic component's intrinsic features, where in *Mutor*, the mechatronic component appears, both visually and sonically, in a direct and untreated way, as found.

The visual aesthetic of Brutalism, as Banham argues, delivers an "anti-beauty in the classical aesthetic sense of the word" [17]. Therefore, the association of glitch music with what is classified as "extra-musical" by a conventional demarcation can be perceived as a sonic transcoding of the anti-beauty Brutalist aesthetic. If Brutalist architecture

Fig. 2. Mo H. Zareei*, Rippler,* mechatronic sound-sculpture in horizontal model, electronics, metal, plastic (transparent enclosure dimensions: 53 × 35 × 6 cm), 2014. Actuation of the solenoids causes the steel sheet to vibrate. (© Mo H. Zareei)

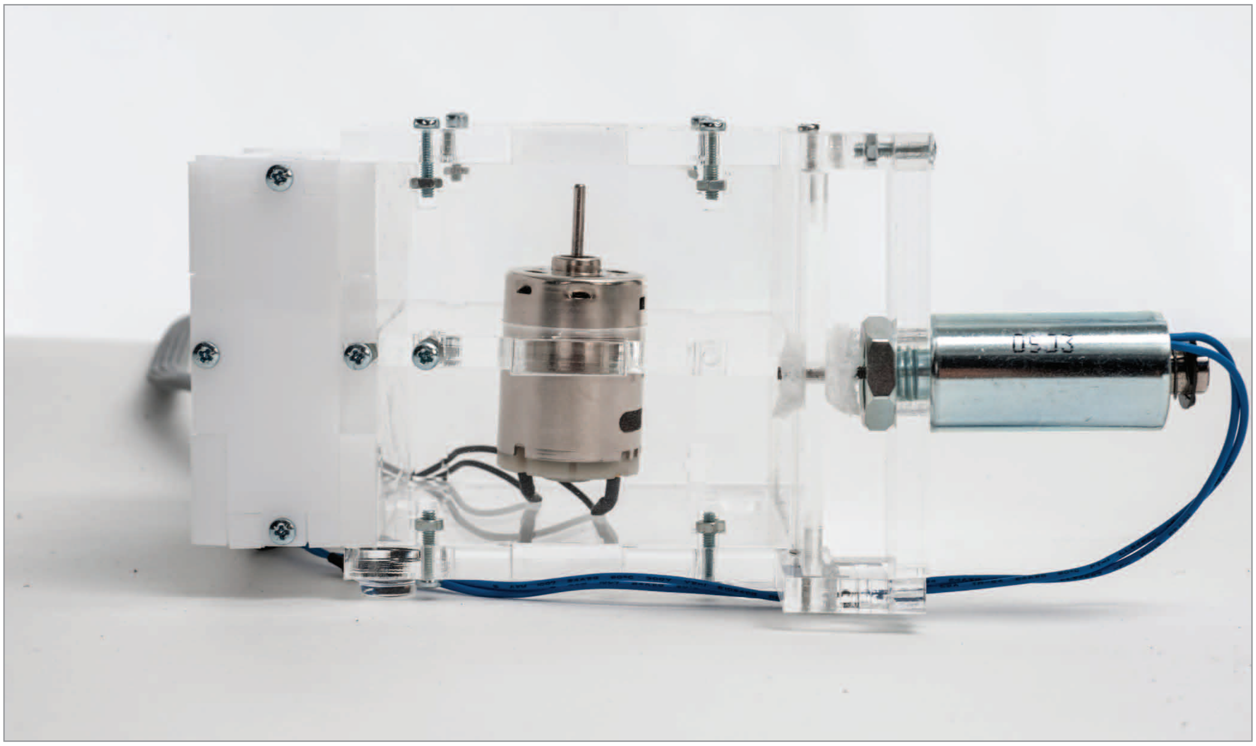

Fig. 3. Mo H. Zareei, *Mutor*, mechatronic sound-sculpture, electronics, metal, plastic (transparent enclosure dimensions: 8 × 8 × 10 cm), 2014. The noise of the DC motor is modulated using a solenoid-actuated pivoting door. (© Mo H. Zareei)

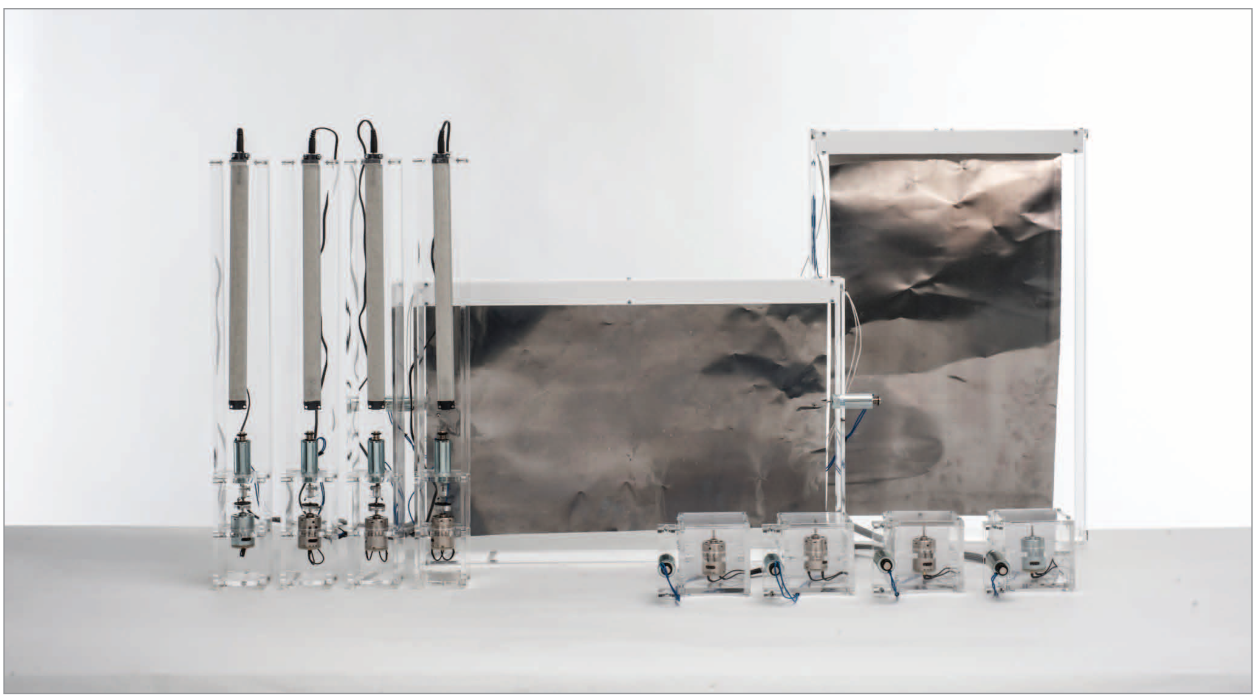

Fig. 4. Mo H. Zareei, *Brutalist Noise Ensemble*, series of mechatronic sound-sculptures: *Rasper* (×4), *Rippler* (×2) and *Mutor* (×4), 2013–2014. (© Mo H. Zareei)

structures its anti-beautiful raw material into spatially gridded modules, the extra-musical material of *Brutalist Noise Ensemble* (an audiovisual piece composed for the noise ensemble [18]) is temporally ordered through the use of repetition and pulse-based, metric rhythmic patterns with clear-cut on/off envelopes: a strategy employed by others in a substantial number of works of digital glitch music. In this way, the structural clarity of Brutalism is not only fully conveyed in the visual aspect of the ensemble but also extends to its audible structure, where the nondevelopmental and repetition-based temporality of the sonic material emulates the block-like monolithism of Brutalist building [19].

AESTHETICIZATION OF THE BRUTE

> You are sitting in a cafe on a Tuesday afternoon. In the background a pop record is playing. Suddenly the CD stutters. You have listened to glitch music for quite a while now. Your reaction has changed. Instead of the usual frustrated response you lean back and enjoy the random loops and skips of the CD, finding it more beautiful in its simplicity than the commercial hit from which it derives. You hear how well it goes with the cappuccino-maker's noise, the cell phone ringing at another table and the chiming from tablespoons on teacups and of forks on plates [20].

Fascinated by post-Industrial Revolution soundscapes, Italian Futurist Russolo believed that "every manifestation of life is accompanied by noise" [21]. Thus, his Futurist manifesto, in addition to a call for expanding the realm of musical sound, was indeed an effort toward embodiment of the modern industrial life in music. Interestingly enough, as Russolo invites the post-Industrial Revolution city-dwellers to "orchestrate together in [their] imagination the din of rolling shop shutters, . . . electrical plants and subways" [22], the Brutalist mind, on the other front, "tries to face up to a mass-production society, and drag a rough poetry out of the confused and powerful forces which are at work" [23]. With this in mind, while "the experience of everyday life is increasingly mediated by a multitude of mechanically reproduced sounds" [24], I present the mechatronic noise ensemble discussed here as an effort to embrace the potential aesthetics of the noisy machines surrounding our urban technological life. In doing so, the work adheres to a Brutalist line of thought through valuation of the very physical existence of its conventionally "anti-beauty" raw material, by expressing them in clear visual and sonic structures.

> *The characteristic of noise is that of reminding us brutally of life.*
>
> —LUIGI RUSSOLO

References and Notes

1 Caleb Kelly, *Cracked Media: The Sound of Malfunction* (Cambridge, MA: MIT Press, 2009) p. 8.

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7 See <www.zimoun.net> and <www.pelang.ch>.

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9 Jacques Attali, *Noise: Political Economy of Music* (Manchester: Manchester Univ. Press, 1985) p. 10.

10 Video documentation of the instruments is available at <www.m-h-z.net/soundsculptures>.

11 Zareei, Carnegie and Kapur [8] pp. 473–478.

12 Russolo [2] p. 76.

13 Mo H. Zareei et al., "Rippler: a Mechatronic Sound-sculpture," *Journal of Comparative Media Arts* **1** (2015): <cmajournal.ca/mo-h-zareei>.

14 Mo H. Zareei et al., "Mutor: Drone Chorus of Metrically Muted Motors," in *Proceedings of the International Computer Music and Sound and Music Computing Joint Conference (ICMC-SMC)*, Athens, Greece (2014) pp. 704–710.

15 Reyner Banham, "The New Brutalism," *October* **136** (2011) p. 28; first published in *Architectural Review* **118** (1955) pp. 354–61.

16 Banham [15] p. 22.

17 Banham [15] p. 25.

18 Video documentation of *Brutalist Noise Ensemble* available at <https://youtu.be/mNPt8ov1bSA>.

19 See also *machine brut(e)* (2015), a series of 10 installation pieces composed for the ensemble, available at <https://vimeo.com/127683583>.

20 Torben Sangild, "Glitch—The Beauty of Malfunction," in Washburne and Derno [6] p. 270.

21 Russolo [2] p. 27.

22 Russolo [2] p. 26.

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