Portrait: Andrew McPherson and the Magnetic Resonator Piano

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Mysterious Sounds

A GRAND PIANO IS ON STAGE: a nest of wires is visible inside the body of the instrument and a few cables run down its side. As the pianist plays, small lights flicker at the back of the keys. Hammers strike the keys as in a typical grand piano, but here and there tones linger as if mysteriously suspended in time. Later, the entire instrument emits sounds quite unlike any traditional piano: these range from ethereal tones reminiscent of the glass harmonica or Aeolian harp, to robust pipe organ sounds, to something startlingly electronic. There are no speakers: all the sound is produced by the strings themselves and amplified by the body of the instrument. This is the Magnetic Resonator Piano, an augmented keyboard instrument created by composer and technologist Andrew McPherson.[1]

The instrument comprises 88 electromagnetic actuators that are installed within the body of a grand piano; when activated, they can induce the strings to vibrate indefinitely. The mechanism does not impede the piano's hammer mechanism: both the magnets and the hammers can be used simultaneously. An optical scanner—a modified version of the Moog/Buchla PianoBar—sits at the back of the keyboard and reads information about the position of the performer's fingers on the keys. Using the sensors, the performer can continuously shape various parameters of a note: notes can crescendo from or diminuendo into silence, timbres can be modified, and pitches can be bent as they sound. Though the instrument is not commercially available—those wishing to work with it do so in active collaboration with McPherson—there is a growing body of compositions for the instrument. It is an instrument that taps into old technological questions while also shedding light on the development of new instrument technologies today.

[1] For a technical description of the MRP, see Andrew McPherson, "The Magnetic Resonator Piano: Electronic Augmentation of an Acoustic Musical Instrument," *Journal of New Music Research* 39, no. 3 (2010): 189–202.

Allure of the Infinite Tone

Let's step back a few centuries. "Keyboard instruments have many merits," C. P. E. Bach began his *Essay on the True Art of Playing Keyboard Instruments* (1753/1762), "but are beset by just as many difficulties."[2] For Bach, keyboard instruments were both universal and problematic. He praised their versatility and their ability to produce harmonies that usually require "three, four, or more" other instruments. This adaptability of the keyboard also created challenges. Keyboard instruments put great demands on the performer's musical knowledge and technique: they required a comprehensive understanding of not just harmony and melody, but of a wide range of musical styles. Other problems were of a more technological nature: each of the keyboard instruments in common use—the organ, the harpsichord, the pianoforte, and the clavichord—had their own affordances and their own shortcomings. Bach highlighted a tension that can be traced through several centuries of the keyboard's history: it is the most comprehensive interface from which a performer can control a potentially dizzying number of musical parameters; at the same time, it has strict limitations, from the restrictions of tuning and the inaccessibility of microtones, to the difficulty of combining the ability to sustain tones with the ability to nuance them.

This potent pairing of versatility and limitation has made the keyboard at once seemingly perfect and perpetually incomplete; it has led to continued attempts to develop new and alternative keyboard technologies. At times, these are cast as improvements or solutions to the "problem" of the keyboard; at other times new keyboards have been created to render a particular set of sounds playable.[3] In the late eighteenth and early nineteenth centuries, builders experimented with instruments that used rosined wheels, glass, wooden cylinders and streams of air to create tones that could be controlled in subtle ways from a keyboard. These include instruments such as the Bogenklavier (which C. P. E. Bach admired and wrote for), the clavicylinder, the harmonichord, the *anemochord,* and the *xänorphica*; many were conceived as attempts to put under the control of the fingers tones as flexible and nuanced as the violin and the human voice.[4] None

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[2] Carl Philipp Emanuel Bach, *Essay on the True Art of Playing Keyboard Instruments*, trans. William J. Mitchell (New York: Norton, 1949), 27.

[3] On the idea of the "problem" of the keyboard interface, see Emily I. Dolan, "Toward a Musicology of Interfaces," *Keyboard Perspectives* 5 (2012): 1–12.

[4] Such instruments, the so-called "sustaining pianos," date back to the sixteenth century and Hans Haiden's *Geigenwerk*, which used rosined wheels set in motion by a foot treadle; the instrument was described in the second volume of Michael Praetorius's *Syntagma Musicum* (1619). I have

Figure 1 *Close-up of the Magnetic Resonator Piano's electromagnetic oscillators, installed in a Steinway D piano at Queen Mary University of London, 2012. Photograph by Andrew McPherson, used with kind permission.*

of these instruments became standardized or widespread. In the twentieth century, new solutions emerged: some electronic keyboard instruments from the 1920s—such as Jörg Mager's Klaviatur-Sphärophone—allowed for quarter tones; later models of the Ondes Martenot included both a keyboard and the original ribbon controller that enabled its iconic glissandi.[5] More recently, new keyboard interfaces have entered the market: the London-based music company ROLI began producing the Seaboard, a soft, foamy interface whose design attenuates the contours of a keyboard—and thus its organizational power—while also allowing for the continuous control of a range of parameters.[6] To use Roger

explored late 18th- and early 19th-century quests for subtly nuanced keyboard instruments at greater length in Emily I. Dolan, "E. T. A. Hoffmann and the Ethereal Technologies of 'Nature Music,'" *Eighteenth-Century Music* 5, no. 1 (2008): 7–26.

[5] On early electronic instruments of the 1920s, see Thomas Patteson, *Instruments for New Music: Sound, Technology, and Modernism* (Berkeley: University of California Press, 2016).

[6] ROLI has received international press coverage. In 2014, NPR ran a feature on the Seaboard entitled "This Expensive Rubber Mat Could Be The Synth Of The Future," NPR.org, accessed September 14, 2015, http://www.npr.org/2014/01/09/261085418/this-expensive-rubber-mat-could-be-the-

Moseley's language, many of these instruments were ways of overcoming the inherent discrete digitality of the keyboard to create an instrument with continuous, analog capabilities.[7]

At first glance, the Magnetic Resonator Piano appears to have been designed explicitly as a solution to this familiar problem of sustain and nuance: one imagines a time-traveling Bach sitting enthralled at the keyboard, delighted to find a keyboard that could truly sing. But the MRP was not conceived as a technological improvement in this sense. "I'm not arrogant enough to say there is any inherent deficiency with the instrument," McPherson says, "It is what it is, and it is amazing."[8] Rather, it was the piano's *robustness* that motivated McPherson. A violist by training, McPherson found the idea of composing idiomatic solo works for the piano—let alone saying something new—daunting. The MRP was a path in: he initially imagined that the resonators could be used to expand the range of color available, enabling delicate and subtle timbural transformation. However, because the hammers elicit far more upper partials than the magnets, this kind of seamless extension was only sometimes possible. Rather than augmenting or nuancing the hammers, the magnets opened a radically different sound world.

McPherson began work on the MRP in 2008, while a PhD candidate in composition at the University of Pennsylvania. The earliest prototype of the instrument used a separate MIDI keyboard to operate the magnets; he later added the Moog/Buchla Pianobar, so that the performer could control the magnets using both the MIDI keyboard and from the piano's keyboard. While he designed the instrument, McPherson simultaneously composed a 35-minute, nine-movement work entitled *Secrets of Antikythera*.[9] The title references the marvelous Antikythera mechanism: tantalizing fragments of an analog computer (dating back to perhaps before 200 BCE) discovered in the early twentieth century. Here instrument and work are intimately connected: the effect of awe in the face of the ancient mechanism and its mysterious functions are captured in the equally mysterious tones emitted by the new musical instrument. *Secrets of Antikythera* draws attention to its own means of production in a manner not unlike Johann Adolph Hasse's cantata "L'Armonica" (1769), which was composed

synth-of-the-future. For more information about the ROLI, see https://www.roli.com/products/seaboard-grand (accessed September 14, 2015).

7 Roger Moseley, "Digital Analogies: The Keyboard as Field of Musical Play," *Journal of the American Musicological Society* 68, no. 1 (2015): 151–228.

8 Interview with Andrew McPherson, London, March 18, 2015.

9 A recording of McPherson's works for MRP is available (*Secrets of Antikythera*, Innova 842, 2013).

around (in both the music and text) the ethereal qualities of the newly invented glass harmonica.[10]

McPherson has since modified the PianoBar to increase its control capabilities, which has eliminated the need for the second MIDI keyboard. Since the PianoBar's production stopped in 2007 and has become increasingly scarce, McPherson has gone on to create his own optical scanner, which will eventually replace the modified PianoBar.[11] The electromagnetics can also be triggered by the computer that assists in the necessary signal processing during performance. This means that a work can bypass the piano's keyboard altogether, activating the strings through other means. McPherson's second piece for the MRP, *d'Amore*, does exactly this: scored for solo viola with MRP, the work uses pitch tracking to activate strings in the piano. It turns the instrument into an augmented viola, exploring Baroque-inspired ideas of sympathetic resonance.

The character of the MRP bears the mark of McPherson's multidisciplinary training: before pursuing his doctorate, he studied at MIT, where his undergraduate studies were in both Music and Electrical Engineering; he then stayed on at MIT to complete a Masters of Electrical Engineering. Though McPherson worked on interactive digital devices and microcontrollers while at MIT, his interest in and work on instrument design in conjunction with composition came as something of a surprise to him: until he began experimenting with the MRP, he lived in a largely analog musical world. He composed almost exclusively for traditional instruments and he was not involved in any electronic music community. Indeed, McPherson's choice to pursue composition at the doctoral level was in part an active turning away from engineering. It was through the MRP that McPherson ended up reuniting his dual interests, and this has profoundly shaped his career. Since 2011 he has been on the faculty at Queen Mary University of London, where he currently holds the position of Senior Lecturer at the Centre for Digital Music within the School of Electronic Engineering and Computer Science. There he runs the Augmented Instruments Laboratory. McPherson has gone on to create *Touchkeys*, a set of thin capacitive touch-sensing boards that can be attached to

[10] For more on this topic, see Annette Richards's article in this volume, beginning on page 1.

[11] See Andrew McPherson and Youngmoo Kim, "Augmenting the Acoustic Piano with Electromagnetic String Actuation and Continuous Key Position Sensing," in *Proceedings of the International Conference on New Interfaces for Musical Expression* (Ann Arbor: University of Michigan Press, 2010), 217–22, http://www.nime.org/proceedings/2010/nime2010_217.pdf; and McPherson, "Portable Measurement and Mapping of Continuous Piano Gesture," in *Proceedings of the International Conference on New Interfaces for Musical Expression* (Ann Arbor: University of Michigan Press, 2013), 152–57, http://nime.org/proceedings/2013/nime2013_240.pdf, both accessed January 25, 2016.

an acoustic or electronic keyboard.[12] These use a dynamic mapping system such that different parameters—like the optical sensor of the MRP—can be mapped to different MIDI controllers. Unlike the MRP, Touchkeys are commercially available, sold as DIY kits: McPherson successfully crowd-funded their production through Kickstarter in 2013. In 2015, due to their popularity, he began a second production run.

Today, McPherson is part of a large community of composers and technologists whose research focuses on the design of new musical technologies, and in particular, new musical interfaces. The proceedings of the international conference NIME—New Interfaces for Musical Expression—testify to the liveliness of this field: one finds essays on new gesture controllers, effects pedals, multi-touch iPad apps, and sequencers, along with a slew of fantastical names for new technologies (*Wubbles*, *Twkyr, Raspar, Notesaaz*, *Voicon*).[13] The emphasis on interface over instrument reflects a shift away from questions of the production of sound and now towards its control: implicit is the assumption that through digital means we have access to any sound we could want.[14] Though McPherson is deeply involved with NIME, the MRP inverts the organization's focus. In using a grand piano keyboard—albeit one with augmented abilities—McPherson deploys an old interface in order to control a new means of sound production, which involves strings physically resonating, rather than the activation of digital signals.

Navigating Novelty

It is precisely the MRP's oldness and the ways in which it taps into existing technologies and techniques that has allowed the instrument to begin to gain a foothold in a broader musical community. This is no small feat: new technologies have always faced challenges. With the emergence of a canon of standard orchestral and keyboard musical instruments in the nineteenth century, novel technologies have often been met with outright suspicion. In E. T. A. Hoffmann's

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[12] Andrew McPherson, "TouchKeys: Capacitive Multi-Touch Sensing on a Physical Keyboard," in *Proceedings of the International Conference on New Interfaces for Musical Expression* (Ann Arbor: University of Michigan Press, 2012), n.p., http://wwweb.eecs.umich.edu/nime2012/Proceedings/papers/195_Final_Manuscript.pdf, accessed January 25, 2016.

[13] NIME Proceedings are available freely online at http://www.nime.org/archives/, accesssed January 25, 2016.

[14] In Sergi Jordà's essay on "digital lutherie," for example, he explicitly employs the term *musical instruments* "when actually referring only to input devices or controllers," distinguishing research into interfaces from research into sound synthesis and acoustics. Sergi Jordà, "Instruments and Players: Some Thoughts on Digital Lutherie," *Journal of New Music Research* 33, no. 3 (2004): 321.

short story *Die Automate* (1814), he complains through one of his characters about the habits of contemporary instrument inventors: all around him intriguing new mechanisms were being created, given ridiculous names, hailed as perfect, and then quickly abandoned before they were truly refined into anything resembling a fully functioning instrument.[15] In 1835, when the instrument builder and mechanic Mathieu-François Isoard was awarded a patent for his "new sound organ," ripples of excitement went through both the French and British press. His proposed instrument was a violin whose strings would be set in motion by air currents, in lieu of a bow. One of the more extensive reports on the instrument—called the Aeolian Violin—expressed intrigue at the instrument's potential effects. But there was also doubt: "[F]irst must be found artists who would apply themselves to the study of these Aeolian violins and basses, to be able to take advantage of them. Our Baillot, our Urban, our Franchomme [i.e., the great string players of the period]: will they deign to lend the support of their sublime talent to a lucky experiment?"[16] These doubts were well-founded: Isoard's instrument had an extremely short life (as the *éolicorde*—a keyboard instrument) before fading away and becoming a mere curiosity in the history of instruments. Any new musical instrument requires an investment of time and effort, by the builder, players, and composers. Most of the new technologies that appear on the scene today follow the life cycle Hoffmann sketched out of efflorescence and rapid decay.

One tension here, of course, is between the need for instrument builders to stress the novelty of a new mechanism in order to get attention; but since we often understand new instruments through and in relation to already existing ones, that same novelty can deter serious investment. This conservative pull has often been frustrating to those whose sights are set on radical new sonic territory. "When Theremin provided an instrument with genuinely new possibilities," John Cage complained, "Thereminists did their utmost to make the instrument sound like

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[15] "… jeder mangelhafte Versuch [wird] … als eine neue schon zur Vollkommenheit gediehene Erfindung angepriesen und vorgezeigt […] Hierin liegt es, daß in kurzer Zeit so viele neue Instrumente zum Teil unter seltsamen oder prunkenden Namen entstanden und eben so schnell wieder verschwunden und in Vergessenheit geraten sind." E. T. A. Hoffmann, "Die Automate," in *Die Serapions Brüder*, ed. Wulf Segebrecht (Frankfurt am Main: Bibliothek Deutscher Klassiker Verlag, 2001), 421.

[16] "Mais il faudra d'abord qu'il se trouve des artistes qui se mettent à étudier ces violons et ces basses éoliques, pour être à même d'en tirer parti. Nos Baillot, nos Urhan, nos Franchomme, daigneront-ils prêter l'appui de leur sublime talent à une expérience chanceuse?" G. E. Anders, "Le Violon Éolique," *Le Revue et Gazette Musicale* 3 (March 6, 1836): 78.

some old instrument, giving it a sickeningly sweet vibrato, and performing upon it, with difficulty, masterpieces from the past."[17] In many ways, Cage's dismay is understandable: Clara Rockmore's virtuosic performances of arrangements of Tchaikovsky, Saint-Saens, and Rachmaninoff show off the theremin's ability to be controlled precisely. She does not explore new musical worlds. But this was Rockmore's goal: she was interested in producing "beautiful music rather than sound effects."[18] Familiar repertoire established that the theremin was indeed a musical instrument.

Because of its familiar form, the MRP does not need to demonstrate its musicality through arrangements of canonical works. Furthermore, the internal mechanism—the electromagnetics—likewise tap into a longer technological history. The idea of using charged magnets to set strings in motion dates back to the nineteenth century. In 1889, Hermann von Helmholtz's student Richard Eisenmann patented a mechanism for a keyboard instrument with electromagnets; his "Elektrophonic Klavier" received international attention through the 1890s and into the early twentieth century. The instrument, unlike the MRP, did not have hammers and was therefore seen as an alternative to the piano, suited for "slow or religious movements."[19] In 2001, composer Per Bloland began experimenting with electromagnetics, creating the Electromagnetically Prepared Piano. His device comprised twelve electromagnetics that were controlled solely by a computer rather than the keyboard.[20] A more familiar application of electromagnetics is Gregory Heet's popular Ebow, first invented in the late 1960s, but not marketed or patented until the 1970s: it is a small hand-held device designed for use by guitarists to achieve sustain on single strings. McPherson is contacted nearly monthly by other musicians and instrument builders who are interested in working with electromagnetics, or have already been working with them and discovered McPherson's instrument during their research. [21] The

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[17] John Cage, "The Future of Music," repr. in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and D. Warner (New York: Continuum, 2004), 26.

[18] "In Clara's Words: An Interview with Clara Rockmore," by Robert Moog, November 1, 1977, posted on *Thereminvox.com*, Oct. 26, 2002, accessed June 15, 2015, http://www.thereminvox.com/article/articleview/21/1/22/index.html.

[19] "The Electrophonic Piano," *The Musical Record* (Sept. 1897): 25.

[20] Per Bloland, "The Electromagnetically-Prepared Piano and Its Compositional Implications," in *Proceedings of the Electroacoustic Music Studies Conference, Szforzando! New York, June 2011*, Electroacoustic Music Studies Network, accessed September 14, 2015, http://www.ems-network.org/IMG/pdf_EMS11_Bloland.pdf.

[21] McPherson has, for example, collaborated on the EMvibe, a vibraphone that uses electromagnetic

innovation of the MRP is not its novelty, but its sustained refinement: it taps into interfaces, sounds, techniques, and technologies that already shape composers' and performers' musical imaginations. For Ryan MacEvoy McCullough, a pianist who has worked extensively with new repertoire, performing with the MRP was surprisingly intuitive: playing the instrument the first time was like shedding training wheels. "We pianists spend so much time trying to coax long sustained tones out of the piano," McCullough says, "it was like some part of my technique had been rendered obsolete."[22]

The Technologist is Present

Establishing a novel technology requires more than the right material and sonic combination of the old and new; it requires advocacy, continued cultivation, and circulation. Since its initial creation and premiere, McPherson has been active on all fronts: in 2010, he took up a postdoctoral position at Drexel University, working with Youngmoo Kim, Associate Professor in the Electrical and Computer Engineering Department, in the Music and Entertainment Technology Laboratory (MET-Lab); that same year, he commissioned six Philadelphia- and Princeton-area composers to write original works for the MRP. The composers—David Carpenter, William Derganc, Daniel Fox, Daniel Shapiro, Jeffrey Snyder, and Anthony Solitro—had access to the instrument and worked with both McPherson and pianist Feifei Zhang for several months to realize their compositional goals.

On a basic level, these commissions helped to promote the instrument, circulating it beyond its creator. They also helped McPherson both refine the instrument and understand its full capacities: different composers push the instrument in new directions. Indeed, it may well be a sign of the MRP's health and robustness that composers and performers can use it in ways unimagined by the original creator. McPherson has himself published on this cyclic process of cultivated exposure and refinement, one of instrument influencing composer influencing instrument.[23]

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actuators to resonate the instruments bars. N. Cameron Britt, Jeff Snyder, and Andrew McPherson, "The EMvibe: An Electromagnetically Actuated Vibraphone," in *Proceedings of the International Conference on New Interfaces for Musical Expression* (Ann Arbor: University of Michigan Press, 2012), n.p., http://www.nime.org/proceedings/2012/nime2012_101.pdf, accessed January 25, 2016.

[22] Ryan MacEvoy McCullough, personal correspondence with the author, June 18, 2015.

[23] Andrew McPherson and Youngmoo Kim, "The Problem of the Second Performer: Building a Community Around an Augmented Piano," *Computer Music Journal* 36, no. 4 (2012): 10–27. This essay chronicles what he learned in the process of the Drexel commissions, and reflects more abstractly on the process of refining any new instrument.

Figure 2 *Pianist Nic Gerpe, rehearsing Alexander Elliot Miller's* 88MPH*; Andrew McPherson attends to the computer in the background. Isaac Schankler, one of the directors of People Inside Electronics, turns pages. Los Angeles, 2015. Photograph by Alexander Elliot Miller, used with kind permission.*

These kind of collaborations have continued: in 2013, the London Chamber Orchestra was in residence at Queen Mary University, and five student composers worked alongside the musicians to write chamber works that included the MRP. In April 2015, Los Angles-based People Inside Electronics (PIE), which currently runs a concert series devoted to electronic and electroacoustic music, put on a concert devoted to the MRP. Four pianists—Nic Gerpe, Aron Kallay, Steven Vanhauwaert, and Richard Valitutto—performed four new works alongside existing repertoire for the MRP. A Kickstarter campaign partially supported the concert, helping to fund the commissions from composers Julia Adolphe, Jeremy Cavaterra, Alexander Elliot Miller, and Élise Roy.

The MRP's expanded sonic horizons and the richness of its acoustically generated sound, for example, are immediately appealing to composers who work with it. Miller found the imperceptible attacks and indefinite sustains, resonating from actual strings, magical; he found himself popping his head into the piano repeatedly during rehearsals. This vividness is an aspect that cannot fully be captured by a recording.

Immediately strikingly is the diversity of the compositional approaches to the MRP. Solitro's *Spectra of Morning* (2011) is a thoroughly pianistic work: he conceives of the MRP as an extended technique and uses it sparingly. Particular moments are drawn out and made special and lush. Only towards the end does it move into an otherworldly space. In the final measures, a short quotation from Strauss's "Morgen!" ("Und morgen wird die Sonne wieder scheinen")—which was first recorded by a singer in a slightly simplified form—is fed by the computer to the resonators. The voice is thereby reproduced by the piano, producing an effect of a voice emerging from the piano strings. Julia Adolphe, in her three-movement *Magnetic Etudes* (2015), treats the resonators as part of her basic musical vocabulary: in the first and last movements, traditional pianistic gestures mingle freely with the myriad sounds of the resonators, imbuing the work with dazzling color and orchestral depth. Miller took a wildly different approach to the instrument. Energetic and playful, *88 MPH* forefronts the instrument's less traditionally "pianistic" sounds. The title references the film *Back to the Future* and the speed necessary for the DeLorean to activate the flux capacitor for time travel. The augmented car neatly equates with the 88 keys of the augmented piano; the traditional hammer sound is starkly contrasted with the futuristic sounds of the MRP.

Composing for the MRP presents some practical challenges: the instrument itself is not always readily accessible; the precise sounds produced by the instrument vary depending on the exact piano in which it is installed; and it is not always clear, for a given composition, whether it is better for some events to be triggered by the pianist or by a second person (usually McPherson) operating the computer. All of this means that McPherson has been closely involved with each composer working with the MRP during the entire compositional process, clarifying questions of pedaling, offering help with notation, and sending test recordings of particular passages. His dedication engenders enthusiasm: "Part of the joy of writing for the MRP was that I didn't quite know what was possible," Solitro says, "It was great to collaborate with someone who said 'We'll find a way to make this possible.'"[24] For now, McPherson plays the role of amanuensis for his creation.

The Future

For now, each composition made for the MRP is a treatise on its capacities; each

[24] Anthony Solitro, interview with the author, June 2, 2015.

work holds the potential to shape the future of the instrument. The instrument is still young. Today only two complete Magnetic Resonator Pianos exist, one in Philadelphia and one in London. McPherson imagines that the instrument might, in the future, be rented out in a manner similar to percussion instruments.[25] Many things seem to indicate the potential for the instrument's extended life: performers, for example, have begun to experiment with arranging pre-existing music for the MRP. LCO performers Robert Max and Elaine Chew have performed Astor Piazzolla's *Le Grand Tango*, adapting the accordion part for MRP. It has also been used by musicians working outside of art music: in 2013, the UK band These New Puritans sought out McPherson and the MRP for their sonically diverse album *Field of Reeds* (2013). Taken with the instrument and its many timbres, the band organized an interactive installation entitled *Magnetic Field* the following year; visitors could play the MRP and experience it for themselves. The instrument also has the power to alter how a pianist experiences his native instrument: after working with the MRP, McCullough has begun to hear "phantom resonances" when he plays a regular, unmodified piano. This is surely a powerful sign of the instrument becoming embedded in the musical imagination.

When asked what made a good new instrument, McPherson reflected, "When the instrument becomes an extension of the body. When it becomes transparent to the performer. That is, if I play the viola, I'm not thinking about *move the bow* and *put the finger here* as such. I'm thinking about *here's the passage on the page and here's what I need to do.* I think a good instrument is one that can become transparent—because it lets the performer forget about the *thing* they are manipulating, and think about the music they want to make."[26] With its highly responsive and intuitive interface, the MRP can already be thought of as largely transparent: we might say that it has a certain transparency of gesture. But it is not *psychologically* transparent. Indeed, it is still quite spectacular: its newness is captivating; its ability to surprise is one of its powers. Many of the works written for the MRP explicitly explore themes of magnetism, spectra, and technology. The question now is whether or not the instrument can, in a positive sense, become unremarkable.

[25] McPherson estimates that a single new MRP would cost around £5000 to produce, though the cost would go down considerably if multiple copies were produced at once.

[26] Andrew McPherson, interview with the author, March 18, 2015.