

2 From Technologies of Representation to Technologies of Performance

This chapter shifts perspectives from media technologies of representation to technologies of performance. It revolves around the hinge of notation, initially regarded as representation, then as a part of the means of articulating performance. The larger shift in perspective, intertwined with the introduction of computational technologies, moves from the design of notation, to the design of instruments, to the design of responsive media.

Two Motivating Stories

In 1922 László Moholy-Nagy wrote:

So far it has been the job of the phonograph to reproduce already existing acoustic phenomena. The tonal oscillations to be reproduced were incised on a wax plate by means of a needle and then retranslated into sound. An extension of this apparatus for productive purposes could be achieved as follows: the grooves are incised by human agency into the wax plate, without any external mechanical means, which then produce sound effects which would signify—without new instruments and without an orchestra—a fundamental innovation in sound production (of new, hitherto unknown sounds and tonal relations) both in composition and in musical performance.

I have suggested to change the gramophone from a reproductive instrument to a productive one, so that on a record without prior acoustic information, the acoustic phenomena itself originates by engraving the necessary etched grooves.¹

One could question the potential effectiveness of this technique—why go to all that effort of impressing a pattern to be produced by electromechanical means, when one could use perhaps more expressive or precise musical controllers, for example a joystick or hand waving over some antennae? Nevertheless, Moholy-Nagy anticipated turntablists' reuse of the gramophone, imagining an even more radical hack. Whereas turntablists essentially work with macroscopic samples, Moholy-Nagy's proposal

would have the performer create sound from the far more primordial level of manipulated wax substrate.

When the creators of the TGarden came together for a two-week workshop in the Banff New Media Institute to come up with a design for the responsive play space, we organized a series of very different modes of ideation reflecting the radically different modes of practice represented by the eight members of the creative team. A musician with twenty years of experience in electronic music and live improvisation with live musical and dance performance demonstrated examples of both sampled and synthesized sound. A PhD in computer science gave a series of talks about the state of the art in particle systems and computer graphics. An experimental theater artist who had formed three companies pioneering performances blending everyday and prepared sites, incorporating video personae with live actors, led some narrative exercises based on imaginary scenarios and language games. Some of the artists also brought samples of visual and written work from scrapbooks that they had been keeping for the months prior to this retreat. Some of the group leaders believed that our goal was to come up with a common multimodal language in which the next version of the TGarden could be described and designed. I didn't share this belief. After Wittgenstein's demolition of positivist theories of language as representation, after all the experiments with artificial languages from Leibniz to Orwell, one might better expect that a common language would evolve in the crucible of the making of an event. And moreover, an "accurate" formal representation of the structure of an event and the modes by which it was created would be possible only after the event was created.

One might believe that a graphical interface would be more universal, but Wittgenstein's infamous arrow, duck-rabbit, and other graphical examples show us that this is no less chimeric than believing in a universal or even a transversal (verbal) language.

This is not to discount all the elaborate technologies for making images and sounds and texts and things that we have developed. What I propose in this chapter is simply to shift how we regard these technologies, to see how they can be used not to represent facts or knowledge but instead to create events. In short, I propose to shift the perspective from *representation* to *performance*. By *technologies of representation* I mean those technologies designed for creating media that are later perceived by a spectator in an edited form that does not vary according to what the spectator or environment is doing during the playback of the recorded media, whereas by *technologies of performance* I mean technologies that vary media by design according to contingent conditions and activity.

This chapter is by no means a survey or critique of representation. It is not a historiographically systematic bit of archival research on the history of musical technologies and notation. My purpose is to reorient our view of media technologies, especially

computational media technologies, toward their performative, expressive, improvisatory uses. The concrete performative and improvisatory uses will become clearer in the examples of responsive environments that I describe at the end of this chapter, and in the chapter on performance.

Briefly, the reorientations in this chapter are: (1) from *technologies of representation* to *technologies of performance*; (2) from the point of view of the composer or critic to that of the performer; (3) from an instrument model of sound synthesis to playing sounding, responsive media; (4) from distributed agency (the ensemble) to plenist magma, material medium, stuff.

Notation

Given the emphasis on computational media, it makes sense to consider how computers are used as the quintessential symbolic processing machines. It follows that it's reasonable to consider the medium of signs. The big shift in perspective is to see how the signs constitute things in a nondualist or, to anticipate Whitehead, unbifurcated ontology, rather than represent (point to, refer to, correspond with) some disconnected part of the world. (How the sign is disconnected from its worldly referent depends on the analytic conceits in force in the situation.) This perspective may prove useful for understanding how we make music, dance, as well as mathematics, all regarded as equally performative and creative modes of human expression, even though they create radically distinct kinds of things. Grammar and notation are technologies for structuring symbolic media as much as brush and canvas structure painting. (By structure, I mean nothing deterministic but not random either, more a matter of conditioning.)

The more profound difference, from a semiotic point of view, is what constitutes an *interpretant* of the sign. As many have observed, from Turing and Wiener to Friedrich Kittler and Katherine Hayles, computers foreground the possibility of machinic interpretations of these signs in tandem with human interpretation. I will tell the story from the point of view of the "symbol machines" that play a role in the generation of performative events. (For the purposes of this chapter, events are changes of material state, and performative events are events in which affective as well as symbolic transformations play a leading role in those changes of state.)

At the end, we will have in hand some theoretical takeaways and concepts. We will consider a notational system's expressive power, which depends on several factors—resolution, syntactic density, completeness, range, nuance, and connotative potential.

Following the tactic of starting outside the domain of the computational in order to get some parallax on the computational, we will consider technologies associated with two areas of performance: (1) musical performance and sound improvisation, (2) dance and movement. In each domain of practice, I will trace the move over recent

of written musical representation inherited from seventeenth-century Europe: five horizontal lines—the “staff”; a “time signature” indicating the basic durational unit and how many units make up each minimum formal segment—called a “bar”; a “clef” indicating a general pitch range; a “key” indicating the scale of pitches to be standardly used; and a vocabulary of terms that have acquired canonical meanings for performance practice, such as “sforzando,” “morendo,” and “G.P.”

The key difference between a literary text and a musical text—a score—is that the latter is written by the musical artist—the composer—for an intermediate interpretant—the musician—who in turn produces the sound to be experienced by the audience. So the musical event conventionally bounded as a “concert” is coproduced by a complex of the score, musician, instrument, audience, and physical site. I’m deliberately confining this description of the production of a musical event to obvious, tangible elements for the purposes of this chapter. Ignoring the enormous components of performance practice, publication and dissemination systems, and sociological and phenomenological modes of experiencing music, I focus on the technologies of performance most directly bound up as musical notation and musical instrument.

Adjoining the systems of signifiers coevolving with 500 years of instrument making and schooled performance practices reflexively refined around the interpretation of musical text (the classical musical score), we can see musical notation as part of a highly refined technology of performance.

But none of these associations, however well sedimented by custom and history of compositional and interpretive practices, are uniquely determined.

Musical notation only partially registers the acoustic signal, and in fact, before the age of mechanically recorded sound, there was always an aspect of the imaginary implied by writing music. There are in fact uncountably many interpretations possible for a given score.

Contemporary Musical Notation in (European) Art Music

Broadly speaking, notation can represent:

1. The corporeal, *kinesic* manipulations relative to a physical instrument (in the context of computer music technology, a *controller*);
2. The *sound* (e.g., acoustic: pitch, loudness, tempo descriptions like “andante”);
3. Conceptual, formal *structure*, metaphor.

Notating kinesics. Examples of notations of corporeal manipulation range from very common tablature diagrams for guitar and lute that show where to place the fingers on the fretted fingerboard to one-of-a-kind diagrams such as Mauricio Kagel’s drawings of how to place the hands on a balloon. Kagel’s score of *Acustica* is a pictographic depiction of how to manipulate an object. But Kagel’s diagrams are compound;

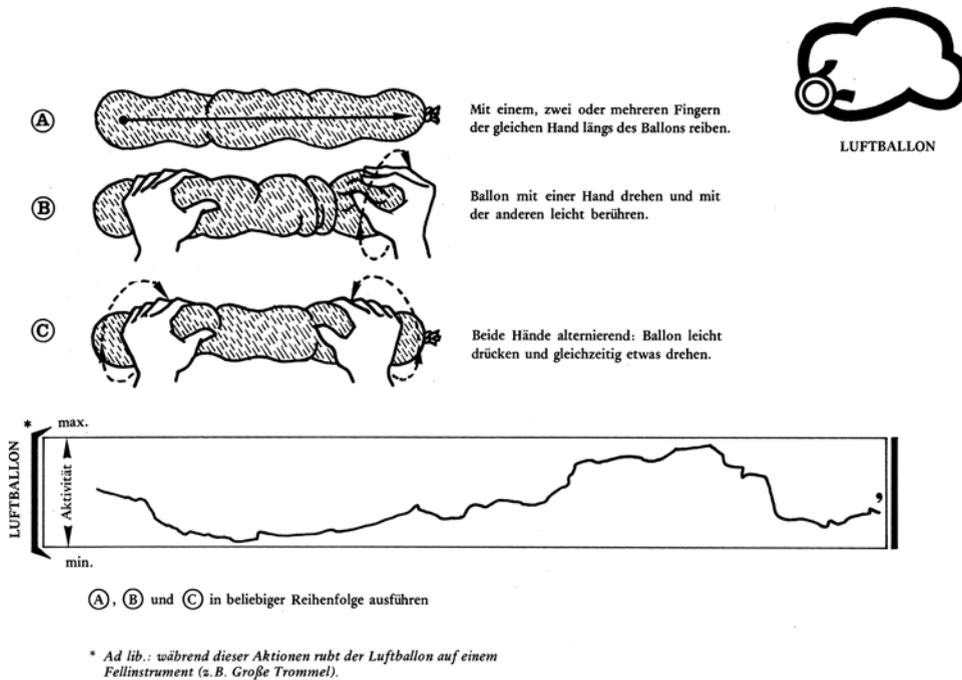


Figure 2.3

Mauricio Kagel, *Acustica*.

he also incorporates representation of the desired acoustic effect to be achieved—a graph showing the aggregate “intensity” of manipulation over time.² Of course this sort of representation is not restricted to European art music. The most notable treatises by Arab theorists (al-Kindi) established the principal Arab non-Pythagorean tone system by showing how to finger the tones on the *ud* (lute).

Andrea Valle writes, “Musical notation makes body . . . most substantially, with which one intends by music: in this study it truly is the case that knowledge is sedimented in notation.”³ For example: Anthony J. Cirone, a distinguished member of the San Francisco Symphony Orchestra, published a set of notes for fellow percussionists about how to interpret the less precise indications for percussion instrumentalists in European art music of classical and postclassical eras. About performing Richard Strauss’s *Don Juan*, Cirone advises the percussionist: “It is important to muffle . . . by using both arms to silence the instrument.”⁴ For playing Mahler’s Symphony no. 2, he provides such detailed comments on kinesthetic aspects of the interpretation of the score as: in bar 9, “Stroke edge of cymbal following,” and in bar 13, to add a bit of drama, lift cymbal in view of the conductor.⁵

Notating sound. The second mode of musical notion describes the acoustic pattern—the sound—to be produced. Cirone remarks that scores for percussion often lack notation for phrasing, whereas for other instruments phrasing is represented by an arc extended over all the notes to be played as if they were sung in one breath. Even though percussion instruments are not played by breath, they can certainly be played with nuance that matches the variations in connectedness and fluidity that accompany the phrases of a piece. So adding such arcs even to keyboard-like representations introduces, suggests, reflects shape added by phrasing.⁶ The obvious point here is that musical written notation can never completely describe the joint musical intention of the composer and the performer. In fact, as Valle also remarks, any (synchronic) semiotic system of representation radically undercodes the corporeal actions to be done by the performer in order to create the scored music in a way that would be accepted by the complex of composer, performer, and audience within the union of their musical frame. But as Valle observes with abundant examples for twentieth-century art music, notation also radically overcodes performance as well.

Let us start with relatively straightforward elaborations of conventional scores, for example bars 27–32 from György Ligeti's second string quartet (1968).⁷ Ligeti chooses to augment the conventions of musical notation of the day with very detailed notes to the string instrumentalists about how to interpret the notation (“[graphic marking] always applies to the pitch not the finger”), the physical movements (*sempre sul tasto*—always near the fingerboard, a nonconventional area on which to bow), and the desired musical effect (*leggierissimo*).

Figure 2.4 shows a musical score for György Ligeti's String Quartet no. 2, bars 27–32. The score is written for four string instruments (Violin I, Violin II, Viola, and Cello/Double Bass). It features complex rhythmic patterns and dynamic markings such as *leggierissimo*, *sempre ppp*, and *sempre sul tasto*. A dashed line connects the notes across the staves, indicating phrasing. A footnote at the bottom explains that the '8' symbol indicates pitch rather than fingering.

Figure 2.4

György Ligeti, String Quartet no. 2, bars 27–32.

But his organ work *Volumina*⁸ has a much more unconventional score—in fact a one-of-a-kind notation, similar to a spectrograph—a display of frequencies present in the spectrum at a given point in time. Ligeti instructs the organist to press fingers, but also elbows and whole forearms onto the keys in order to create masses of sounds—tone clusters and tone masses, which suggests a set-theoretic conception of sound.

In any case, such scores presume a classical (pre-quantum mechanical) relation between the composer-performer and the musical work: there is the presumption of a definitive entity—the musical work—the text as conceived by Ligeti and “realized” by the properly prepared organ and properly prepared organist.

Notating Musical Event Structure

Notation can also prescribe, in the most flexibly abstract way, musical event structures. One example is the notation of a key, which selects a set of pitches that will actually occur in the sound and sequences of sounds to be produced. Another example might be paratextual glosses like “Sonata” or “Overture.” (“Text” in this chapter refers not to ordinary-language words but to the musical score.)

As Valle put it, “A notation, like every sign, is a crystallization of knowledge not reducible solely to predispositions of the signifier [*segnale*], and consequently it is impossible to speak of notation without entering into aspects of compositional technique.”⁹ Ligeti’s *Volumina* shows how a notational scheme can fuse all these modes of articulation at once. Of course with contemporary computational means we can synthesize the sonic clusters, but it makes a tremendous difference that the performance is done by a human body, which conditions the production and the perceived qualities of the sound in a radically different phenomenal way. Stravinsky relied on a similar performative tension when he scored the *Rite of Spring*’s opening melody to be played by a bassoon far above its customary range, precisely in order to hear the strain of being outside the normal range of performance practice of professional bassoonists of the day. There are uses in performance for performing at the limits of the capacity of the technical ensemble (to use Simondon’s terminology for the complex of technical object and technical individual, discussed below).

Krzysztof Penderecki’s score for *Threnody to the Victims of Hiroshima* shows how the 24 cellos are grouped into clusters of voices, and also when they enter staggered across time to build the mass of sound.¹⁰

Issam El-Mallah’s diagram depicting the formal structure of the *sot*¹¹ goes to one extreme of being primarily a tool for analysis, not a part of the instrumental apparatus for performers to produce a musical event. This is an important distinction when we consider a notational system for dance.

Myron Levine’s score for *Parentheses* is a diagram in the form of a matrix, with arrows showing possible transitions to neighboring cells in the matrix. We can easily interpret this as a graphical program in which each cell is a possible state of the musical

Es. 11. G. Ligeti, *Volumina*.

rechte Hand

linke Hand

Pedal

19

20

21

22

Originaler Klangartenwechsel auf dem Mannal (M und J.H.) vom Runkeltätig allmählich zu Bardenig... nur Bordenig 16' (beide Hände stets auf dem selben Mannal)

Allmählich entstehende dicke interne Bewegung des Clusters: die einzelnen Töne sind nicht mehr angehängt und losgelassen (mit acc. und *mf*: ad lib.)

molto legato!

(wie die rechte Hand)

Register-*diminuendo* im Pedal

rechte Hand
weiter
mit
linker
Hand
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men

Die interne Bewegung wird beibehalten und allmählich in einen sehr leichten Triller überführt.

(wie die rechte Hand)

Register-*diminuendo* im Pedal

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Figure 2.5 György Ligeti, *Volumina for Organ*, tone cluster strips for right and left hands and pedal.

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18

12Vn

12Vn

10VI

10Vc

8Cb

20"

Figure 2.6
Krzysztof Penderecki, *Threnody to the Victims of Hiroshima*, for 24 cellos.

event (its contents indicating orchestration and voicing, and so forth), with adjacent cells as the possible successor states and arrows indicating transitions. So it is a paper version of a piece of code, except that this is meant to be read by a human performer rather than a computer.

Notating Metaevents

John Cage gave up a deterministic coupling to corporeal production and the resulting sound. One could, with Valle, think of “notation as operation,”¹² but with Cage and subsequent composers the operation works more at the level of musical event as cybernetic system. Notation serves more as a metascore, a set of instructions to the performer on how to arrange the elements provided in order to assemble a score that can then be interpreted. For example, in *Fontana Mix* the musician is told to slide a graph-ruled transparency across a printed paper, and then to read out the resulting “line” constituted by the superposition of the grid over the printed drawing as a notation to be interpreted for playing musical instruments.¹³

Most radically, Cage gave up the presumption of a stable entity called the musical work that predates the moment of performance. A critic like Genette may claim that Cage’s strategy was a historical anomaly, and that art objects are largely determinate or become determinate. But as Guattari pointed out, borrowing from Lacan’s *objet petit a*,¹⁴ every art object enjoys this quality of being only a partial object, its radical indeterminacy underscored by the arbitrary and boundless ways in which it may be “completed” contingently in every encounter with an observer. (In this chapter, we pursue this to its material limit of what I will call substrate.)

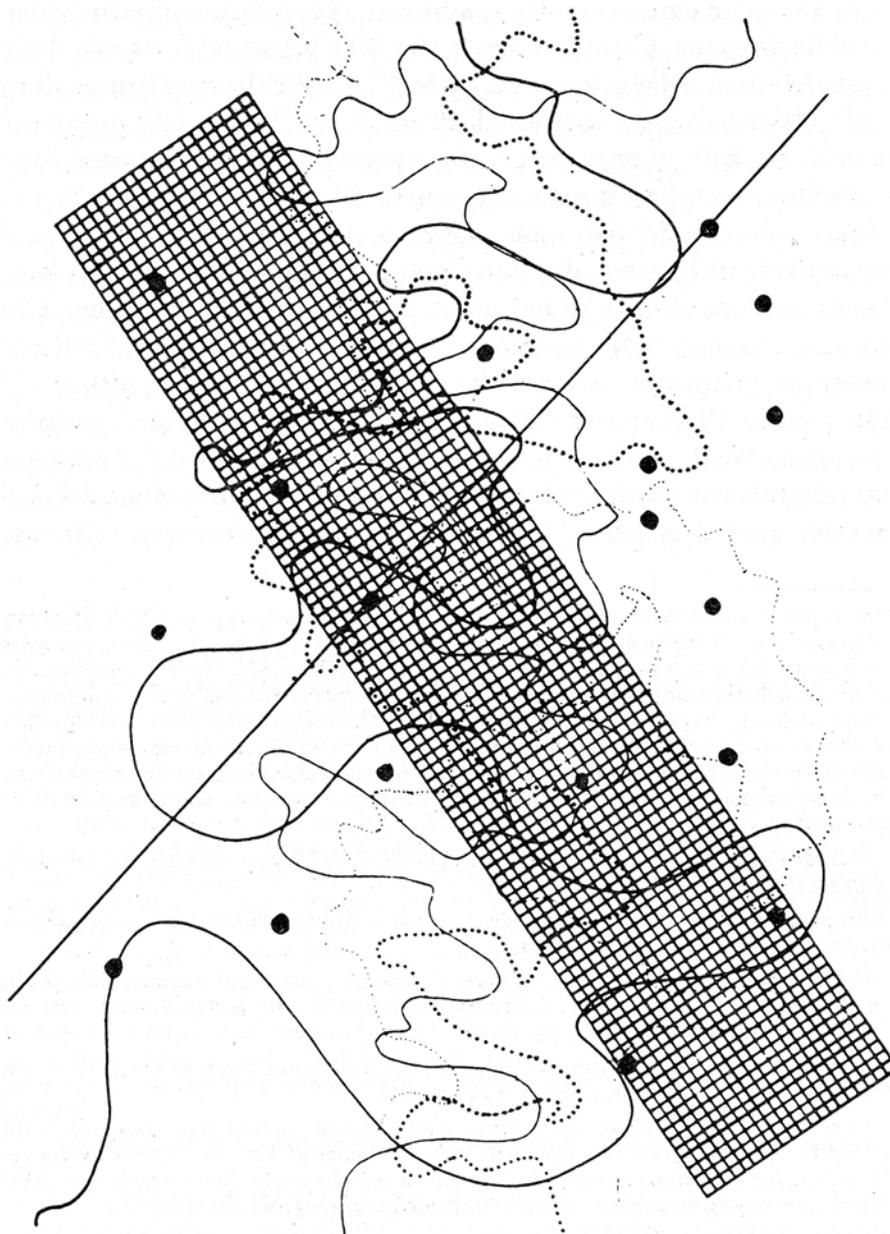
Just as with Levine’s *Parentheses*, Cage’s metainstruction is another “analog” analog to a set of instructions—a program—that instructs its reader to execute a set of operations according to the potential logic encoded.

This anticipates the transition from human-legible scores to be interpreted by human performers to machine-readable scripts or code (software) to be executed by electromechanical machines. Looking ahead, I will multiply the notion of score into code versus script, code being more allied with numerical and logical instructions to instruments, and script more allied to “semantic” instructions for playing instruments. Alongside this I will transition from thinking scores as representing some entity to the instrumental performance, instruments, apparatuses, environments, and media in which these performances are constituted.

To gain some parallax on this, let us look to a neighboring domain of movement and time-based expression: dance.

Movement Arts, Dance: Rudolf Laban and Dance as an Art

Why do dancers not use a written notational system such as Laban notation whereas European classical musicians do? Of course, contingent histories play a major role in



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Figure 2.7
John Cage, *Fontana Mix*.

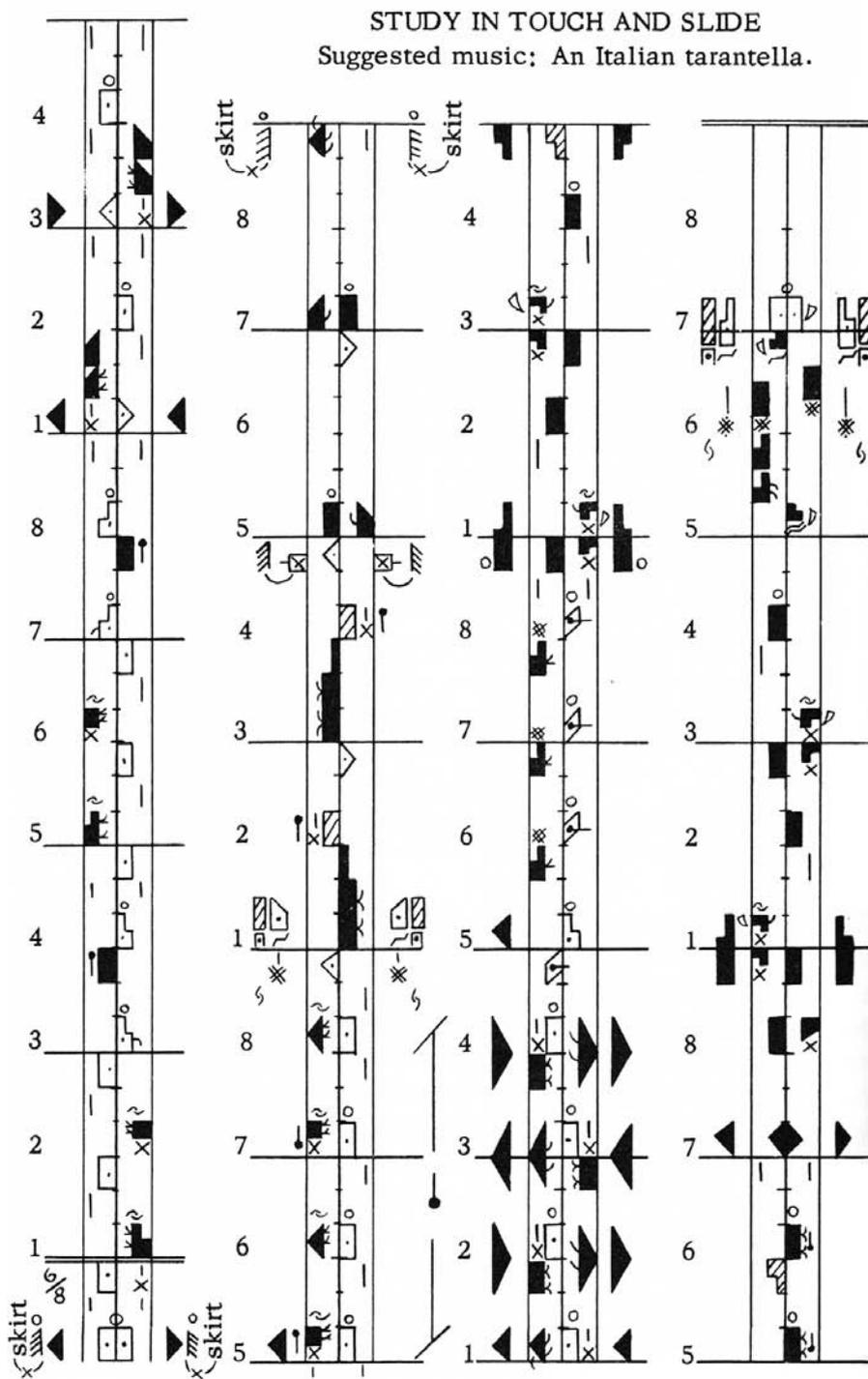


Figure 2.8
Touch slide study, from Ann Hutchinson Guest, *Dance Notation* (1984), 143.

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the adoption or nonadoption of a written system of notation to represent some social practice. Hungarian-born Rudolf Laban (1879–1958) created a notational system in order to provide a way not only to record but to compose dance with as much reflection and citationality as literary forms. The main purpose of what Laban called *kinetography* is “making the movement event precise through analysis and freeing it from being blurred, which makes a language of dance appear on the one hand unclear and on the other monotonous.”¹⁵ Although it is true that Laban studied crystal symmetries for formal purposes of understanding spatial rhythm and space harmony, it would be inaccurate to describe his notation as a description of positions in space relative to the center of gravity of the body. In fact, for Laban movement was primary. One can see this in his sketches of a dancer’s movement—he attached labels not to positions of body parts, but to trajectories of movements in the sequence in which they occur, a thoroughly dynamical attitude. Laban wrote: “The conventional idea of space as a phenomenon which can be separated from time and force and from expression, is completely erroneous. . . . Movement is the life of space. Dead space does not exist for there is neither space without movement, nor movement without space.”¹⁶

We often mistake a thinker’s scaffolding for his or her conclusion, or pedagogical rhetoric for actual practice. Christopher Alexander’s approach and practice cannot be reduced to his set of “patterns” without entirely desiccating the approach and turning it into its deadly opposite. Likewise, Laban’s approach cannot be reduced simply to his system of notation. A common move by technicians is to reduce Alexander’s or Laban’s compositional approaches to a fixed schema or typology and try to build entire worlds by combinations of a set of primitive elements. In the illustrations and fragments of texts published from his notebooks by one of Laban’s students, we can see how he started from the full richness of bodily movement and moved in a double spiral toward geometrical notation. One branch of this spiral was progressively codified movement, and the other a progressively refined system of signs.¹⁷

Laban was sensitive to the dynamical and full richness but availed himself only of piecewise linear geometry. So, for example, on page 31 of the sketchbook, he started with a fully drawn body and placed it inside a bounding polyhedron. But even in this Euclidean cage, the body was drawn in the middle of a movement rather than some straightened, symmetrical profile. And the vertices are formed out of the extremities so that the bounding shape is clearly changing all the time in the course of the movement. Laban also built from simple lines to more complete movement-skeletons: from 1-simplexes¹⁸ to ribbons centered on such complexes of lines¹⁹ to polyhedra.²⁰ But to sketch the full movement, he also drew the dynamics in a much more evocative way, such as in one figure with the swirls traced by a body in motion.²¹

The actual syntax derives from multiple sources in European arts ranging from musical staff notation to solid geometry, streamlined over thirty years into a dense, compact notational scheme. In 1928, Laban laid out the ground principles for his

notational scheme (figure 2.9). The basic durations are denoted by length. (Laban credited the woman who collaborated on his project for this innovation from his original token-based representation.) The final form of the notation was oriented vertically to map more naturally the bilateral symmetry of the upright body. There is an important point to the vertical, bottom-to-top syntax for writing and reading a line of Laban notation. *Together with the mapping of left-hand signs to left parts of the body, and likewise with the right, the vertical orientation of the syntax matches the embodied perspective of the performer.* Here is a notation system designed not for the convenience of the European typesetter or literary reader, but for the dancer. The photograph of a dancer walking in line with the score on the floor (figure 2.10), along with the sequence of examples from Ann Hutchinson's definitive text, illustrate this point.²²

Laban himself was not interested in propagating his approach as a methodical system, but rather as a reorientation, a modernist awakening of sensitivity to corporeal kinetic movement in human life generally: in science, art, spirituality, and health. For our purposes, the dance notation, stripped of the obvious and obscuring indirection through mechanical instruments, is a particularly clear example of a notation constituting

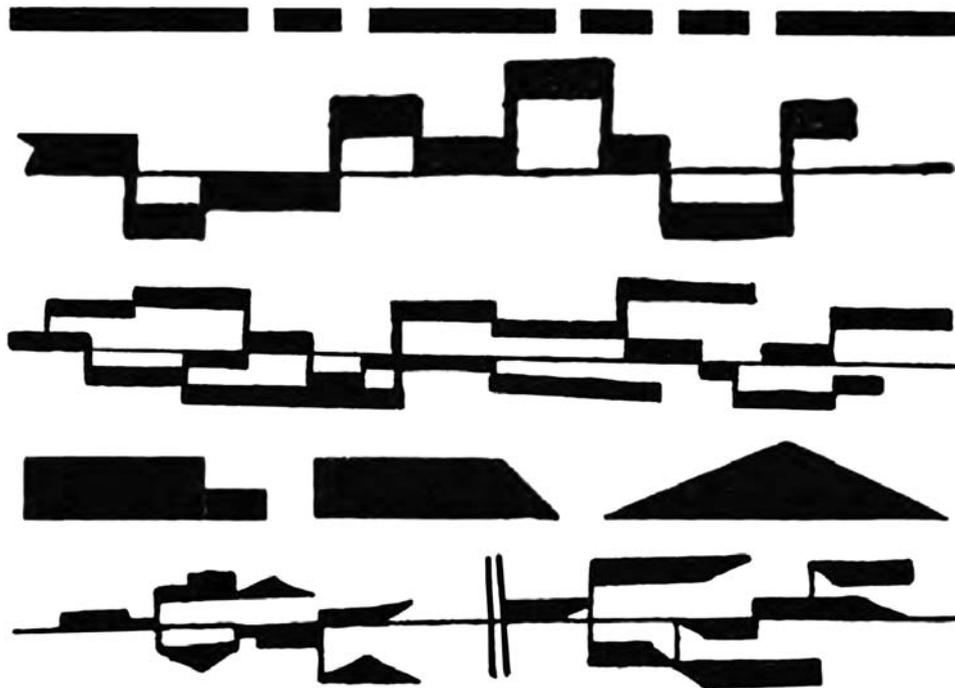


Figure 2.9
Rudolf Laban, *Ground Principles*.

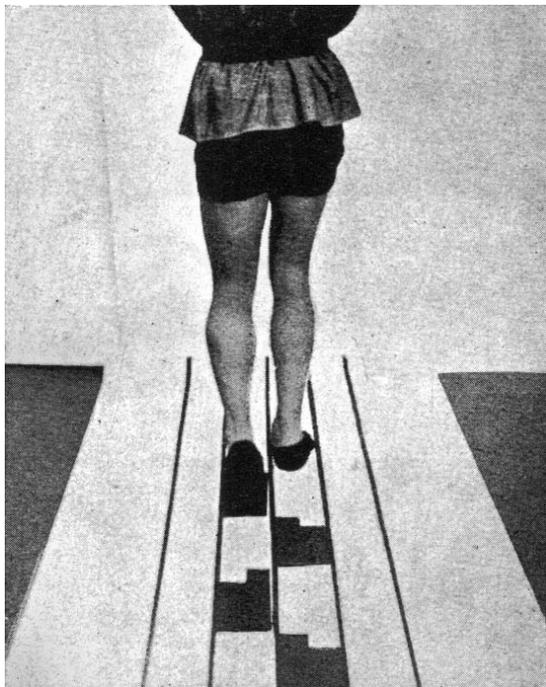


Figure 2.10

Walking a prototype notated floor, from Rudolf Laban, *Schrifttanz*, vol. 2.

a technology of performance as I have characterized it in this chapter, the medium being the movement of human bodies in an event.

Of course, in the past half century, and especially in the past twenty years, movement artists have begun to augment the moving body with electromechanical instruments, and to augment scenography and costume with computational media—video and sound. Notable examples include the work by the media group Riverbed (Paul Kaiser, Shelley Eshkar, Michael Girard) with Merce Cunningham’s *Biped*, and Robert Wechsler’s work with *Palindrome* in Germany.²³

Let us turn to the computational present.

Computational Media: Sound and Video

Furnished with these examples, we can think of notation as a part of a *technical ensemble*—to use Simondon’s well-developed framework²⁴—for modulating kinesics, sound, and structures of sound in a musical event. In this context, the technical ensemble comprises *technical objects*—musical instruments, figures of musical notation—and *technical individuals*—trained musicians. The composer, the technical objects, and tech-

nical individuals are *informed* by the score. Simondon's notion of informing is a profound amalgam of theoretical knowledge, corporeal performance practice, and matter flow. *Notation* suggests both retentively and protentively how memory and anticipation shape the musician to her sounding instrument, and vice versa. One of Simondon's large challenges to prepare for a technologically informed humanism was to invent what I would call modes of articulation interrelating the evolution of humans and machines. *Musical notation* serves as one of the richest examples of such intercalating modes in the contemporary age of computationally mediated sound and musical performance.

Computational techniques for recording, processing, and synthesizing sound make it possible for musicians to vary from analog concepts of record and playback, and put in play such categories as score, performer, spectator, sound, composer, instrument. What the computational adds to the paper-based machines of musical notation are the prolongation of gesture, pluralizing of agency, blending of instrument design with composition, and blending of composition with performing, via making code. Decisions may be deferred in any number of ways, by simple delays, by Boolean logics that depend on contingent conditions to be triggered, by parameterizing the resynthesis of sound depending on continuously changing conditions during the event, by calling on random processes, and so forth. Even in the case of appealing to chance operations, the computer can help flexibly and even programmatically control the degree and timbre of indeterminacy.²⁵

Prolongation of gesture means deferring action by computer-controlled electromechanical means, using for example the mechanisms of indirecting or deferring action by: (1) Boolean IF <conditions> THEN do <action>; (2) table look-ups (tax tables, MIDI, scales); and (3) computable functions (compare figuring out the taxes you owe by looking it up in a table with precomputed values versus using a formula).

One lens through which we can view this is the transmutation from the role of notation as (part of) a machine for modulating sound to the ways that score, script, and code coarticulate practices in the technical ensemble that produces computational organized sound (see figure 2.11).

The impetus in the mid-twentieth century toward "preparing" conventional instruments in European art music has extended in the present epoch of computational software-hardware to electromechanical instruments that are so continually reprogrammed as to be essentially unique for each performance. On one hand this extends the compositional control into the very capacities of the instruments, but on the other it severely limits the capacity of the human performer to develop what would constitute musical virtuosity in pre-electronic instruments whose playing characteristics did not change appreciably over the period of an individual musician's career.

So, in place of the musical score that intercalates the composer's actions with the performer's, we have at least three significant intercalating semiotic systems: the score, the code written by a software programmer-engineer to activate the electronic instrument,

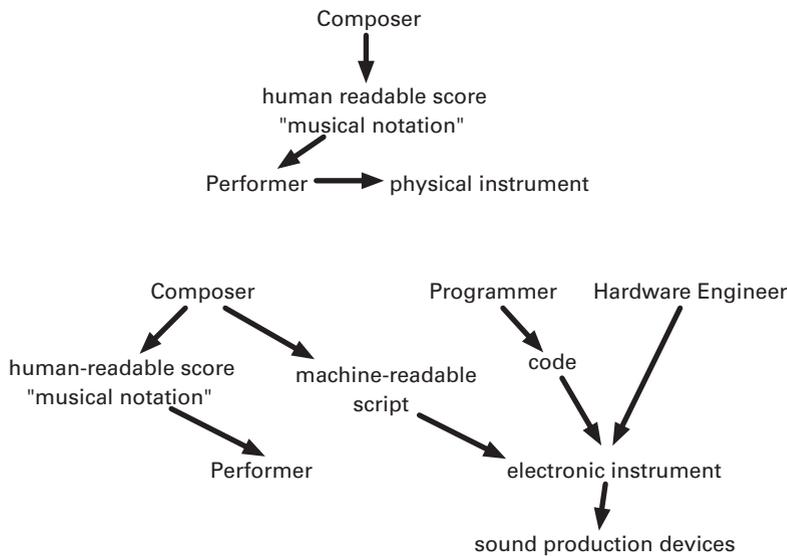


Figure 2.11
Coordinating relations among musical agents.

and the machine-readable script written by a composer to parameterize the execution of the electronic instrument, which may also be manipulated by a live performer in the musical event.

This multiplication of types of notation serving to mediate human as well as machine processes calls for a more careful look at how these semiotic systems work, before we continue our reorientation away from what Karen Barad calls *representationalism* to the *performative*. The other reorientation that I will suggest later in this chapter, and in chapter 3, is from *instruments* (and other objects of musical production) to *medium*.

Theoretical Interlude: The Problem with Representationalism

Why did Laban's and his collaborators' thirty years of titanic effort not yield a more universal language for movement and dance, a written form in which choreographic art could develop? Certainly historically profound changes in the diffusion of new movement forms, new performing arts industries, new mass media industries displacing live arts, new recording technologies, the diversity of ways in which performers learned to dance and transmit dance, and so forth all played a role in making it practically impossible to induce a universal written notation for movement and dance. But perhaps also there is the intricate fusion of body, movement, and thought that is only now being split apart and infiltrated by computational technologies, along with the mercurial evolution of ever-changing, ever-unfolding practice that escapes every time-

invariant system of representation. In this last respect, notating dance is no more and no less impossible than fixing the written representation of all human speech practices. This points to much deeper problems with any sort of representation, whether of movement or of other living or social activity. For this we draw summarily from Wittgenstein's *Philosophical Investigations*.

Wittgenstein against Positivist Representationalist Notions of Language

What does musical notation represent? Nothing in itself, the late Wittgenstein would say.

The basic claim is that a time-invariant system of representation cannot be formally specified and adequate to any living phenomenon of languaging. By a series of carefully, devilishly constructed examples in the *Philosophical Investigations*, Wittgenstein exploded whole genres of theories of language and meaning, including those based on correspondence, rule, formal or axiomatic method, and prototype. This is not the place to rehearse the critiques of representation and representationalism that have occupied modernist art and philosophy for at least a century. But for efficiency, rather than endlessly debate what one might call, after Wittgenstein, “ungrammatical questions” let me just summarize a few useful observations from his interrogation of how we think about language and representation.

The first of these is that correspondence is a poor anchor for meaning. One common way to define a term, one might think, is to point to it. But not every referent can be the target of such action. Wittgenstein gives an apparently Carrollian example, with a serious consequence:

I say “There is a chair.” What if I go up to it, meaning to fetch it, and it suddenly disappears from sight?—“So it wasn’t a chair, but some kind of illusion.”—But in a few moments we see it again and are able to touch it and so on.—“So the chair was there after all and its disappearance was some kind of illusion.”—But suppose that after a time it disappears again—or seems to disappear. What are we to say now? Have you rules ready for such cases—rules saying whether one may use the word “chair” to include this kind of thing? But do we miss them when we use the word “chair”; and are we to say that we do not really attach any meaning to this word, because we are not equipped with rules for every possible application of it?²⁶

One might say that meaning can be assigned by some rule. But there are many problems with this hypothesis. Even the apparently simple task of teaching someone to write down a series of numbers by mimicry is not unambiguous. A pupil can be tested to interpret a rule as the teacher would for, say, the first 1,000 integers, then interpret it differently beyond 1,000, yet come up with a rule that agrees with the teacher’s interpretation for integers below 1,000.

No course of action could be determined by a rule, because every course of action can be made out to accord with the rule. . . . If everything can be made out to accord with the rule, then it can also be made out to conflict with it. And so there would be neither accord nor conflict here.²⁷

One might argue that rules describe an ideal situation and perfect form of imperfect practice. But we could take the practical response of the ontological principle, that we start from what there is, not from ideal types:

[I]n philosophy we often compare the use of words with games and calculi which have fixed rules, but cannot say that someone who is using language must be playing such a game.—But if you say that our languages only approximate to such calculi you are standing on the very brink of a misunderstanding. For then it may look as if what we were talking about were an ideal language. As if our logic were, so to speak, a logic for a vacuum.—Whereas logic does not treat of language—or of thought—in the sense in which a natural science treats of a natural phenomenon, and the most that can be said is that we construct ideal languages. But here the word “ideal” is liable to mislead, for it sounds as if these languages were better, more perfect, than our everyday language; and as if it took the logician to shew people at last what a proper sentence looked like.²⁸

The key point is that the *interpretation* of rules is conventional.

Is what we call “obeying a rule” something that it would be possible for only one man to do, and to do only once in his life?—This is of course a note on the grammar of the expression “to obey a rule.” It is not possible that there should have been only one occasion on which someone obeyed a rule. It is not possible that there should have been only one occasion on which a report was made, an order given or understood; and so on.—To obey a rule, to make a report, to give an order, to play a game of chess, are customs (uses, institutions).²⁹

Another family of methodological problems goes under several names, such as *reification error* or Whitehead’s *fallacy of misplaced concreteness*. Just because your theory has a name for something does not mean that something exists as a coherent thing or concept, not to speak of coherence or adequacy for your theory.

There are no absolute “primitives.” Wittgenstein’s famous example for this is the sole colored diagram in the book (see figure 2.12). And so for instance the sentence “RRBGGGRWW” describes an arrangement of this sort:

Here the sentence is a complex of names, to which corresponds a complex of elements. The primary elements are the coloured squares. “But are these simple?”—I do not know what else you would have me call “the simples,” what would be more natural in this language-game.

But under other circumstances I should call a monochrome square “composite,” consisting perhaps of two rectangles, or of the elements colour and shape. But the concept of complexity might also be so extended that a smaller area was said to be ‘composed’ of a greater area and another one subtracted from it. Compare the ‘composition of forces’, the ‘division’ of a line by a point outside it; these expressions shew that we are sometimes even inclined to conceive the smaller as the result of a composition of greater parts, and the greater as the result of a division of the smaller. But I do not know whether to say that the figure described by our sentence consists of four or of nine elements! Well, does the sentence consist of four letters or of nine?—And which are its elements, the types of letter, or the letters? Does it matter which we say, so long as we avoid misunderstandings in any particular case?³⁰

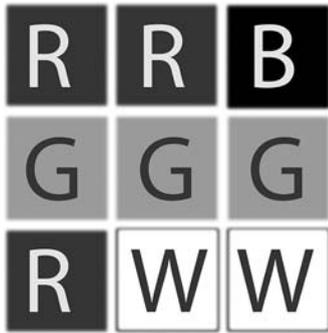


Figure 2.12

Diagram by author of colored squares (R = red, B = black, G = green, W = white), based on Wittgenstein, *Philosophical Investigations*, §48.

This raises questions about Genette's claims to the objective existence of stock phrases and building blocks for improvisation.

Perhaps the most fundamental contribution of the *Philosophical Investigations* is to deflate the positivist project of looking for meaning encoded in a sign (raising insuperable problems of taxonomy, context, and interpretation), and looking instead to how people language with one another in practice.³¹ In brief, meaning comes from use.

Valle recognizes linguistic and nonlinguistic conceptions of notation, in which the linguistic frame, characterized at a most fundamental level, is the unidimensional sequencing of phonological units.³² Text, regarded as a transcription of speech, inherits such a syntactic structure, but it need not do so.³³

Many dance notations use linguistic models, even though dance is far from amenable to a reduction to a unidimensional continuous index (like clock time). Rudolf Laban rejected the necessity of aligning dance with music, with verbal linguistic pattern, and in fact with any reduction to a unidimensional structure. Yet the dance scores published in *Schrifttanz* are all indexed to musical lines.

For more than a decade, computers gathering dozens and hundreds of sensor channels have been generating "motion capture" data as humanly unreadable scripts of movement.³⁴ It is only more recently that performers have begun to use the same data-collecting apparatus but map the sensor data through to sound in real time so it can be modulated in concert with the movement of the performer. This transmutes the technology to a technology of performance.³⁵

After this detour into the inadequacy of approaching notation as a technology of representation, can we seek certainty by appealing instead to the musical object in itself?

R

A Classical Positivist View: The Art Object

Objects

For Gérard Genette, in his *Work of Art: Immanence and Transcendence*, improvisations or executions of music and dance steps are acts, and thus facts, where a fact is a property of the world, about which one can make a statement with truth value, true or false.³⁶ For him there are two kinds of art objects (of immanence): (1) “real” factual objects, and (2) eventual objects, performances.

A performance is a physical event, and as such is a unique autographic object. Recordings make multiples of an autographic art object (an “object-multiple”), whereas *iteration* (as in a run of a show on Broadway) yields a “plural” autographic art object.³⁷ Following Nelson Goodman, Genette spends a fair amount of effort classifying and distinguishing various types of “autographic” and “allographic” art objects, using the test of counterfeitability. An allographic object is one that cannot be forged, as is the case when a copy with identical artistic effect can easily be made. He also devotes considerable effort to the status of the multiple, but from the perspective of performance all such questions miss the point, which is the *durational* (appealing to Bergson) *experience* of the event. Indeed, in chapter 5 of his book, Genette turns his attention to performances in order to subsume them also as stable objects as well.

Having posed factual and eventual objects of immanence, Genette claims that there are stable building blocks, and presumably therefore stable objects. Regarding building blocks in the setting of performance, Genette claims, setting aside free jazz as “unconvincing,” that even improvisation uses stock phrases, formulas, to render performance “more facile” for musicians as well as audience.³⁸ In other words, he claims that there are primitives in the ontology of jazz music. In what manner is free jazz unconvincing, as music or as freeness? In any case, Genette’s claim immediately falls under Wittgenstein’s challenge to the coherence of the notion of the analytic primitive.

Genette claims, further, that (1) every improvisation is simultaneously created and interpreted; and (2) a “text” emerges from every performance. As evidence, he claims that any performance can in principle be written out by anyone with “competence”—much less than the competence needed for performing a text—in the “notation proper to the art in question.”³⁹ A professional jazz musician will write out his prerehearsed written solo, note for note. Genette observes that any “competent” musician can score a performance of Charlie Parker, note for note. Although conventional musical scores cannot record the muscular motion, embouchure, etc. that Parker used, nonetheless another trained performer can imitate his style, and with practice can record as adequate a “cover,” a reproduction, of a Charlie Parker song as required.

However, it would be naive to believe that a score could possibly encode every macroscopic aspect of a performance, a fact borne out by the great effort almost any child must expend to learn how to sight-read European art musical notation. Further-

more, transcription competence could itself arise from a dispersed and largely tacit field of performance practices in which there are no stable music objects.

Again, it helps to look at recent (twentieth-century) Arab musical practices as documented by Issam El-Mallah in his monograph *Arab Music and Musical Notation*. In Arab practice, there is no standard tonal system, because such systems vary by region and by musical “philosophy.”⁴⁰ In fact, the instruments are tuned at each performance to the singer’s condition at the moment, not to a universal scale.⁴¹

The melodic scores that have been evolving in the latter part of the twentieth century, borrowing from European notational systems and under the impact of recording technologies that supported the development of a whole new economy of industrially produced and marketed commercial music as well as heritage recordings, record only the skeleton of the melody. But several severe artifactual problems have arisen with this introduction of notation, beyond the by-now-obvious political, economic, and social effects.

One problem is that the very act of scoring some songs imposes a selection effect: while in practice there are no definitive versions of a given song, by scoring one version, the one that happens to be performed for the notator, one version *becomes* definitive. Secondly, what is notated is merely the skeleton, and omits all fine structure of the melody because of the variety and “microtonal” pattern of Arabic tonal systems that have no representation in the relatively coarse Pythagorean system codified in European art music. For example, Arabic tonal scales include 17 and 24 steps, not all of which are equal. And thirdly, the very notion of ornament as superfluous is inconsistent with a musical practice which makes no such distinction. As El-Mallah writes: “For the Arab artist, ornamentation does not represent an addition or a dispensable and replaceable element of his art. It is *the material itself*, out of which the artist creates *infinite forms*” (emphasis added).⁴² Moreover, the nature of the ornamentation is that it does not consist only of substitutions into a prescribed region of a form (an algebraic syntax). It is in fact variable in an endlessly variable way: even given a repeated form, the performers can vary in any segment, and a given nuance can vary *through a continuous range*. El-Mallah cites an early musicologist, R. G. Kieswetter: “The Arab singer’s character aims to ornament a melody with numerous neighboring tones.”⁴³ We will return to this notion of “the material itself” in continuous (and therefore infinite) variation when we turn to substrate in chapter 4.

In traditional Arabic musical practice, a *note* is not defined as an absolute frequency but by the manner in which it is produced on an *ud*,⁴⁴ the lutelike principal instrument of Arabic music, which in turn is tuned to the condition of the singer at each particular performance. As this music is a primarily vocal art, its instruments model the human voice, analogous to the practice of bowed stringed instruments like the Eastern European *gusle* or the Chinese 二胡 *erhu*. So the *note* is not defined as in European musical convention, by its position on the musical staff paper with an “absolute”

nominal frequency. We can interpret this as a radical illustration of Wittgenstein's observation that the musical (which is *not* the same as the literary or cognitive) "meaning" comes only through use. This seems surprising only before we who have been disciplined under what Brian Rotman would call the alphabetic regime have been infected/cured by exposure to the *Philosophical Investigations*. In a passage characteristic of his argument against the coherence of definitions and rules, Wittgenstein writes:

When one shews someone the king in chess and says: "This is the king," this does not tell him the use of this piece—unless he already knows the rules of the game up to this last point: the shape of the king. You could imagine his having learnt the rules of the game without ever having been shewn an actual piece. The shape of the chessman corresponds here to the sound or shape of a word.

Consider this further case: I am explaining chess to someone; and I begin by pointing to a chessman and saying: "This is the king; it can move like this . . . and so on."—In this case we shall say: the words "This is the king" (or "This is called the 'king'") are a definition only if the learner already 'knows what a piece in a game is'. That is, if he has already played other games, or has watched other people playing 'and understood'—and similar things. Further, only under these conditions will he be able to ask relevantly in the course of learning the game: "What do you call this?"—that is, this piece in a game.

We may say: only someone who already knows how to do something with it can significantly ask a name.⁴⁵

The point is that the meaning or significance of a piece only comes about through its use. Rules and definitions come after.

Moreover, rhythm is barely represented. This is not for lack of rich theorizations and highly subtle reflections on rhythm over a thousand years of performance practice. El-Mallah argues that this is due in large measure to the fact that rhythms and melodies coarticulate one another. For that reason, a percussionist or any member of the audience can join in beating or clapping in tandem with whatever is being sung without being told in advance what rhythm to produce. In fact, there are even aspects of the rhythm that cannot be deduced from the acoustic data of a performance because it is interrelated with the way the bodies of the participants move during the course of the performance. El-Mallah observes that this is evident only from the video record.⁴⁶

Beats and rhythms are all named using syllabic sounds that have developed by convention over several centuries, using syllables that are reproducible in all the dialects of the Arabic countries. Rhythm operators such as subdivision are named by extending the syllable names by some other syllable. This very elaborate naming convention is more an algebraic assignment of a sonic signifier to some rhythmic practice than onomatopoeia.⁴⁷ But as Wittgenstein pointedly said, to name a thing—i.e., to associate a verbal or written sign with a thing—is not at all the same as using it or knowing how to use it. In this sense, naming rhythms and operations upon

rhythms bears analogy with mathematical notation and how it functions in deployment as *instantiations*, rather than representations, of mathematical objects and processes.

Texts

Genette insists that a “text” is an interpretation of rule.⁴⁸ However, he allows that the text may be created in the moment of the performance. He claims this is true even when the speaker Mirabeau exclaimed in the passion of his historic, unrehearsed speech on June 22, 1789: “We are here by the will of the people . . .”—in which case that extemporaneous exclamation was not the interpretation of a preexisting text. However, after-the-fact memorialization of an event does not imply the existence of a well-defined object coincident with the performance, except by convention. In principle, the difference is whether a “text” preexists or is created in the event, in the moment of the performance. Genette asserts that this difference is “irrelevant to the way we describe the mode of existence of the work of performance considered in and of itself, that is, without regard to whether it is pre-existent or not.”⁴⁹

Notation

Citing Goodman’s definition that “*notation is any unambiguous system for identifying an object,*” Genette exhibits the point of view of the critic or literary scholar, rather than the composer or performer. He cites Goodman’s claim that it is necessary that “identification of the or a [possibly unique] instance of a work be independent of the history of production; a notation as much codifies as creates such an independent criterion.”⁵⁰ This is a very useful way to interpret an event’s “text,” but if we more rigorously pursue the tactic of moving from nouns to verbs, we need not start with representations of any object, whether a song or a text, but with performances instead.

Objects, Again

An allographic art object can have both immanent and ideal manifestations. Genette gives a particularly enlightening example: a particular copy of a novella can have 200,000 words and be 400 pages long, whereas the ideal text also has 200,000 words but is no pages long. Genette diagrams this general scheme in all modes of art, including musical performance, in which case the scheme takes the form shown in figure 2.13.⁵¹



Figure 2.13

G rard Genette, musical text, performance, score. Diagram by author.

But as the extensive counterexample of nine centuries of Arabic music indicates, this is by no means a necessary ontology. El-Mallah devotes an entire chapter of his monograph to explaining why this music has no written notation. We can turn that around and use that fact to learn something about the relation between musical performance and its technologies. El-Mallah summarizes Arabic musical practice as:

- (1) an “oral” cultural practice;
- (2) collectively performed—all people corporeally participate in the construction of the musical event. A performer plays a large or even identifying role in coconstructing a musical work together with the composer and noninstrumentalist participants; and
- (3) *improvisatory*—“Arabic music is about *variability, not variation*” (emphasis added).⁵²

From Object to Deep Structure of Objects

Beyond the putative eternal object (using Whitehead’s terminology), what Genette calls the “immanent” “text” of a performance, one could also claim that there is a deep structure invariant beneath all particular texts and performances. Valle cites Reginald Smith Brindle:

It can be said that where notation is used, the general norm is the free twelve-note language, while where notation is not used (in graphic scores, for example) still at some point the score has to be realized in sound, either by improvisation or in the player’s own performing version, and again the free twelve tone idiom would almost certainly be employed—unless the composer specified other means, which is extremely rare. . . . [So even with the graphic innovations of the 1960s and 1970s] “the situation has been much more static than at first seems apparent,” because “the basic language—free twelve-note music has remained the same. . . . [I]f that which counts is only a phenomenologically accurate transcription of the time development of sounds . . . , modern musical notation in use from 1600 is demonstrated to be a perfectly functional instrument even for improvised music.”⁵³

Although Smith Brindle’s observation may be true of European art music, this is false in general. It is certainly not the case for Arabic music since the ninth century, considering diachronic evolution of the 17- and 24-interval tonal systems and the synchronic variation of idiosyncratic tunings from region to region. Indeed, Valle allows for this, admitting a possible ethnocentrism in such a claim.⁵⁴

So, retreating from this stronger claim about deep structure, what about Genette’s weaker claims about the ontological if not chronological priority of an object, a “text”?

Toward a Nonclassical Theory of Performance: Partial Objects and Partial Actions

A fundamental problem with Genette’s “objects of immanence,” “real,” factual, or eventual, is that he makes an a priori distinction, weighted toward a plastic object, as

against performed, temporal process. He subscribes exactly to what Simondon identified as the ontological reversal of prioritizing the individual object over the process by which it comes to be.⁵⁵ But instead of trying so hard to turn a performative event into a synchronic “text,” why not focus on the instructions to the maker for use in the making? We will be shifting our focus from objects like a text or a musical work to the performer’s performances and improvisations.

Think of the historical Arabic characterization of a note (pitch) in terms of how it is fingered on an *ud*. The instrument in turn is tuned not to an absolute frequency, but to the regional conventions and the singer’s condition at the moment. Moreover, it is by no means necessary to accept such a universal claim as the existence of a “musical text” immanent to every instance of a performance. As Antonin Artaud wrote, “Instead of continuing to rely upon texts considered definitive and sacred, it is essential to put an end to the subjugation of the theater to the text, and to recover the notion of a kind of unique language halfway between gesture and thought. This language cannot be defined except by its possibilities for dynamic expression in space as opposed to the expressive possibilities of spoken dialogue.”⁵⁶

Against Genette’s claim that text is interpretation of rule,⁵⁷ we have Wittgenstein’s trenchant skepticism and El-Mallah’s histories of Arabic musical practice. El-Mallah reports two stories. The first is the example of an “informant,” a local Arabic musician, hired by an ethnomusicologist to “write” down a song central to his community. The informant comes back several times for more money, till at last it is revealed that he was making it up. The point of course is that the musician could not have done otherwise. The other example is the story of a prince who wanted a particular song from a neighboring court, and sent a spy to steal this song by committing it to memory. The spy was repeatedly frustrated because every time he returned with a different song. The point is that every time the song was performed it changed in substantive ways: *there was nothing like a canonical version with variants*.

Genette’s assertion that the difference between a text preexisting or coconstructed in an event of the performance “is irrelevant to the way we describe the mode of existence of the work of performance considered in and of itself” is tautological. Moreover, this ignores the fundamental aspect of performance as event rather than as text. And it is not surprising that Genette, a literary theorist, seeks to reify “the text” so insistently against performance; following Walter Ong, this is in fact a hallmark of literate culture.

And finally, the perspectives maintained by Genette and Valle are the perspectives of the spectator or the composer, but not the “first-person” experience of the performer. Genette accepts the theatrical convention, the same irreducible dual that Jerzy Grotowski insists on: an actor and a spectator. But whereas they insist on a classical distinction between these as two distinct, fleshy bodies, I mobilize these as dispositions that can be taken on by any body, even by one and the same body.

Musical Notation as a Semiotic System for Performance

Valle sees notation as an essentially temporal semiotic system:

Notation reflects constitutively a temporal instant, an aspect of transition of time from an initial situation to a successive one, in which it is necessary to conserve something which precedes it. In that way, the concept of notation centers on a characteristic of mediation, the transitoriness between states, connections between elements. . . .

A note is a special sort of sign. Every note is an “act of notating.”⁵⁸

Yes, but by symmetrizing one’s temporal perspective, not from t to $-t$ but from Dt to $-Dt$ —or more vaguely but less reductively, the directionality, or temporality, of action—every notation is also a *performative act*. In other words, the act of notating that the composer makes, to use Valle’s term, could be fruitfully regarded as a *partial action* (to détourne Lacan and Serres) that is complemented by the corporeal action of the performer and perceiver in the production of sound of a musical event.

Using Peirce’s semiotic framework, Valle remarks that notation exhibits an obvious “secondness,” a distance or difference from that which the notation effects. Moreover, it bears also a “thirdness.” For Valle,

Two elements constitute every notation: (1) The secondness of a procedural simile as a difference in space and time (that is, in the necessarily heterogeneous constitution of the note with respect to that which is notated) [and] (2) the note’s thirdness, . . . which mediates between two instants: [he] who notes and that which the notation effects.⁵⁹

However, in so distinguishing these semiotic agents, Valle obscures the instrumentalist-performer.

A Notation’s Expressive Power

A notational system’s expressive power, as I suggested earlier in this chapter, depends on factors including syntactic density, resolution, range, completeness, degree of nuance, poetic potential for connotation over denotation. No notational system can completely and precisely describe or prescribe every nuance, and the mechanical means merely exponentiate the complexity of the problem. Therefore, as a practical matter, one can proceed with an eye to the minimal notational systems that adequately scaffold coarticulation in the technical ensemble linking composers, instruments, instrumentalists, and all the participants and media in the event.

Moving to the macroscopic social and historical scales, Valle reminds us that evolutions of notation reflect changes in performance practice, but their histories are not congruent.⁶⁰ Valle quotes an essay on the history of musical notation: “only a fundamental break with established musical aesthetics and philosophies can bring about a commensurate notational change, and such profound upheavals have been extremely rare.”⁶¹ He identifies three great semiographic shifts: (1) the passage from monody to

polyphony in the ninth century with the adoption of diastemazia and mensura (measures, bars); (2) the shift from horizontal polyphony to the predominance of harmony, which sees the substitution of unique parts; and lastly (3) in the mid-twentieth century, the unprecedented augmentation both of precision and of aesthetic ambiguity.⁶²

Valle makes a most significant observation: “the employment of very short duration values which indicate in all probability a mode of execution similar to the speaking voice reflected the rhythmic innovations of performers during the Ars Nova.”⁶³ The converse to Valle’s point, that notational innovation can drive changes in performance practice, is true as well. We see this especially clearly in twentieth-century European art music in many instances. For his vocal-instrumental piece *Ancient Voices of Children*,⁶⁴ George Crumb used a custom notation in the opening movement asking the soprano (the piece was written for Jan DeGaetani, a virtuosic and experimentally adventurous singer) to sing sequences of notes of (continuously) progressively shorter and then longer duration (figure 2.14). Twentieth-century composers invented ever more radical notational neologisms for performers to enact, sometimes far beyond their abilities to reproducibly, let alone “expressively,” produce a sound. In fact, it’s useful to regard Cage’s *Fontana Mix*⁶⁵ as an analog computer with a graphical interface. His instructions are high-level “code” interpreted by human performers.

At an appropriate scale of historical time, one can see the intercalation of innovations by performers and writers (composers and notators). One can see an analogous intercalation of innovations among Arab performers, composers, and “notators” from the 1940s, when European art musical notation was adapted to represent Arab music—first by ethnomusicologists (echoing European colonial and postcolonial anthropology) and then in the complicated social dynamics of accommodation, in which musical notation was interpolated along with studio recording-based production and

The image shows a musical score for George Crumb's *Ancient Voices of Children*. It features three staves: Soprano (Sopr.), Mandolin (metal piece), and Harp. The Soprano part includes the lyrics "sal-ten las fuentes al-re-de-dor!" and a performance instruction "(exuberant!)". The Mandolin and Harp parts include dynamic markings such as *fff*, *mf*, *mp*, and *rit. - - - molto - - -*. The notation is highly detailed, with various rhythmic values and articulation marks.

Figure 2.14

George Crumb, *Ancient Voices of Children*, score.

radio diffusion economies alongside traditional nonpublic, nonmarket practices of music making.

As Valle described twentieth-century musical notation in European art music, musical notation both undercodes and overcodes musical performance. This is not only true for twentieth-century composers' practice vis-à-vis instrumentalists in the West, but is true in general of any notational scheme. For example, in his account of how Arab musicians' orally transmitted practices adapted in the twentieth century to European notational schemes, El-Mallah notes in detail how European notation radically underspecifies the tonal structure, the relation between rhythm and syllabification of the Arab languages, rhythmic complexities, the *continuous* variability of the practice, and most of all the radical contingency of the orally transmitted and community-performed Arab music. To underline a point worth reiterating, because it can be said of all live musical performance, Arabic musical performance consists of continuous variability, not a permutation or substitution of one variation in place of another in a form that is fixed across all instances of performances of a song.

Computational Technology

As musicians have adopted electronic technologies and then computational techniques, new questions have emerged concerning proficiency, and rehearsal versus tinkering. With computational techniques, notation evolved not only in degree—temporal precision, tonal resolution, or fineness of instrumental manipulation—but in kind. Who or what interprets the notation in the course of production of the sound during a performance? As performance scores and scripts extend beyond the limits of what a fleshly musician can realize, and with the augmentation of the performing body, the locus of compositional invention has diffused into the design of electronic and now computational instruments. These questions are deeply related to whether the activity is about making experience for the spectator or for the self. We will take up the question of what *expressivity* means in this context later, as we draw out what serves in place of notation when we adjoin computational technologies to the production of organized sound and video.

Off-Line Model to Real-Time Modulation

In any case, the strengthening in degree and kind of operation sustained by exponential advances in computational technology has enabled a different object of computationally mediated activity. Mathematical models once only realizable as retrospective, “off-line” simulations of some physical phenomenon can now be used as instruments of “live performance.” And the present state of computational media technology is combining rich models with dense visual and sonic media. There is nothing except convention to prevent us from using such instruments for expressive applications.

Of course, the historical narrative of technology just sketched does not determine the actual, critical, and symbolic argument that I trace in the next sections of this chapter. It suggests the necessity but not sufficiency of the individuation of computational technology in the technological milieu of media arts and sciences, borrowing Gilbert Simondon's terminology for understanding the evolution of technology.

With the advent of electronic computation, representation in its particular form of the scientific model comes alive in the mode of numerical simulation and graphical visualization. The key question here is the status of the (computer) model, which is transformed by the increase in speed and the enrichment of the operators, enabling but not determining the transformation of attention from off-line computer software modeling to directly manipulating the material world.

In other words, with the increase in computing power as measured by arithmetic operations per unit time, memory capacity, and scientific expressive capacity of software programming languages and machine instruction sets over the past fifty years, what could only be presented as a synchronic or retrospective model can now, in certain domains, be presented as "real-time" computation that changes in tandem with living processes. This enables, but does not guarantee, a "performative turn" in the domain of computer music, witness for example musicians like Michel Waisvisz, Laetitia Sonami, Pamela Z, Joel Ryan, and Carl Stone.

What Is a Numerical Model or a Simulation?

For our purposes, a *model* is a set of numerical data structures and operations coded into a computer to represent some system or objects in the world. It is essentially a snapshot, synchronic. A *simulation* is a set of processes in the computer that represent some changes of state in the world. Simulations are essentially temporal, diachronic.

How is a mathematical, scientific, or computational model related to what the model is supposed to represent? For my purposes, a scientific model is some combination of physical objects, fictional objects, set-theoretic structures, descriptions, and equations representing portions or aspects of phenomena, data, or theory concerning nature. Models intercalate observers, phenomena, and theories and can sometimes be manipulated in regular ways. Some models, for example, in biology are discursive narratives, whereas mathematical models have parameters that can be matched to numeric empirical data. Such models may have algebraic or function-analytic structures that can be manipulated, given those parameters, to yield definite statements that can be compared with empirical observation. Despite what one might believe under the regime of digital computation, not all scientific models have such manipulable parametric structure. (Physicists like to call them the constants in a theory, such as the speed of light or the ratio between the electromagnetic force and gravity.) And of those models that do have an algebraic or analytic structure, some fraction

can be represented or approximated in a digital form, and therefore operated in a computer. This means that the model must at bottom be a numerical or a logical model, which covers a much smaller range of models than mathematical models in general, still less than scientific models (looking back through biology and astronomy for example).

Fifty years ago, finite-element models of structures such as the steel skeleton of a bridge could only be realized on a computer as a batch job, meaning that the engineer had to write out elaborate encoded, textual descriptions of a configuration, along with descriptions of forces, then submit the data and instructions on what to do with the data into a device that transferred these instructions into some electrical states in the machine, and then wait a considerable time (a “coffee hour”) for the results. This stop-and-go-and-wait necessarily divides the process of thinking about building a structure into a step-by-step process with large gaps (hours or even days) in between one configuration of thought and the next. However, when more powerful computers allowed the adjustment of tensions in tandem with the change in some segments of a proposed structure, the engineer could experimentally vary structures continuously, and reason with the structure in continuous variation. Continuous variation allows a qualitatively more flexible order of invention, and enables the exploration of a much larger design space.

Computer processor speed alone does not suffice to transform the nature of computationally augmented life. The type of operation must also be more *expressive* in the senses that I sketched above: resolution, range, syntactic density, completeness, nuance, connotative potential (poetry).

What makes the representation of finite elements in engineering building structures amenable to “real-time” manipulation by humans is the presentation of such information not as coded algebra but as visual depictions of the geometry, along with ways for the engineer to insert, tug on, and vary the “physical” elements of a structure, with the computer visually presenting the stresses that it computes using its encoded models of numerical physics.⁶⁶

Graphics and Sound Editing Software as Technologies of Representation

Another, more everyday class of software is the genre of image and moving-image editing applications. Consider the difference between editing digital and Foley sound effects into a film or video that is perceived later by an observer who cannot intervene in the sound as you make it when you speak. Analogously, consider the difference between creating visible effects in a film to be viewed later by a spectator who cannot intervene in the playback of the visual imagery and the play of the visual features your face makes as you talk. Examples of the software typically used as technologies of representation rather than as instruments in live performance include Photoshop, Premiere, Final Cut, and After Effects.

Again, for the purposes of this book, we are not concerned with the synchronic representation of media but with how it is created, synthesized, or modulated “a tempo,” in real time.

Real-Time Video and Sound Instruments as Technologies of Performance

Examples of software technologies of performance include VJ (video jockey) software, Ableton Live, and Max/MSP/Jitter, presently the lingua franca of live-media artists. This class of applications characteristically presents images and sounds without exposing what computational or mathematical models may be used to create or manage them. Unlike the class of software used to manipulate models, this class allows the user to manipulate bits of image and signal. What one loses in structure, one gains in sensorial density. For example, one could represent the physics of a clamped plate as a solution to a biharmonic partial differential equation on a simplicial complex approximating a physical shape, then “excite” the physical model by presenting some simulated stimulus (or an input from some sensor attached to some physical controller). That would require a complicated software acoustical simulation that would have to be carefully optimized for particular hardware. Or one could bang on the physical object with that shape, and record the resulting sound via a microphone. The software representation in the former case is a very complex set of models and algorithms simulating processes in those models. The software representation in the latter case contains no such model of the physical object but is merely a file with a stream of numbers representing amplitudes as a function of time, an “audio” file.

Such software, especially if it includes compression-decompression algorithms, may contain some sophisticated algorithms, but the algorithms are semantically shallow in that they do not model humanly legible descriptions of a physical object, system, or situation. Nothing in that audio data representation codes humanly legible sonic semantics such as key, time signature, instrumentation, or the name of the composer or the form of the piece. The AI literature used to call such data-centered rather than model-centered representations “opaque.”

The set of softwares for modulating sound and video in real-time performance bifurcates into those that are shrink-wrapped as “applications” whose logic or mode of behavior is encapsulated into a few commands (e.g., Ableton Live), and those whose logic is always editable (e.g., Max/MSP/Jitter or any “programming environment” with access to media data). The latter class permits (or forces, depending on your point of view) the performer to also be an instrument maker. Whether you think this extends or inhibits the performer’s musical expression, in practice what we witness, in the present era of computational programming environments for processing time-based media for performance, is the performers’ incessant tinkering with the “instruments” that they play.

There is another, equally powerful consequence of Moore's Law—and that is the enormous decrease in size and cost of the devices, the equipment needed to produce these media effects. The history of such media centers, especially in the domain of electronic music, parallels interestingly the rise and decline of high-energy physics labs. Whereas in the 1970s, supporting works by Nono and Stockhausen required a whole institution with labs, space, and dozens of specialist technicians, similar work can now technically be realized on a personal computer with some gear that can be purchased by an individual artist or even hobbyist.

Four Shifts of Perspective

The rest of this chapter intertwines four shifts of perspective:

- (S1) From composer and critic to performer;
- (S2) From tools of analysis to instruments of performance;
- (S3) From designing sound objects to designing controllers—devices manipulable as instruments;
- (S4) From designing instruments, to designing the dynamical, material, palpable qualities of the temporal medium itself, to manipulating stuff as instrumental media. An example is the motto “shaping sound like clay” that titles Achim Heidenreich's history of electronic music at the ZKM in Karlsruhe.⁶⁷ This last constitutes a shift from the perspective of instrument makers to that of makers of media, i.e., *alchemists*.

S1: From Composer or Critic to Performer

Refocusing on the performer has been accompanied by a surge in gesture-based “interaction” and “controllers” and sensor engineering. But as Yves Abrioux has noted, the fundamental conundrum of these engineered turns to the performative is that “meaning does not reduce to behavior.”⁶⁸

Genette consistently considers the point of view of the author or composer, not surprisingly given his home in literature. But the performing arts introduce a key difference, which is the role of the performer who intermediates the composer and audience, spectator, or reader.

S2: From Tools of Analysis to Instruments of Performance

Returning to computationally synthesized sound and video, we can shift attention from computer programs as tools of *analysis* or *representation* of “physical” sound or “physical” musical performers or “physical” instruments (as if there were some ontological priority to such things), to software applications that can be played *as instruments* rather than as models of the real. Take OMax as an example, which bundles learning algorithms like hidden Markov models (HMMs) built atop feature extractors into live-play instruments.

Although many of the learning algorithms used have been known for years, OMax represents a qualitative shift in how they are organized into instruments for real-time performance. The processing logic is both powerful and elegant, as succinctly presented by an image of loops of paper printed with strings of text (figure 2.16). The instrumental interface is nonetheless complicated (figure 2.17). Moreover, such interfaces are by no means restricted to a virtual panel on the screen. The basic problem with the WIMP interface is the assumption that there is only one point of interaction (the cursor). But in a musical control, there are often dozens of parameters functionally

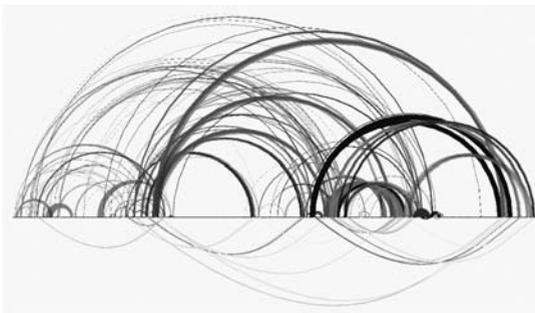


Figure 2.15
OMax Markov-model-based pattern recognizer. Arc diagram interface suturing intervals with similar features.

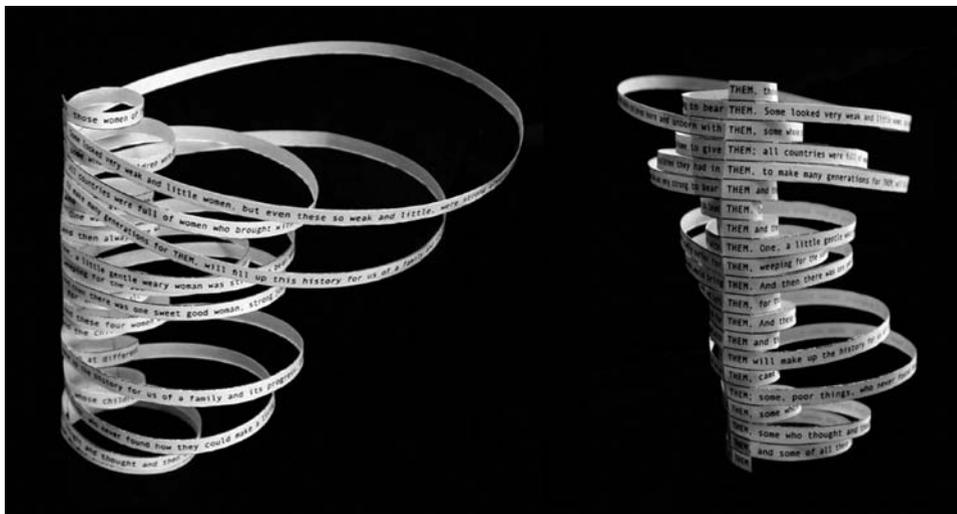


Figure 2.16
Analogy for OMax looping algorithm based on matching subsequences.

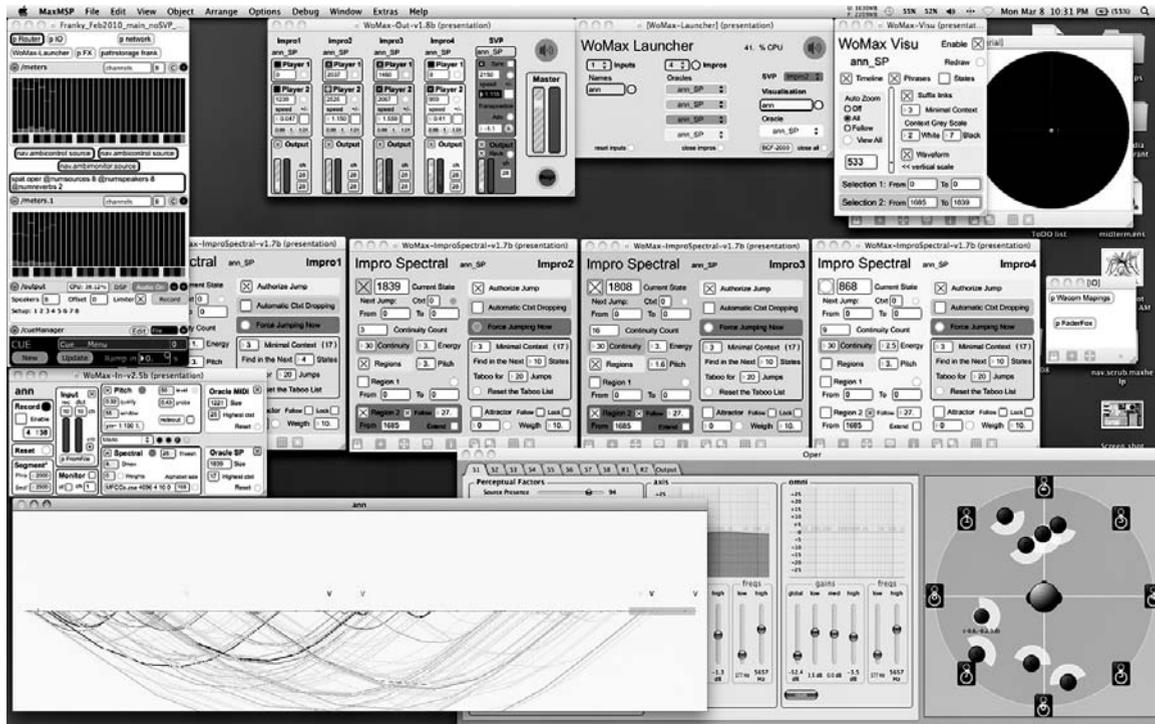


Figure 2.17
Navid Navab, OMax-based instrument, TML 2010.

mapped to hundreds of experientially meaningful parameters. Therefore performers use combinations of screen-based displays with physical hardware with many parallel inputs (hence the term “fader boxes”).

Our earlier three-way application of notation maps interestingly to this case. Notating the kinesis manipulation becomes coding and twiddling parameters on the software instrument. Notating sound becomes coding granular synthesis, FM synthesis, physical models, some SuperCollider processes. Notating structure becomes coding SuperCollider, or scripting in higher-level machine representation or languages: MIDI, LOOPS, Kyma, OMax, and so forth.

However, notice that these are still discrete inputs. Next, let’s consider a class of “instruments” whose inputs are *continuous fields*.

Example: Responsive Media Environments

A responsive media environment is a physical space in which people’s activity and time-based media (video, sound, active materials) influence each other and evolve in



Figure 2.18

External hardware controllers supplementing the window-keyboard-mouse software interface for live musical performance: faders and knobs, and pine cone plus microphone as an audio-rate sensor.

concert to create an event. The people may or may not be expert or have rehearsed in the space for the event. Contemporary techniques for sensing activity and coordinating or synthesizing the media draw on a large variety of sensors, including position or force sensors, photocells, air and contact microphones, and cameras. They can be placed on or inside the body, in air, or on the floor, walls, or objects (props). For our purposes, the important point is that all these sensors transduce physical, analog conditions into electrical signals that are then converted into numerical data. Along the way, effectively *continuous* matter in motion is transcribed into *noise* to be neglected and *signal* to be further processed. Sampling this signal at intervals further introduces artifacts of discretization. A lot of fundamental reduction has already been committed before the data even gets to the input to a real-time media programmer's software, coded in real-time media programming environments such as Max, PD, VVVV, or SuperCollider. A programming environment like Max/MSP/Jitter make idiomatic quite different logics than procedural languages like Java, Expressions, or C. Rather than thinking in terms of variables, iteration, loops, and cases, it's more idiomatic to think of streams of values, sound, or images pushing through a net of operators connected as if they were physical devices plugged together by physical cables. In fact, the programmer must unlearn Boolean "if-then" thinking in order to write idiomatically, more freely and expressively.

The major distinctions introduced by responsive software systems based on movement and gesture include the following:

- Notation bifurcates into media that humans can manipulate, and code for machines. Instruments, instead of being prefabricated, can be fabricated out of the responsive medium: sound + sensors + software + gesture + controller, practiced together as a reproducible "instrument" along with performance practices idiomatic to that instrument.

- A responsive environment supports the nuancing of any gesture to any degree of fineness (e.g., in a continuous gesture space, in a sense to be made rigorous in chapter 6). We evaluate a responsive environment according to the qualities we used to characterize expressivity: syntactic density, resolution, range, completeness, nuance, connotative potential. We leave open the question: For political, ethico-aesthetic experience, do the inhabitants need to shape the notation, or the conditions of an event, during or outside the event?

S3: From Designing Objects to Designing Instruments

The intricate history of electronic and now digital instruments exceeds the scope of this book. But as we stated earlier, with the introduction of electronic and computational technologies, the locus of compositional invention diffused into the design of new sensor- and software-mediated instruments.

Responsive-media environments allow people to play in concert with whole bodies in free space. Composers of the responsive environment can condition the possible events by introducing costumes, furniture, or other architectural constraints.

S4: From Designing Objects and Instruments to Designing Media: Alchemy

The TGarden contains already a general example of an apparatus sustaining cross-modal temporal media whose qualities can be composed to vary over the course of an event according to both the composer's imagination and the inhabitant's contingent play.

The analogy would be to shift the perspective from the making of a particular vase or its deployment in the interpretation of a particular script, to the shaping of the clay from which vases or many other ceramic objects can be shaped. Alchemical artistry would change, for example, how clay responds to and remembers touch as it is shaped on a wheel.

Example: Interstitial

We can see clearly this sort of alchemical design in the much simpler example of an exercise by three students in a movement + media workshop, called Interstitial.⁶⁹

A dancer-acrobat stands behind an elastic, translucent screen and presses his body into the elastic membrane. The elastic sheet constrains the free movement of bodies to a neighborhood of a two-dimensional surface. Although it is two-dimensional, the membrane is not a rigid plane; it continuously evolves, and palpably resists or augments movement by summing players' gesture with its own field of tensions. A transducer attached to the membrane transmits oscillations to sound feature extraction and synthesis software that modulates to accompany the movement. The real-time video instrument processes the live video of the infrared "shadow" of the dancer from the membrane, and processes the image into a silhouette that is reprojected back onto the membrane, illuminating, edging, and halooing the figure. Simple relays and feed-

back create video as structured lighting that produces a rich range from highlights on the body to coronas to doppelganger imprints.

In this example, a membrane constitutes a material, embodied, continuous mode of expressing corporeal entanglement. A “score” can in fact be projected onto the membrane not as a matrix of discrete icons or diagrammatic signs, but in the form of a continuous field of a continuously running video image. In fact, we can regard the processed video feedback from earlier videos of a dancer as in fact a “score” for the current dancer. The same membrane that images the score simultaneously serves as the dancer’s medium of articulation. This membrane is an extension of his tissue, and its oscillations instantaneously modulate the field of sound that saturates the space of the performance. With this example, we have traveled a long way from the realm of classical distinctions between composer and performer; sound, kinesics, and score; instrument and body; notation and body.

Example: Constellation

Returning to sound technology, Meyer Sound’s Constellation system uses the company’s most advanced speaker arrays, acoustic analyzers, acoustic models, and sound field synthesis algorithms and devices not to present a specific, spatial sound field

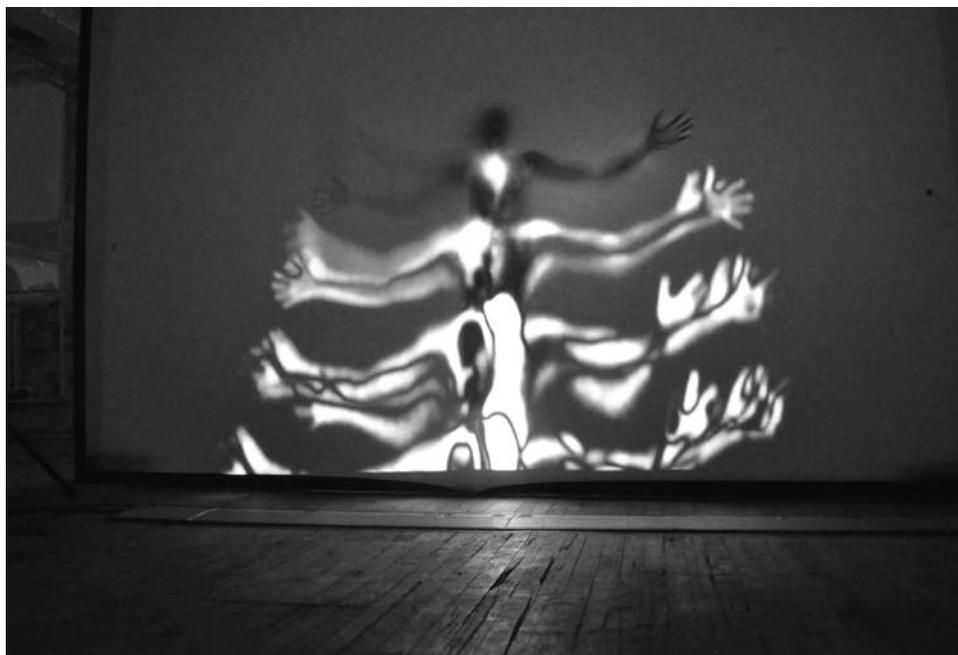


Figure 2.19

Navid Navab, Jérôme Delapierre, and Bruno Gagnon, interstitial sonic membrane experiment, 2008.

(e.g., a tableau of sound objects) but a set of *latent* acoustic responsivities characteristic of the acoustics of various architectural spaces, in the computational model. This is technoscientifically a most subtle and intricate accomplishment because the system must map the *response* of another physical space so that any sound (object)—a clap or a singing voice—can be preprocessed so that it appears to resound in that other space, with all its material features (volume, wooden walls, carpeting, glass windows, etc.).

The Larger Stakes: From Representationalism to Performativity

I have deliberately focused my attention on expressive performance in the sound and video media, in order to get some traction on the notions relevant to technologies of performance. But their significance extends beyond media art and entertainment.

Genette's factitive objects and musical texts are, in the end, fetishes, or at least, as Wittgenstein might put it, grammatical errors. Martin Heidegger, in his *Metaphysical Foundations of Logic*, criticized both the claim that there is an object at hand with every subject and the claim that a subject is at hand with every object, because the at-handness already entails a givenness that does not require the other entity.⁷⁰ Instead, we can think of the software/hardware systems assembled for responsive environments not as housing a prescribed sequence of sound or image objects, but as sets of *potential* performances. I will return to this in chapter 3.

Much social, political, epistemological contest comes down to the stabilization of objects, or who gets to stabilize these objects and under what conditions. (I will expand on this in chapters 4 and 5.) Graphic design, musical composition, film, and all the arts of object making do not necessarily grapple with this crisis. Why not? Perhaps, despite the best efforts of the artists, we tend to elevate the object itself over the process of its gestation or construction. Of course, we could acknowledge with Baudrillard that we live deep in an epoch in which objects have won over subjects, but this would be too simple a response after quantum mechanics forced physics to blend objects and subjects, the thing regarded with those who regard.

Latour, too, makes use of objects but in the sense of object of concern, calling upon us as social actors and social scientists to shift from being concerned with making matters of fact to making objects of shared concern. However, I think that reducing questions of ontology to "What objects make up the world?" confers upon objects a peculiar temporal invariance that effectively fetishizes them. Instead, my questions turn on how objects materially form in the world. I'll take up the question of ontogenesis in chapter 5.

If the crises of political and linguistic representation stymie us, can we sidestep these crises by sidestepping representation? Can we sidestep some of the rigidities imposed by discrete symbol systems and rules (abstract machine) and schemas by

playing in open continuous material that responds to our continuous action? After all, if human experience is thick, dynamic, and continuous, then let's play in material fields that are thick, dynamic, and continuous. By material fields I mean distributions of matter, energy, and affect, such as people in a collective space, the sound of their speech, the light incident on the space, or the sound in which they are immersed.

For more than a decade, the work of the Topological Media Lab has been motivated by these concerns. But we decided to take an experimental, ethico-aesthetic approach distinct from the direct approaches of political/cultural theory, critique, or activism.

Karen Barad succinctly motivates the turn from representationalism to performativity in her book *Meeting the Universe Halfway*:

Language has been granted too much power. The linguistic turn, the semiotic turn, the interpretative turn, the cultural turn: it seems that at every turn lately every "thing"—even materiality—is turned into a matter of language or some other form of cultural representation. The ubiquitous puns on "matter" do not, alas, mark a rethinking of the key concepts (materiality and signification) and the relationship between them. Rather, it seems to be symptomatic of the extent to which matters of "fact" (so to speak) have been replaced with matters of signification (no scare quotes here). Language matters. Discourse matters. Culture matters. There is an important sense in which the only thing that does not seem to matter anymore is matter. . . .

A performative understanding of discursive practices challenges the representationalist belief in the power of words to represent preexisting things. Unlike representationalism, which positions us above or outside the world we allegedly merely reflect on, a performative account insists on understanding thinking, observing, and theorizing as practices of engagement with, and as part of, the world in which we have our being.

Performativity, properly construed, is not an invitation to turn everything (including material bodies) into words; on the contrary, performativity is precisely a contestation of the excessive power granted to language to determine what is real. Hence, in ironic contrast to the misconception that would equate performativity with a form of linguistic monism that takes language to be the stuff of reality, performativity is actually a contestation of the unexamined habits of mind that grant language and other forms of representation more power in determining our ontologies than they deserve.⁷¹

I would extend Barad's characterization of performativity to include the dynamical change of the material state or configuration of the world. In other words, performativity is thoroughly attuned to the temporal. Since we are concerned with material change, we should attend to the technologies by which we effect such change, which in the present epoch is dominated directly or indirectly by computational technology. In this chapter, I have shifted attention from representational applications to live performance applications. I do not claim that a particular piece of software or a technique is either representational or performative, only that one can regard an application in representational or performative modes of use. Nor do I simply align the performative with the body and representational with the sign, since even a physical action can be carried out representing something other than the physical action.

Keeping Barad's characterization of performativity in play, we should also add its positive, generative aspects. After all, the significance of an action, or of any nameable object or process, becomes evident to the participants in an event in the course of action. Wittgenstein distinguishes between the descriptive definition of a chess piece and its use in playing a particular game—the description or the concept of an act versus the act.⁷²

Res Publica: Arena of Objects to Arena of Care

Ethico-aesthetics of Technologies of Performance: Play Spaces, Not Games

There is also an ethico-aesthetic question: In light of such an understanding of the performative, can we design technologies of performance that feel rich but not complicated? Yes, of course: consider the ordinary technologies of food and of cloth. The art collective Sponge built responsive play spaces based on fields of tangible media evolving according to folk physics that can shape and be shaped under folk knowledge. We have built play spaces in which people can individually and collectively improvise meaningful gesture. But people can construct things of joint concern by movement and gesture without first explicitly agreeing on a common working vocabulary or even a conversational protocol. In a responsive space like the TGarden, players escape the straitjacket of sequential discrete conversational speech acts. In a formal model of "explicit" communicative action, we deploy language to represent ourselves to our fellows, and we take turns making utterances. But in a TGarden, the air currents, shadows, pieces of words, fabric, or hair that one leaves in one's wake form the material conversations in a corona around explicit conversation. Ordinarily such detritus does not constitute matter of articulated concern, but this is where the technologies of calligraphic responsive media come into play. Thick media, computationally synthesized or not, provides a substrate in which bodies need not be so dogmatically identified: it can put into play where your body ends and where the world begins. (Consider the appeal of a salt bath at body temperature.) Sensors for movement and physical conditions, together with computational means to modulate media, provide a substrate whose quasi-physics may be artfully varied. Responsive visual or sonic or physical media driven by sensors map movement and gesture into dynamical textures that render the dynamical spaces between our bodies palpable, shareable, and infinitely open.

Although the TGarden was conceived as a play space in which participants could continuously invent gestures significant to themselves and others, there is a serious implication. Unlike in "serious games," there is no explicit rule or goal or didactic purpose to deaden the event. Such telos can generate games as deadly as what Peter Brook called Dead Theater.

In political process, it is the substrate lobbying, researching, writing, and caucusing processes—punctuated but not constituted by formal parliamentary procedures—in which individual and collective and political identities emerge. And offering the public a view (whether via Internet archives or via box seats in the physical assembly chambers) of the parliamentary debate does not make legible the more primordial process of emergence of political position and relation. Sheathing the Bundesrepublik building in Berlin with glass symbolically represents this faith in surface politics. So does the machinery of digitizing and making available on the Internet the texts of the bills passed in Congress.

In 2004, Peter Weibel and Bruno Latour curated an elaborate exhibition titled “Making Things Public: Atmospheres of Democracy” at the former’s institution, the Zentrum für Kunst und Medien. This hybrid between an art exhibition and an academic conference attempted to materialize Latour’s argument for a democracy oriented to things, by which they meant materially, socially constructed things. As Latour argued, the way to do that is to hybridize politically good representations that faithfully gather “the legitimate people around some issue” and are scientifically accurate—representing “what is the object of concern to the eyes and ears of those who have been assembled around it.” However strong and clear in concept, the exhibition seemed to carry a didactic air, the same didacticism that has limited science museum audiences in North America. Latour himself is sufficiently anthropological to suggest that not all cultures value the assembly of assemblies that he poses as a political ideal, naming in fact the Japanese, Chinese, and Papua New Guinea islanders as those to whom such political practice seems implausible or impractical. However, Latour insists on the position that, notwithstanding such skepticism, a “parliament of parliaments” is still a desirable political form.⁷³

However, a parliament is a political machine in which defined interests take on set positions and create set battles with procedures closer in spirit to the Euclidean formations of eighteenth-century military science than to nomadic warfare.

I do not say that stable, even rigid structures ought to be abolished! Indeed it is extremely useful to have refined, visible structures with respect to which we can perform tacitly informed, continuous and microtonal improvisations. What is more important is whether, how, and by whom the conditions of this improvisation can be modified.

So what about the primordial processes themselves, the dynamics of care prior to the formal conversation articulated in writing and verbal language? What about the processes prior to the formal events that in bureaucracies are more loci of ratification than of emergence? In chapter 4, we will see that a consequence of a plenist (versus atomist) approach to the world is the possibility for articulation of this primordial dynamics of care.

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