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Taeji Sawai's work can be seen at <[www.taeji.org](http://www.taeji.org)>; I work with The SINE WAVE ORCHESTRA <[swo.jp](http://swo.jp)>.

2. For example, The Evening of Yukiko Shikata: EnigmaAnagma, DEAF 04, <[www.deaf04.nl](http://www.deaf04.nl)>.

3. See also the following videos: 1st iteration: *eye's balls in 2k5*,

<[www.youtube.com/watch?v=Ps53rFdd\\_t8&mode=related&search=](http://www.youtube.com/watch?v=Ps53rFdd_t8&mode=related&search=)>; 3rd iteration: *aaaaaaeueueOsaka!*

<[www.youtube.com/watch?v=4NE5gSX1FjY](http://www.youtube.com/watch?v=4NE5gSX1FjY)>; 4th iteration (with Boredoms):

<[www.youtube.com/watch?v=FFtD3b99rv4&mode=related&search=](http://www.youtube.com/watch?v=FFtD3b99rv4&mode=related&search=)>; <[www.youtube.com/watch?v=s09yKdX5-C4&mode=related&search=](http://www.youtube.com/watch?v=s09yKdX5-C4&mode=related&search=)>.

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## THE TRANSFIGURED INSTRUMENT: *PLAYER PIANO*

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Although it was certainly not the first automated instrument, the player piano was one of the first to become commercially available and created a significant

disruption in the history and philosophy of musical interaction. This was an invention that made virtuosic performance available in some way to any household that could afford it, but at the expense of the flexibility and expressiveness that a live player could provide. The steel sculpture *Player Piano* symbolized a desire to sustain immediate contact with musical objects in the context of those emerging technologies that alienated the corporeal performer. It was influenced by hand-cranked barrel organs and elements of piano design: the fully symmetrical, balanced sitting posture, the frontal presentation of the paper roll, and the integration of organic linear patterns into an otherwise squarish, heavy shape. Handwritten text on a vintage piano roll of Franz Liszt's *Liebestraum* discusses the physical demands of performance and the possibility of injury, as well as Heinrich Heine's account of one of Liszt's recitals. Liszt was known for having defined the modern concept of the virtuoso, through his physically and technically demanding music.

My work in the plastic arts strives for an interpretation not resting solely on verbal dialogue but also on kinesthetic and emotional responses in the viewer. *Player Piano* (Fig. 20) is a transfigura-

tion of the piano and the activities associated with it: reading and simultaneous hand movement. Resembling a writing desk, it invites visitors in an exhibition setting to sit and read the text, using a slow and patient rotation of the hand crank. What follows is an excerpt from the writing:

The piano addresses the sense of immediate touch. Here I feel the physicality of silence, the layer of space beneath the hand that cannot be controlled or penetrated until the rest ends. This breathing space splits the unity of the two hands; they become equally entitled. . . . They create an argument for primacy.

This text is an interpretation of J.S. Bach's keyboard works. Each voice is treated equally, and every note is given a separate impulse. This is essential to counterpoint, reflected in the composition and in the use of the hands.

The Romantic melancholy evoked by the sculpture, the industrial building material and the exaggerated prose reflect an extended period of time when the trajectory of technological advance and the effects of urbanization came into conflict with sociological concerns. Now, more than ever, there exists the question of whether the organic person will continue to function during such rapid development. This pattern of transformation, however, is dialogic: the instrument modifies the performer's bearing, general body use, reflexes and mannerisms. Most Western instruments were no longer objects of substantial experimentation by the 19th century. Piano makers, however, made a significant structural advance with the introduction of the internal cast-iron frame in the 1820s. The instrument itself was then more capable, with an expanded keyboard, creating a higher demand on the performer.

Many recognize that expert performance relies largely on kinesthetic sensations, or muscle memory, and less on aurally perceived information. Yet what is lacking, not only in the general public, but in specialized musical practice as well, is a developed and analytical understanding of proprioception (internal feelings of muscular contraction or expansion, balance and weight distribution). The reciprocal, upward pressure from the piano key as the action returns to its resting position points to the mechanical behavior of the instrument as well as the opposite force supplied by the player.

Physically active interfaces create a



**Fig. 20. Laura Emelianoff, *Player Piano*, mild steel, paper roll, chemical patina, 2004. (Photo © Laura Emelianoff)**

perceptual unity, a reciprocal transmission of movement and vibration in the auditory or extra-auditory range. Through this unity, a “vital touch” can be achieved. It is correct to approach music study by addressing the player’s physical apparatus, just as it is important to understand the behavior of the oral and nasal cavities while learning a new language. The body is a medium of music. In fact, almost all instruments are built to a human measure, centered on the human hearing range and bodily proportions.

New interfaces, acoustic or electronic, disrupt familiar notions of musical interaction; yet this provides a possibility for critical dialogue on the concept of sensorial unity. I would like to continue developing greater physiological literacy and aesthetic grounding for the advancement of musical practice, especially in the context of the potentially dissociative effects of emerging technologies. This new direction may even come from examples so burdened with history as the piano.

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### SIMULATED CHANCE AND STAGGERED GEAR RATIOS

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*Sound examples and images related to this article are available at <www.marcberghaus.com>.*

One of my primary artistic activities has long been to create mechanical representations of chance, to try to capture the incredibly complex non-linearity of the world around us using only very linear, 19th-century, Newtonian technology—brass gears, motors, hand-built crankshafts.

My artwork has always been concerned with chance, and human perceptions of causality, but I had initially employed more symbolic depictions of these phenomena, such as small, mechanized dioramas, or dice as a symbol of chance. In the late 1990s, I discovered several sources that would expand my outlook on random and semi-random

processes, among them James Gleick’s *Chaos* and Brian Eno’s *Year with Swollen Appendices*, in which he writes about Steve Reich’s early tape works and his own “Generative Music.”

I thought that such processes—the overlapping of several simple elements to achieve complexity—would be an excellent way to actually incorporate chance, or at least perceived chance, into my own artwork, rather than just symbolizing it—and it was only a matter of combining simple mechanical systems rather than designing new, complex machines.

I began using these systems in two visually oriented pieces, *Mandala #2* (2000) and *Haiku Machine* (2002). In *Mandala #2*, 16 dice, arranged in a grid under a bell jar, all roll at different speeds, powered by one motor hidden under the base (see cover of this issue of *LMJ*). Due to my use of unusual gear ratios (say, 1:1.7, rather than 1:2) in the gears that connect the drive shafts to the dice’s axles, very few of the cycles line up again at once, and it becomes impossible to predict the patterns of all the tumbling dice, despite the fact that all actual randomness has been stripped from them. *Haiku Machine* works in a similar way, but uses three rows of motorized paper spools, each with six words printed around them, constantly rolling at different speeds. Six words per spool times nine spools produces 10,077,696 haiku.

For my first sound sculpture, I decided to use these same methods again. *Randomized Red Piano* (2005) (Fig. 21) is a tiny, worn toy piano, which I mounted atop a tall tower to fetishize it to a degree. It has 10 keys, all producing miserably tinny sounds. In the base, four motors turn 10 small crankshafts, each at a different speed, which then raise the long “pull-rods” that latch onto spring-powered levers at the top, which when released strike the keys.

The gear ratios for this piece were chosen to be truly randomizing. The drive shaft gears have either 21 or 23 teeth, while the crankshaft gears, with which they mesh, all have even numbers of teeth. This produces such ratios as 1:1.391, 1:1.417, 1:1.714... Since the motors turn at a slow 1 rpm, it will take an incredibly long time for the cycles of all 10 gears to come back and line up the same again. The viewer/listener is extremely unlikely to hear the same sequence twice, and interesting moments do occur: randomized chords; arpeggios.

Although I am working on several



**Fig. 21. *Randomized Red Piano*, 2005.**  
(© Marc Berghaus. Photo © Doug Koch.)

new installations using digital randomizers, I do have two more mechanized pieces in the works. *Crawling Clavichord* is a slow-moving “cart” of 20 piano hammers from a salvaged piano, semi-randomly striking a row of 20 wires strung tightly across a gallery. The cart travels along on sprocket chains strung on either side of the wires, and the wires have guitar pickups and amplifiers on both ends. As the motorized cart slowly crosses the room, the tones and overtones on each side of the cart’s hammers change. The cart then reverses itself after bumping into either wall.

My other staggered gear piece is titled *Randomized Gregorian Piano* and is somewhat similar to the *Red Piano*. However, this machine is designed to be installed onto the keys of an already existing grand piano in the gallery space (a converted church), and instead of each gear playing an individual note, every *octave* on the keyboard has its own little machine that repeats snippets of melody, each at a slightly different speed. These snippets of melody are taken from old Gregorian chants. It will be a very pretty chaos as the repeating cycles of melody overlap unpredictably.

*Marc Berghaus is a sculptor, photographer and sound artist living in Kansas, and has exhibited throughout the Midwest and western United States. Examples of his work can be seen and heard at <www.marcberghaus.com>.*