FIREWORKS FOR THE TYMPANUM AND THE CEREBRAL CORTEX

Noise, Sound, and Music in the Work of Janet Cardiff & George Bures Miller

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Octopuses, snakes, and beetles cannot hear, far less appreciate, music. Hearing is primarily the preserve of vertebrates, and the appreciation of music is almost exclusively restricted to human beings. Even for monkeys musical entertainment gives only a limited enhancement of pleasure. While birds do sing in the generally accepted sense of the word, like most vertebrates they, too, have no concept of music as they simply cannot process the patterns that underlie and organize its sounds.[1] The American music scholar, science journalist, pianist, and composer Robert Jourdain has said that hearing "was forged through hundreds of millions of years of natural selection as countless lineages perished from detecting a predator too late, finding no mate, or overlooking a meal hidden nearby. Hearing was a late bloomer, following upon already well-developed vision and touch and taste and smell. Yet we take for granted the experience our ears provide. For us, sound is self-evident, complete, inevitable."[2]

To renew our awareness and consciousness of sound and of the experience and supreme importance of hearing in what Jourdain calls "an age of widespread musical obesity,"[3] the two Canadian artists Janet Cardiff and George Bures Miller have been working for more than fifteen years in a quite singular way with noises, sounds, and music in order to reveal undiscovered or long forgotten worlds. Jourdain, the author of the book *Music, the Brain and Ecstasy* first published in 1997, will accompany us in our attempt to capture and understand these worlds with greater precision; he will be our guide to the wonders of hearing and music appreciation. Upon closer inspection, hearing reveals itself as a phenomenon that deals with movement through space, the resistance of bodies, and the transformation of energy: "vibrating air to trembling membrane to oscillating bone to pulsating fluid to surging electrochemical discharges that spurt like fountains toward an expectant brain."[4]

These "fireworks" for the tympanic membrane and the cerebral cortex are ubiquitous in the work of Cardiff and Miller. The breadth of the musical material they use is impressive. It embraces over four centuries of music history, ranging from a new recording of a Renaissance choral work by Thomas Tallis in *The Forty-Part Motet* (2001), to Giacomo Puccini's "O mio bambino caro"

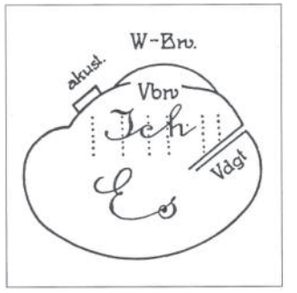
heard in a structure specially constructed for it in *Playhouse* (1997), to the opera arias by Enrico Caruso and others used in *Opera For a Small Room* (2005), all the way up to Judy Garland's "Somewhere Over the Rainbow" in the room installation *The Dark Pool* (1995) and the performance of David Bowie's "Rock'n'Roll Suicide" in the sound and film installation *The Berlin Files* (2003). This is not to mention the many pieces of music from film that Cardiff has employed for the audio walks she has been making since 1991, like the soundtrack of the film *Fahrenheit 451* used in *Münster Walk I* (1997). Beyond integrating samples of preexisting pieces of music, the two artists also commission compositions specially for their works,[5] have new concert recordings made,[6] and even compose, sing, and play instruments themselves.[7]

Although the works in question are generally multimedia, the human voice and the music accompanying it, as well as a conceptual focus on the sense of hearing, are always central. The Venetian Renaissance painter Vittore Carpaccio expressed the same interests in a distilled form in his painting of *The Vision of St. Augustine* produced shortly after 1500 [FIG. 1]. In the image, the master and his dog are all ears, frozen in the spell of the vision—one that is heard, however, rather than seen. Augustine's gaze is directed inwards; he is listening enthralled to the voice of St. Jerome, who, according to legend, informed Augustine of his imminent death and his ascent to heaven in the very moment that Augustine was writing him a letter.[8] One of the hands of the listening saint hovers above the desk, arrested in the act of writing, while only the fingertips of the other touch the table top, as if electrified by the "acoustic vision." All his senses seem stretched to the limit, intent on perceiving the unheard.

However, Carpaccio's Augustine by no means lends his ears to supernatural voices alone. This is evident in the painting through the prominent presence of earthly music, albeit spiritual in nature, in the form of musical scores spread out in the foreground of the lavish study.[9] While the voice of the far-off Jerome obviously reaches the dog just as it does Augustine, the music belongs entirely to the earthly world of the Renaissance scholar and humanist portrayed in the painting. The piles of volumes at his feet displaying legible musical scores reveal themselves to be complex polyphonic compositions involving multiple tenor and bass parts.

This striking painting by Carpaccio visualizes the recognition that the appreciation of music —one of the most sophisticated levels of hearing—is the preserve of *homo sapiens*. As Jourdain explains: "One reason we hear music when animals don't is that our brains are able to manipulate patterns of sound far more complex than those the brain of any other animal can manage.... You'll never see a goldfish twitching in time to a waltz, because it is not a waltz's notes, but rather relations between those notes, that make a body want to dance. It's these relations ... that *are* music, not the atmospheric vibrations that jiggle out of musical instruments. The vibrating molecules that convey music from an orchestra to our ears don't 'contain' sensation, only patterns. When a brain is able to model a pattern, meaningful sensation arises. When a brain isn't up to the job, nothing occurs, and an animal's experience of the world is that much less than our own."[10]

A drawing by Sigmund Freud is extremely illuminating with regard to the special processing capacity of the human brain as it brings the structure of the brain into congruence with the neurologist's model of the psychic apparatus [FIG. 2]. Looking at the scientific sketch, the philosopher Günter Schulte comments: "The extent to which Freud took account of the anatomy of the brain in visualizing its mental apparatus is shown by the auditory lobe (*Hörkappe*) sitting at a slant in his drawing on the left side, corresponding to the acoustic Wernicke's center. ...for him, a more precise pinpointing of mental processes was not possible."[11] All the same, Freud was aware of the great importance of the brain's center of memory and understanding to the overall experience of sonic sensory impressions, particularly speech and music, even if its relationship to the "ego" and the "id"—to consciousness and the unconscious—remained unexplained at the time. Cardiff, in contrast, firmly believes that "sound does come into your unconscious more directly than visual information."[12]



[2] Sigmund Freud, *The Apparatus of the Soul*, 1923

This is the reason why she and Miller work so successfully in their synesthetic fusions of film, theater, radio plays, sound, and room installations, and why their multimedia hybrids can generate atmospheres rich with subtle nuance. They deliberately work with psychoacoustic knowledge on the threshold between external awareness and internal stream of consciousness. Despite the often highly visual nature of the worlds these artists create, these worlds actually originate first in the heads of the visitors through exposure to carefully created auditory experiences which, to some extent, penetrate more deeply into the body and mind than mere images can. A brief glance at the historical, evolutionary origins of the sense of hearing helps demonstrate why this is true.

THREATENING BASS TONES

"Many mammals emphasize a range an octave higher—perfect for sensing a predator brushing against tall grass. Bats have minuscule ossicles that magnify the ultrahigh frequencies they broadcast to make their way around in the dark. Kangaroo rats take the opposite track with ossicles so large that each middle ear chamber is as big as the rat's entire brain, boosting the subtle bass tones of an owl's wing beats or a snake's slithers."[13]

One of the origins of the development of hearing lies in its supreme importance as an early-warning system against life-threatening predators. It is the traces of this early function that are still unconsciously present in human beings (today generally subordinated by the perception of speech and music) which are the source of much of the contents and appeal of the auditory works Cardiff and Miller create. As Cardiff has said, "I think that the element that resonates with the detective/film noir/science fiction genres in my pieces partially comes out of the medium that I use. Sound has an ability to scare you, its invisible ghostly presence is connected to our primal fears. The impression of a footstep behind you or a cracking twig can make you jump immediately without thinking. By their very nature, the sounds that I use create the content of the pieces."[14]

Overleaf: [1] Vittore Carpaccio (ca. 1460–1526), *The Vision of St. Augustine (St. Augustine in His Study)*, 1502–04, oil on canvas, 141 x 210 cm, Scuola di San Giorgio degli Schiavoni, Venice

On the way human hearing is used today, Jourdain observes that "almost all of our auditory experience is devoted to identifying things: a faucet dripping, a spoken word, a clarinet's warble.... But evolution's priority was to find out where sounds come from rather than what they are. There's not a lot of point in distinguishing the sound of prey or predator when you can't tell which way to approach or flee."[15] Cardiff and Miller exploit this "directional hearing"—evolutionarily speaking, the earliest function of the sense of hearing—in many ways. Going beyond dramatic or psychoacoustic effects, a virtually physical, experiential space can come into being exclusively through the use of directional noises and sounds. As Cardiff explains, "in our work we use that evolutionary ability to define location to create a physical narrative but also to create a sculptural space, to try to make the virtual into physical space, especially in the cinema pieces and the binaural walks."[16]

THE MECHANICS OF HEARING

"The ear is quite ... remarkably sensitive, but from pinna to receptor cell the entire process is necessarily *mechanical*, for sound is the mechanical bumping of molecules together. This means a mechanical device is needed to convert vibrations to nerve impulses."[17]

Miller's work *Imbalance.6 (Jump)* (1998) captures both the physical reality of sound and its perception. A television showing feet jumping is made to wobble, turn, and swing to and fro using a pneumatic mechanical device to provoke the same vibrations that the feet would make. In *Imbalance.6 (Jump)*, the mechanics of hearing (the oscillations which make hearing possible) and the very beginnings of hearing (the bass notes of a vibration caused by the movement of bodies) are placed before our eyes and projected at our ears. *Imbalance.6 (Jump)* reveals itself to be an exemplary and elementary experience of sound through movement. If it were completely realistic, and thus based on the actual floor, even deaf people would be able to perceive the vibrations without any problem, as they would receive and feel them via their bodies rather than their ears.[18]

On the question of the connection between body and feeling, Schulte has noted that "feelings, in accordance with the word 'feel,' are related to the sense of touch, [and] therefore to the mechanical relationship of the body to its surroundings through propulsion and resistance. Our expression responds to impressions."[19] In a way, the mechanics of hearing are directly linked to what Schulte calls the "mechanics of the emotions,"[20] emotions which are similarly generated by physical experiences and their impact upon the brain. In Cardiff's notes on *Music, the Brain and Ecstasy*, she specifically states the importance of physical sound as a catalyst of emotions: "Sound is all a part of the body, it invades the body with sound waves physically hitting us. I think this is one reason that it can effect us so profoundly."[21]

THE INSTRUMENT OF INSTRUMENTS

"The vocal cords produce a strong fundamental and an evenly graded series of harmonics, but the sound is nothing like a human voice. For that you need the resonating chambers formed by the throat, mouth, and nasal passages. What makes the human voice the most versatile of all instruments ... is that its resonances can be continuously altered by movements of the larynx, jaw, tongue, and lips."[22]

In *The Forty-Part Motet* (2001) the "instrument" of the voice rings out simultaneously from eight choirs, each comprised of five male or female singers, in a polyphony unique to the history of music—a veritable apotheosis of the human voice. The choral work entitled *Spem in Alium* that forms the basis of the sound installation was composed by the English Renaissance composer Thomas Tallis (1505–85) in 1573, but never before has it been possible to experience its incredible vocal diversity in any recording of the work. Experts surmise that even the composer himself would not have been able to hear all the details in their subtlety; this richly multi-layered music had been developed within his mind.

Cardiff's *The Forty-Part Motet*, however, radically changed this through its unique acoustic installation. She had the forty voices in the composition recorded separately, and then projected each of them with their own, individual loudspeakers set up in a wide oval in groups of five and placed at the height of a human head. Suddenly, one could hear not only the busy hum, the chatter back and forth, and the vocal warm-ups of the individual singers before the concert, but when the voices began to sing in unison, the impressive antiphony of the forty voices could be experienced from within. Walking up and down between the rows of "singers," visitors can inspect each individual voice, lending their ear to the tenor voices one moment, and then to the baritones or to the basses the next. This experience of choral sound is singular indeed. Unlike with a stereo recording or the traditionally frontal performance of a choir, Cardiff allows us to plunge into the sound space of the music; she renders its musical structures apparent, yet without depriving them of their magical power. The over four-hundred-year-old music becomes an overwhelming physical and mental experience when the combined sound waves of all the singing voices meet our ears. In the installation, every modulation of the individual voices, every subtle shift in the chorus, and every one of the composition's echo effects is simultaneously perceptible. Cardiff's *The Forty-Part Motet* thus offers an extraordinary exploration of musical psychoacoustics by catalyzing the visitor's awareness of both sonic nuance and musical depth of field.

CARUSO IN THE LOG CABIN

"Edison had done for music what Gutenberg had done for words by creating mass audiences for musical ideas. His invention would completely alter our relationship with music. With the recording of sounds, and later the broadcasting of sound through the air even to astronauts on the moon, music took on all the characteristics of mass affluence. Before, concertgoers were slaves to the conductor's tastes, hoping to hear a favorite composition once in twenty years.... Now anyone could *own* music and indulge in a cherished piece over and over again."[23]

Thomas Edison created the first sound recording in history with his "talking machine" in 1877. Ten years later, wax was used for the first time to record the traces of sound using the phonograph and make them more enduring. In 1897 the gramophone was finally invented, and, with it, the record as an independent bearer of sound. Speech and music thus became reproducible in any

[3] *His Master's Voice*, trade mark of the *Gramophone Company*, 1899

place and at any time. This reproducibility is one of the fundamentals of Cardiff and Miller's work, and given that until recently—little more than a century ago—mankind was without sound-recording technology, it should not be taken for granted. Our easy access to the music that we enjoy today makes it difficult to appreciate the quantum leap in acoustic perception that the ability to record sound had caused. Once recordings were possible, music could ring out in the most remote regions of the world and at any time of day or night, and exert its frequently hypnotic effect on human beings and animals without the aid of live musicians or instruments [FIG. 3].[24]

One of the people for whom music's availability on records seems to have generated a particularly powerful fascination was Royal Dennehy. Cardiff and Miller found more than a hundred opera records inscribed with his name in a secondhand shop in rural Canada, and these became the starting point for and the nucleus of *Opera for a Small Room* (2005), their work on the opera of a life: "We [were] interested in the extreme cultural juxtaposition between opera and the small western town in which R. Dennehy lived. What did he think about while listening to these records, recorded in cities halfway around the world?"[25] In the installation, almost two thousand records are piled up in a modest log cabin that also contains a chandelier and a lamp made from a tin can. The cracked voice of an old man rasps out from an antiquated megaphone. As he begins his story, the music starts up. Twenty-four old-fashioned loudspeakers project the sound of eight record players, which are occasionally playing together as if in concert.[26] *Opera for a Small Room* has structural parallels with the early operas of around 1600 in being a "melting pot of musical ideas,"[27] weaving together everything from arias by Caruso to folk and rock music. The installation exemplifies the potential of music to generate or reinforce the entire gamut of human emotional states, from crippling melancholy to electrifying vitality. At the same time, the installation is an extremely lively, almost hypnotizing reminiscence of the long since vanished age of vinyl with its characteristic pops and crackles, a time when records represented the technical avant-garde of sound recording and, as such, found immediate acceptance in the world of human science.

As early as 1880, only three years after its invention, the phonograph became a contemporary metaphor for human memory. The French psychologist and philosopher Jean-Marie Guyau resolved "to regard the human brain as a continually perfected phonograph,"[28] just as human memory had earlier been compared to a tablet of wax, a book, a printing press, a theater, a mechanical piano, and a photograph, and just as it would later be compared to film, television and radio technology, and, ultimately, the modern computer [FIG. 4].[29]

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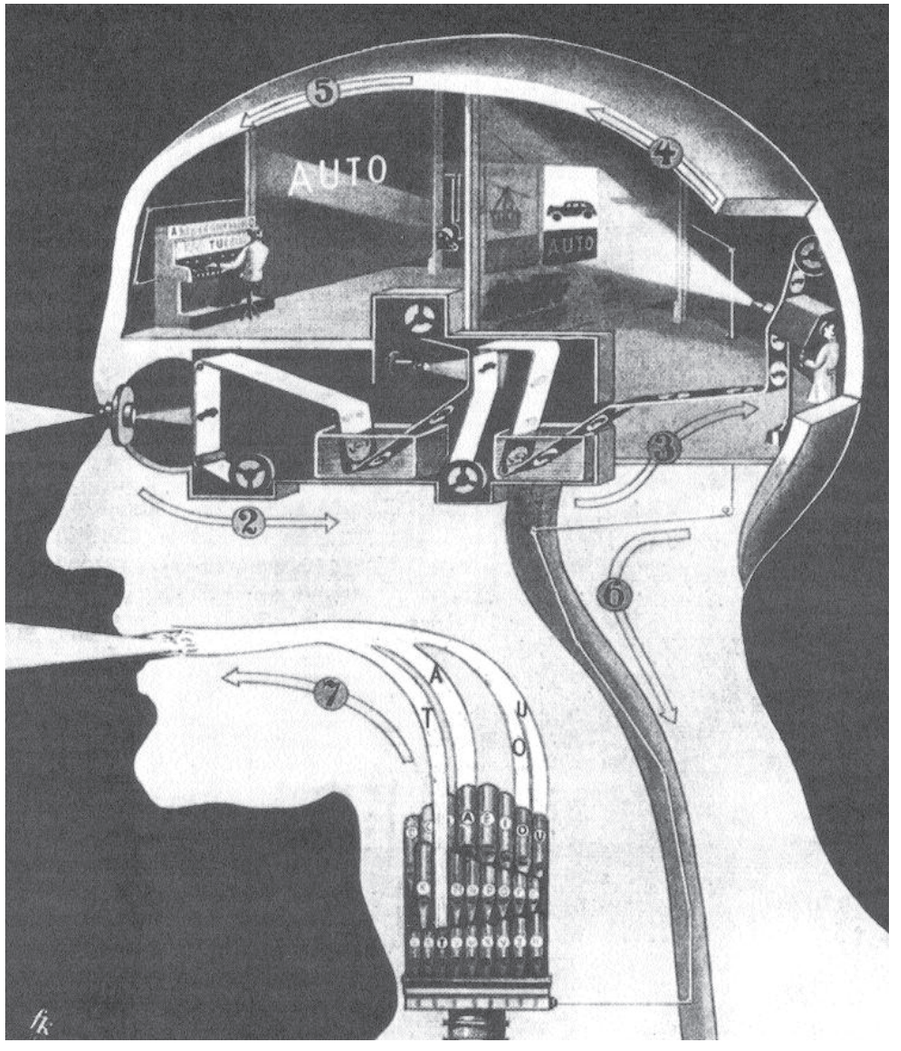

[4] *What happens in our Head, when we see a Car and Say "Car,"* graph. Ex: Fritz Kahn, *Das Leben des Menschen*, 1939.

THE HYPERREALITY OF SOUND

"Where lies sound's advantage? Surely in the fact that sound unfolds across time, that it *moves*." [30]

At first only a cut-out of white light can be seen, accompanied by the whirring fan of a slide projector. Then photographs of a woman's face appear, passing from slide to slide with the clacking noise of the projector mechanism, until one of the pictures begins to move, thereby creating a second reality. The past-tense nature of the slide is transformed into a cinematic present when the still image becomes the film. To a large extent, this presence is achieved acoustically by means of loudspeakers placed all around the walls of the specially constructed projection room. As Cardiff explains, "the twelve-sided room for *The Berlin Files* is completely covered in a sound deadening material so that the spatial quality of the sound can be felt..."; in this way, "the train can be heard crossing the room from right to left and ... you can feel it physically in the space." [31] The three-dimensional sound heightens the film's presence to the level of hyperreality. Barking dogs, the whumping of helicopter rotors, the staccato of women's shoes in an underpass, and the subtle whirring of a bicycle dynamo on a street wet with rain all form part of the soundtrack of *The Berlin Files* that drives the "action" forward in a constant movement from one sequence to the next, quite frequently without the visual anchor of an image.

The noises, sounds, and music of the soundtrack generate the special appeal of this curious cross between film noir, experimental film, and love story. We follow the sounds of a piano through an apartment in an old building to the hands of the obviously endangered man playing it.[32] We then dive down into the dark through a ventilation grate, drawn by the unaccompanied singing of a female voice—Cardiff's own [33]—to find ourselves unexpectedly in a below-ground bar where a man is enthusiastically singing "Rock'n'Roll Suicide" in a loose imitation of David Bowie. The thirteen-minute film loop was inspired by Julio Cortázar's continuous literary loop entitled *Continuity of Parks*, and it constantly reveals new relationships between its sounds and its images. The boundaries between the virtuality of the film and the reality of the visitor are blurred in particular by the physical experience of sound. What Cardiff had already explored in her audio walks continues to be important: "I want people to be inside the filmic experience.... I want the pieces to be disconcerting in several ways, so that the audience can't just forget about their bodies for the duration of their involvement like we do in a film." [34] The surround sound emanating from the loudspeakers distributed around the room, together with the suggestive power of the pictures, gives rise to an extraordinary artistic place in which we are invited to immerse ourselves in a fictive hyperreality, and yet to become conscious of audiovisual perception at the same time. Cardiff herself perceives this sound/film work as being part of a long tradition: "I think contemporary cinema is one stage of a long journey in which people have been attempting to create virtual worlds. I guess it started with cave drawings and continued through linear perspective in Renaissance paintings, then into photography and film. I think my video walks and installation pieces are a continuation of this obsession." [35]

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THE ARNOLFINI EFFECT

"Perhaps what music needs now is not so much another Beethoven as an Isaac Newton ... who can systematically describe music's deepest relations and make them analytically approachable." [36]

In 1434 Jan van Eyck painted *The Arnolfini Portrait* depicting the Genoese merchant Giovanni Arnolfini, who was staying in the Netherlands at the time, and his wife, Jeanne de Chenany [FIG. 5]. Looking at the work, the renowned art historian Ernst Gombrich marveled how "a small, simple corner of reality was suddenly captured in a picture as if by the power of magic. We could now see everything there, the rug and the wooden slippers, the rosary on the wall and the little brush hanging on the bedstead, the fruit on the windowsill, and the bull's-eye panes in the window. We can virtually visit the Arnolfinis in their home." [37] The painting filled Gombrich with the same enthusiasm that can be sensed today in a different way among those who experience Cardiff and Miller's exhibitions and installations. If, as Gombrich suggests, Van Eyck's painting was the first in history to make the artist, and hence the viewer, a true "witness" to an event,[38] then the two Canadian artists similarly transform their visitors into both visual and aural witnesses. Beauty is not of primary importance to this transformation, but rather reality in all its complexity. Van Eyck's love of detail, his penetrating observation of nature, and his meticulous craftsmanship all serve to create the illusion of reality, and all of these characteristics are equally present in more modern forms in the work of Cardiff and Miller. Also, just as the Flemish artist made a considerable contribution to the development of oil painting through his experiments with materials and techniques, so Cardiff and Miller have blazed a trail in the field of narrative aural art through the introduction of advanced recording techniques. Like Van Eyck, Cardiff and Miller are interested in duplicating reality, in conquering or enhancing it by honing and sharpening our perception of the world around us though the medium of art.

However, the affinity between the work of these very different artists does not end here. Van Eyck's painting is rendered extraordinary by the artfully depicted convex mirror hanging in the background, which reflects the whole scene in rich detail from behind. In the mirror, between the backs of Arnolfini and his wife, the painter and another onlooker appear, figures understood to be standing in front of the scene portrayed in the picture. A second pictorial space thus opens up in the work, one which is not traditionally included in painting, and thereby discloses a new dimension of perception within the medium by making it multifocal.[39] In fact, this is the aspect of the painting that has fascinated Cardiff and Miller the most: "A topic of interest to us is the painting of the Arnolfini wedding and the space of the mirror. In ways I think that our work is about entering into dimensions such as this." [40] It is a question of extending our realms of experience and reflecting them, of creating a multiplicity of worlds through the medium of art. Cardiff has remarked, "I've always loved to escape, whether it was through walks, books, films, or dreams, and it's only now that I realize what I've been doing this past decade. I've been creating portholes into my other worlds." [41]

The memory-filled, acoustic landscapes she and Miller create have taken the form of the abandoned laboratory cluttered with memory aids and transmitting media like books, mega-

phones, and telephone-strings in *The Dark Pool* (1995); the puzzling experience of an opera house for one visitor and a thousand guests in *Playhouse* (1997); the visualization of the mechanics of hearing via a video monitor set into motion in *Imbalance.6 (Jump)* (1998); the spatially expanded chorus of *The Forty-Part Motet* (2001); the surreal moviegoing experience in *The Paradise Institute* (2001); the three-dimensionally audible film reality in *The Berlin Files* (2003); the telephone conversation about time and space in *Telephone/Time* (2004); the slide show of faded holiday slides with a voice-over commentary in *Road Trip* (2004); the musical epic evoking the dying world of vinyl records in *Opera For a Small Room* (2005); and the strange and threatening *Killing Machine* (2007) with its robot arms. All of these works entice us into other worlds by means of their completely unique "Arnolfini effect," and despite their sometimes powerful visuality, they all focus in particular on our sense of hearing. By electrifying and provoking both the tympanum and the cerebral cortex, Cardiff and Miller's works take their visitors on intensive sensory journeys, much like a cultural history of the perception of sound and of media-recorded memory, largely by means of their own unmistakable voices. Their soundtracks are ultimately the anchors that ground the worlds Cardiff and Miller create through their work—they are the artists' most important instrument and the fulcrum of their art.

1 The attempt to transform pieces of music into living animals (Mozart quintets into birds, Beethoven symphonies into beetles, etc.) was therefore doomed from the start, and fails in an equally surreal and exemplary way in Philip K. Dick's short story *The Preserving Machine*, also reproduced in this volume; see pp. 65–72.

2 Robert Jourdain, *Music, the Brain and Ecstasy. How Music Captures Our Imagination* (New York: Harper Collins, 2002), p. 2.

3 Ibid., p. 245.

4 Ibid., p. xii.

5 Tilman Ritter composed the soundtracks for both *The Paradise Institute* (2001) and *The Berlin Files* (2003) in close collaboration with the artists, and he worked together with Gordon Monahan, Cardiff, and Miller on the piano composition for *Pianorama* (2005).

6 New recordings were made in the case of *Playhouse*, *The Forty-Part Motet*, and *The Berlin Files*.

7 Miller composed a cello piece for *Opera For a Small Room*, and Cardiff sings the first half of "Rock'n'Roll Suicide" in *The Berlin Files*. Both times they also collaborated with their team in balancing all the instruments for the recordings. In addition, a piano improvisation by Miller is heard in *The Dark Pool*.

8 See Francesco Valcanover, *Carpaccio* (Florence: Scala, 1992), p. 42.

9 An impressive representation of voices and music (depicted visually so that they are almost audible,

[5] Jan van Eyck (ca. 1390–1441), *The Arnolfini Portrait*, 1434, oil on oak, 81.8 x 59.7 cm, The National Gallery, London

unlike the soundless, only intellectually reconstructible appearance and reading of notes in *The Vision of St. Augustine*) can be found in Carpaccio's paintings on many different occasions: in *The Triumph of St. George* and *The Baptism of the Selenites* there are musicians playing drums and trumpets, while in *The Presentation in the Temple* three androgynous, music-making angels play violin, flute, and lute. For illustrations of these works, see Valcanover, *Carpaccio*, pp. 53, 55, 64.

10 Jourdain, *Music, the Brain and Ecstasy*, pp. 4–5.

11 Günter Schulte, *Neuromythen. Das Gehirn als Mind Machine und Versteck des Geistes* (Frankfurt am Main: Zweitausendeins, 2000), p. 186. The quote was translated by Judith Hayward.

12 Cardiff interviewed by Atom Egoyan in *Bomb Magazine*, http://www.bombmagazine.com/cardiff/cardiff.html

13 Jourdain, *Music, the Brain and Ecstasy*, p. 10.

14 Janet Cardiff and Mirjam Schaub, *Janet Cardiff. The Walk Book*, with contributions by Tom Eccles, Gary Garrels, Madeleine Grynsztejn, and John Weber (Vienna: Thyssen-Bornemisza Art Contemporary and Public Art Fund, 2005), p. 209.

15 Jourdain, *Music, the Brain and Ecstasy*, p. 20.

16 Janet Cardiff, "Notes to *Music, the Brain and Ecstasy*," email to the author dated November 7, 2006.

17 Jourdain, *Music, the Brain and Ecstasy*, p. 11.

18 This also applies to bass notes from loudspeakers that are perceived by the deaf via the vibrations of the floor in such a way that they can dance rhythmically or move to the beat of the music.

19 Schulte, *Neuromythen*, p. 91. The quote was translated by Judith Hayward.

20 Ibid., p. 92.

21 Cardiff, "Notes to *Music*."

22 Jourdain, *Music, the Brain and Ecstasy*, p. 40.

23 Ibid., p. 244.

24 This is also valid particularly for later times when ear-splitting rock concerts can boom out of any cell-like room, however small. An artistic realization of this notion is the enthralling "Rock'n'Light Show" which takes place after the opera arias in *Opera for a Small Room*.

25 "Janet Cardiff & George Bures Miller, *Opera for a Small Room*", in *Cardiff + Miller, The Secret Hotel*, exh. cat. Kunsthaus, Bregenz (Köln: Walther König, 2005), p. 77.

26 Like the musical and spoken elements, the lighting design, too, is thought through carefully, not to mention the three-dimensional Ambisonic Sound of the loudspeakers on the walls of the room outside the wood cabin that allow visitors to *Opera for a Small Room* to become immersed in further hyper-realistic, fictional, auditory worlds. See Christy Lange's essay "The Impossibilists" in this catalogue, pp. 175–177.

27 The expression is one coined by Jourdain; *Music, the Brain and Ecstasy*, p. 96.

28 Douwe Draaisma, *Die Metaphernmaschine. Eine Geschichte des Gedächtnisses* (Darmstadt: Primus, 1999), p. 100. The quote was translated by Judith Hayward.

29 See ibid., pp. 98, 216, 217, 233, 234.

30 Jourdain, *Music, the Brain and Ecstasy*, p. 329.

31 Cardiff, "Notes to *Music*."

32 When the camera pans on to the piano player in the adjacent room his solo is suddenly accompanied by an orchestra and heightened to the extreme drama of a film soundtrack. Cardiff and Miller are skillfully playing with suspense conventions here, and fully exploiting the audiovisual possibilities of the genres.

33 This is a free quotation from the French feature film *Delicatessen* by Jean-Pierre Jeunet and Marc Caro made in 1991 in which conduits likewise become transmitters of sound.

34 Cardiff interviewed by Atom Egoyan in *Bomb Magazine*.

35 Ibid.

36 Jourdain, *Music, the Brain and Ecstasy*, p. 333.

37 Ernst H. Gombrich, *Die Geschichte der Kunst* (Stuttgart and Zurich: Belser, 1986), pp. 189–190. The quote was translated by Judith Hayward.

38 Ibid., p. 190.

39 This is a transgression of the notion of linear perspective before it was formally developed and theorized.

40 Cardiff in an email to the author dated March 29, 2006.

41 *Janet Cardiff. The Walk Book*, pp. 4–5.