

Abstract: This article introduces the concept of real-time composition and composition as a “dispositif” in the sense of Foucault and Deleuze, defining it as a heterogeneous ensemble of pieces that together form an apparatus. The introduction situates the dispositif in the context of cultural developments, most notably its slow but steady shift away from textualization in digital media. As musicians are adapting to ensuing cultural and, above all, economic changes, new musical forms emerge that rely to a lesser degree on fully notated scores, such as “comprovisation” or laptop performance. Antithetically, the computer also allows the creation of “authorless” notated scores in real time to be sight-read by capable musicians—a practice for which special software has been developed in recent years. Because these scores are not meant to be kept and distributed, they are ephemeral and, therefore, disposable. Three examples by the author are given to illustrate the interwovenness of this approach, where carefully selected narratives and dramaturgies make up for the inherent unpredictability of the outcome.

... whereby it is a beautiful form, not to write
a thing down that ought to have a sound...
—Thomas Brasch

Introduction

In English, the phrase “disposable music” has a larger semantic scope than what the German translation *Wegwerfmusik* (“throw-away music”) would suggest, which is why I decided to consistently use only the English term in the original German article (Hajdu 2013) on which the current article is based. “Dispose” connotes not only “get rid of” but also “have ready for using.” The noun “disposition” implies the condition in which someone has an innate propensity for (“to be disposed to”) something, but also the arrangement of something, e.g., an apparatus. It is used as a cognate of the French word *dispositif*, introduced into research discourse by, among others, Jean-Louis Baudry and Michel Foucault, following Gilles Deleuze (1992): “a tangled, multilinear ensemble... composed of lines of different nature.” Film theorist Jean-Louis Baudry (1978) originally referred to the apparatus of the cinema. Foucault later expanded the notion and applied it to human institutions such as prisons with their particular power structure. In an interview entitled “The Confession of the Flesh,” he stated:

What I’m trying to pick out with this term is, firstly, a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions—in short, the said as much as the unsaid. Such are the elements of the apparatus. The apparatus itself is the system of relations that can be established between these elements (Foucault 1980, p. 194).

In this article I outline a new form of computer-assisted composition, in which the author, in the classical sense, recedes and his artifact, the score—dynamically generated from algorithms—exists only in the moment of its creation. I will now undertake the attempt, in the context of a real-time composition and notation *dispositif*, to thin out the thicket of lines a little and, wherever possible, reduce the agreed-upon basic discourse. Therefore, we need to take stock of media theory and history, and for that we must go fairly far afield. Marshall McLuhan distinguishes four phases in the historical development of media: oral tribal culture, literal manuscript culture, the “Gutenberg Galaxy” (i.e., print), and the electronic age, which is supposed to have begun in 1894 with the invention of radio telegraphy (McLuhan 1962). Each transition is characterized by the loss of old skills—such as the art of epic memorization, which was no longer needed after the invention of writing and therefore withered away—and the acquisition of new skills. More so than McLuhan, Neil Postman considered in

Amusing Ourselves to Death the negative impacts due to the loss of expertise that the media age brings, and which concern the classic modes of writing and learning (Postman 1985).

Indeed, it seems that by the late 20th century the validity of writing culture was increasingly eliminated (much about this is also in the writings of Friedrich Kittler). Because of the ubiquity of broadband Internet—which not only has static content such as text and images, but also has time-varying content such as audio and video—our habits of reading and writing texts have radically changed overall. Increasingly, the contents of lectures, tutorials, and manuals available as streaming video clips, as well the new phenomenon of massive open online courses as an alternative study format, are being uploaded to the Web, which functions as an extension of our memory, accessible by voice-controlled portable devices, such as smart phones and tablets, capable of instantaneously providing answers to almost any question. Owing to the degeneration of literacy, according to McLuhan, we return, interestingly, to the beginning of media history, namely, oral tribal culture, only now it is an electronic one, hence his term “global village,” in which the indigenous population, through social media, is defined by “elective affinities” and where they barter their wares in the form of digital, virtual objects.

This problem affects not only book publishers. At the beginning of the millennium the music industry also suffered a heavy blow, from which it has barely recovered. The problem is not that we no longer consume print media or portable audio media—quite the opposite! But owing to the availability, pervasiveness, and altered appearance of goods as mere data files on the Internet, our notion of ownership has changed, and it has become increasingly difficult to earn money using the traditional distribution channels. As if this was not already hard to bear, a creeping debasement of the artifacts of contemporary, bourgeois high culture seems to lead to an ever starker marginalization of authors who can hardly withstand the viral YouTube culture of ratings or “likes.” Nevertheless, as in any dynamic system that is subject to change, artists and musicians react by adapting to the new

economic and media structures, and the result is in no way to be considered inferior compared to the previous period. Here we could launch a discussion about the unfortunate role of the public broadcaster, the fact that pieces rarely see more than a single performance, the reluctance of publishers, the self-publishing activities of young composers, and how “prosumers” (producers and consumers) have altered the connection with audiences. We shall refrain for reasons of space.

Music Without Score

Before the ubiquity of the Internet, musical forms had been created that already challenged the status quo of the “Bermuda Triangle” of music publisher, performance rights organization, and public broadcaster, by challenging the score as the actual artifact of musical composition. In his article “Jenseits der Partitur: Improvisation und Digitalelektronik” [Beyond the Score: Improvisation and Digital Electronics], Hamburg musicologist Peter Niklas Wilson laments the increasing loss of textualization in contemporary music practice, from electronic music to new forms of ensemble music-making in which directed or free improvisation occupies ever more space. He writes:

In face of the sheer quantity of new productions today it seems reckless to speak of a crisis in musical notation. Yet an erosion is currently taking place of the authority of the score, one that infiltrates from two sides the status of notation as the sole, representative medium of advanced music production (Wilson 1999).

Today, the majority of traditional roles from composer to interpreter (and even the public) are blurred, progressively evolving into intermediate forms between composition, interpretation, and improvisation, becoming labeled as, among others, “comprovisation” (composition and improvisation, Dudas 2010) or “conduction” (conducted improvisation and interpretation)—a term trademarked by Butch Morris (Stanley 2009). That the way of writing is pushed into the background, with other forms of communication thus coming to the fore, is

also manifest in the recent practice of “soundpainting” (Thomson 2006), a gesture language developed by the American composer Walter Thompson in the early 1970s. This language has, at the time of writing, 1,200 different gestures to control what the musicians play in rehearsal and performance, and in doing so enables composition at the moment of action. The motivations for the increasing shift of compositional skills to the interpreters and, as a consequence, the abandonment or, at least, simplification of scores are manifold and can only be hinted at.

First of all, conservatories are releasing sufficiently competent interpreters who can improvise in diverse modern styles with ease, authentically realizing all the tedious details of fixed scores. It only makes sense to inspire artists by graphics or verbal instructions to achieve the desired results. The statements made by Theodor Adorno in his article “Schwierigkeiten” [Difficulties] are as relevant today as they were in 1964, in which the toil of contemporary composition is discussed as a reason for the problematic exploitation of extramusical aids:

This shrinkage is out of all proportion to the compositional expenditure of means and construction. It may have something to do with what one can call the preponderance of extras, of the extra-musical in the most recent music, which Schnebel identified as one of the most characteristic phenomena of its development. It is as if music . . . wanted to make up of what it is temporarily blocked from achieving in the way of immanent unfolding. Those actions, however, frequently have something aimless about them (Adorno 1964).

In this context, the work of the composer and Stanford University professor Mark Applebaum is worth mentioning, wherein he renounces the musical symbols of fixed scores and devotes himself wholeheartedly to masterfully complex, graphic scores as a means of facilitation. In the film *There's No Sound In My Head: Mark Applebaum's Metaphysics of Notation*, by Robert Arnold, Applebaum admits that he does not hear sounds in his head while drawing his scores

(<http://www.lateralfilms.com/films/theres-no-sound-in-my-head>). In this respect he is close to contemporary music pioneer John Cage, who often made use of nonmusical sources in his graphic scores (for example, see his work *Atlas Eclipticalis*).

Second, interactive electronics in performances of contemporary music are becoming increasingly important. With the introduction of interactive systems that react in real time to gestures or other input, the need to use traditional symbols for the development of scores wanes. Nevertheless, with computer music languages such as CSound, SuperCollider, Pure Data, or Max, the author's intentions are precisely fixed in the form of computer code. In interactive systems, also used for installations, the authors place emphasis mostly on a field of possibilities to be explored by their users, so the audience is assigned the role of the interpreter. Since the early 2000s, the role of laptop performance has also been growing, with computer musicians improvising on their computers on stage and thereby rarely guided by fixed scores.

My own alienation from the score was triggered by the collaboration with the writer and filmmaker Thomas Brasch who, in his film *Der Passagier: Welcome to Germany*, allowed the actors to improvise for long stretches. In our collaborative work *Der Sprung: Beschreibung einer Oper* (1994–1998) it was necessary to find an adequate form for the radio-play parts that were derived from the nonphonetic noises of a sentence Brasch left on my answering machine. Between the two acts, a 17.5-min computer-controlled interlude unfolds, its running time fixed, in which an eight-voice chorus of soloists sings according to sounds given to them through headphones, and a polyphonic synthesizer improvises background music following predetermined algorithms. The music follows another of Brasch's (improvised) answering machine messages, quoted at the beginning of this article, “whereby it is a beautiful form, not to write a thing down that ought to have a sound” (Hajdu 2005).

Score Without Author

In 1999, after the opera, the work which I began on my network software Quintet.net (Hajdu et al. 2010)

Figure 1. Example of an ephemeral score: Body Score Painting by Jacopo Baboni Schilingi. (This image belongs to Jacopo

Baboni Schilingi's project Body Score Painting, used with kind permission of the composer.)



revealed to me for the first time the possibility of dialectically overcoming the contradiction between a fixed score and freely improvised music. To create a scenario in which there is indeed a score, but one (like the sounds it encodes) of ephemeral nature: After use, it disappears irretrievably, without a trace, forever (see Figure 1 for an example). Owing to their short lifespan, the scores are disposable and thus become a metaphor for the role of the author in the electronic age. It indicates, moreover, one of the fundamental problems of saving documents and artifacts on electronic storage media: None of these media has a life expectancy that comes close to approaching that of paper, stone, and clay. If they are not regularly updated and adapted to the latest technology, the data stored on them are inevitably lost. In this way some computer music works have already reached the hereafter. Interestingly, even

representatives of the computer music community, such as Johannes Goebel, director of the Experimental Media and Performing Arts Center at Rensselaer Polytechnic Institute, believe that this outcome was probably unavoidable. Is this Darwinism in art? Perhaps it is. It remains to be seen whether cloud computing, where service providers should be responsible for data preservation, provides a suitable solution for this problem. Apart from the fact that there have certainly been cases by now in which a remote server farm went off the grid without notice and users lost all data stored there, we must consider that the transfer of ownership of personal data to an anonymous storage system—a further step towards a global tribal culture—is where the concept of property (and intellectual property) requires reconsideration.

I soon realized that I was not the only one who saw opportunity in computer-generated scores to, on the one hand, cement the tradition of reading music and, on the other hand, to go beyond. In the mid 1990s, diametrically opposed to the apparent loss of textualization, a practice emerged in which composers experimented with scores generated in real time (i.e., at the moment, or shortly before, the music sounds). Among the first to adopt this in the 1990s were the Austrians Gerhard E. Winkler and Karlheinz Essl, using the multimedia authoring environment Max as their platform.

Lindsay Vickery (2012, 2014), as well as Wyse and Yew (2014), have devoted publications to the growing body of works that have ensued, also discussing urgent issues as to how to organize the resulting notation on screen (see also Eigenfeldt 2014). In this context, Vickery (2014) created a taxonomy distinguishing between segmented, scrolling, rhizomatic, 3-D, and animated scores, much of which is documented on Ryan Ross Smith's Web site (<http://animatednotation.com>).

In 2002, Nick Didkovsky, the New York musician and author of the music programming language Java Music Specification Language (JMSL), realized the composition *Zero Waste*, which can be regarded as a milestone in interactive, real-time composition: A pianist reads two bars of computer-composed random music from a monitor and renders them ad hoc at the piano. The data are sent via an

integrated MIDI interface to the computer, which transcribes the data and displays the result to the pianist, who interprets anew the transcription of his own performance. This process is repeated for 10 minutes and remains interesting for the listener because neither can the computer transcribe perfectly nor can the pianist execute flawlessly. Jason Freeman, professor at the Georgia Institute of Technology, referred to this kind of *prima vista* performance as “extreme sight-reading” (Freeman 2008). Because of the small imperfections of reading and transcribing, the material is constantly changing and going through a metamorphosis not unlike many processes in minimal music. To prevent an error from being perceived as such and to be used as a shaping force, Didkovsky selects an abstract, chromatic material for the two opening bars. JMSL, the software driving the performance, became the foundation of MaxScore, the first real-time notation package for Max, co-developed by Didkovsky and the author since 2007, and still the tool of choice for many a real-time notation practitioner (Hajdu and Didkovsky 2012).

The Dispositif of Real-Time Composition and Notation

The aforementioned term “dispositif” is ideally suited to bringing the different strands of thought that have been presented here into a framework. The first step is to define what a dispositif generally is. Originally discussed by film theorist Jean-Louis Baudry (1978) in the context of cinema, it refers to an arrangement or an apparatus. The term—which has been extended by Foucault and applied to apparatuses of political power, such as prisons—is a popular term in media technology texts because it reflects media in their technological contexts as well as the mechanisms of their perception and discourses concerning them. Let us therefore approach the dispositif of real-time composition and notation analytically. The first task is to describe the arrangement of its elements: Usually one or more musicians are integrated into a top-down computer network in which a central computer, calculating the music according to prescribed rules, conveys the

data in the form of notation by means of network protocols to the musicians’ computers.

The strict hierarchy (in which, not unlike the matrix in the film of the same name, the musicians are threatened with becoming slaves of the machine) can be mitigated in scenarios in which (1) the score elements admit larger free space in interpretation (e.g., graphic notation); and (2) the network nodes (the performing musicians) exert greater autonomy or, by feedback, are influenced by the system. Such scenarios were described by Rebelo, Schroeder, and Renaud (2008), who introduced the term “network dramaturgy” to the theory of networked music. It is questionable, however, whether the sociopolitical power metaphor actually describes the interaction adequately. That the microsociological implications of musical performance practice allow different readings is evinced by Seth Kim-Cohen’s interpretation of the live performance of the sound artist Francisco López. Although López wanted to offer an immersive listening experience to an audience sitting blindfolded in outwardly expanding concentric circles, Kim-Cohen (2009) reads the arrangement as a metaphor of power and control. Perhaps it is more of a sports metaphor, as the sight-reading musicians need instantaneous sensory perception and motor reaction skills, as challenging as extreme sports (which is already implied by the Freeman’s term “extreme sight-reading”). Because the interaction requires a high degree of competence, the interpreters understand that they are not mere underlings, but human counterparts in a game of “Man versus Machine,” as for instance, in computer chess. Although it is clear that for this kind of interaction a special faculty is demanded from the musicians—one that is actually rarely applied during a concert—the question arises whether this can be appreciated by the audience. Likely, participatory compositions such as those by Freeman (2008), in which the audience can actively exert influence on the real-time compositional algorithms, have had the best chances to make tangible the paradigmatic differences between traditional concert pieces and real-time compositions.

A teleological interpretation of real-time composition and notation could lie in the elucidation and acceptance of the transience (which formerly

resonates as a *topos* in music): The product of the system is an authorless artifact that disappears after use and execution. We can engage in this metaphysical interpretation and understanding of the score as a medium that—besides the obvious communicative function—also has the job of preserving the artistic process to allow our “survival” beyond physical death (which is also, among other things, occasionally economically relevant to our inheritors). With real-time composition and notation the importance of the score is put into perspective, and with it the (often unconscious) hope of “eternal life” is accepted as an illusion.

This dispositif is not entirely without any author, however. It is only the roles that have shifted: The composer has become a programmer, the machine has become a conductor, and, depending on the scenario, the musicians or even audience have become composers. Thus in our dispositif highly heterogeneous discourses are bundled together: the disappearance of work and author, the question of intellectual property, *objets trouvés*, autopoiesis in networked systems, and human-machine interactions.

Examples

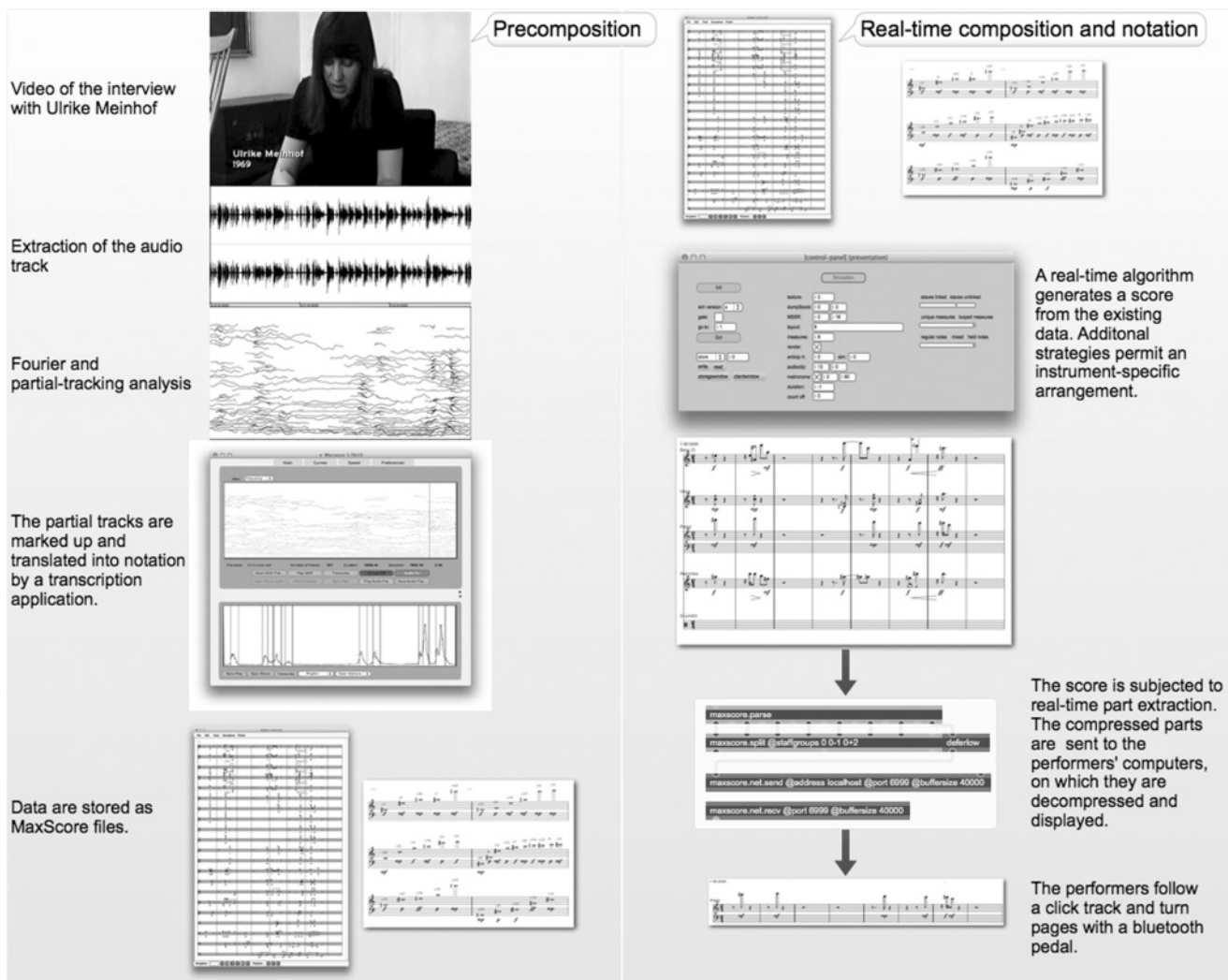
In my pieces various narratives envelop the structure of the dispositif like an outer shell: reversal of modernism in *Ivresse '84* (youtu.be/4TNR0871k-Y), veering away from social fabric in *Schwer... unheimlich schwer*, and suicide in the simultaneity of two dramaturgical levels in *Swan Song* (vimeo.com/74439911). All three narratives are characterized by the focus on a turning point or end point, and as *objets trouvés* are shaped through either a composition by Cage (whose score in turn was derived from *objets trouvés*), the Fourier analysis of an interview, or the audiovisual material from a film by Chinese director Chen Kaige.

With scores generated by the computer, the dream of 1960s composers is now within reach. Realizations of mobile, open, and even graphic scores used to suffer often because interpreters, within their rights, composed their own versions and then simply froze them in place. So the perfor-

mances always sounded the same—or at least very similar—despite the composer’s intention. Through the intervention of the computer, however, performers are now out of their comfort zone and have to endure the uncertainty of their immediate “musical future.” I highlighted this existential component in my piece *Schwer... unheimlich schwer* [*Difficult... incredibly difficult*, 2009], which is based on an interview with the Red Army Faction (RAF) terrorist Ulrike Meinhof. The following text is from the program:

Ulrike Meinhof was certainly one of the most fascinating people in the history of West Germany. As an avowed leftist and former journalist of left-wing magazine *konkret*, certainly not averse to an upper-class lifestyle, she descended like a mythological character into the Hades of the terrorist underground through her connection to Gudrun Ensslin and Andreas Baader, leaving her children in the process—a hated person for some and a constant fascination for others. In an interview with Helma Sanders-Brahms, which Stefan Aust (later chief editor of *Der Spiegel*, who accompanied Meinhof’s journey for a time) used in his RAF report *Der Baader Meinhof Komplex*, we zoom in on the moment where the obviously deeply depressed Meinhof speaks about the role of politically active women and suggests the possibility of leaving her family. She wavers between tearfulness, on the one hand, and a provocative overemphasis, on the other (clearly visible during the television interview, when she goes so far as to bend over the microphone as if giving a press conference.) *Schwer... unheimlich schwer* is a musical portrait depicting this person’s inner conflict, swinging back and forth between two sound textures, one affirmative, the other a brittle filigree. All of the musical material originates from a speech analysis of the interview (audio of Stefan Aust and Ulrike Meinhof) and is delivered in real time to four players on their laptops. By stochastic processes it is impossible, in many parts, to predict what the musicians will play in the next moment. The uncertainty brought about by this tension,

Figure 2. Simplified representation of precomposition and real-time compositional and notational processes in the composition *Schwer... unheimlich schwer*.



combined with Aust's and Meinhof's statements, adds to the atmosphere of the piece and plays with the title on multiple levels.

The composition, for bass clarinet, viola, piano, percussion, and live electronics—was commissioned by Oldenburg's "oh ton" ensemble, premiered in 2009, and received, in a second revised version, an exemplary performance by the Ensemble Intégrales in 2011. In this piece I entered new musical territory (see Figure 2 for an overview of the compositional and notational processes). It turned out, after the

first performance, that fundamental issues about the performance of real-time, generated scores and parts still needed to be addressed. For example, the players initially received the whole score from which individual parts were to be read. In addition, page turns were performed automatically by a central computer, which led to inevitable uncertainty due to irregular time delays between the generation of the score and its representation on the players' computer screens. The second version eventually saw automatic part extraction and interactive page turning. In both cases, however, it became

apparent that the musicians had been quite up to the challenge after sufficient preparation with special exercise material.

The piece *Ivresse '84*, composed two years previously, also has to do with difficulty, grappling with John Cage's *Freeman Etudes*. In my 2007 paper "Playing Performers" (in the sense that a computer "playing the performer" is akin to a musician playing an instrument, such as "playing the piano") I wrote:

Typically, for me a composition is a result of intersecting lines—biographically, aesthetically, technically, historically, etc. The creation of *Ivresse '84*, which was commissioned by violinist János Négyesy was fueled by my continuing interest in (and sometimes bewilderment by) 20th-century modernism and the notion of Western avant-garde which, despite its claims, has become a historical practice just as any other music practice. I am interested in the moment when modernism and its iconoclastic attitude had lost its impact—a moment representing a paradigmatic change in history and society. I suspect that this could be pinned to John Cage, probably the most influential icon of the 20th-century avant-garde. Fortunately, János had worked very closely with Cage, premiering his four books of the impossibly difficult *Freeman Etudes* and, hence, provided some insights into that very moment in an hour-long interview I conducted with him at his and his wife Päivikki Nykter's place in Lappeenranta, Finland in April 2007. In this interview, he describes a scandal (the provoked result of iconoclasm and expected by-product of avant-garde art works) during the premiere of the first two books of the *Freeman Etudes* in 1984 in the Italian city of Ivrea. This was probably among the last scandals Cage's music would elicit and marks the beginning of his last period, the *Number Pieces* (on which Cage was said to comment to Morton Feldman: "Morty, I'm writing beautiful music again").

I decided to base my piece on the first *Freeman Etude* and the first 4 minutes of the interview, attempting to create a crossover between a documentary and a real-time interac-

tive composition for violin and four electronic musicians. The music consists of a version of the first *Freeman Etude*, transcribed into standard music notation, in which the material is rearranged to follow the narrative of the interview. For each of the 20 sections, a stochastic process chooses among a range of measures and recombines them into a new structure, which is sight-read by the performer. (This approach, of course, assumes familiarity with the material.) The soloist is accompanied by the electronic musicians who react to his actions and read instructions from their computer screens while playing audio samples taken from Négyesy's own CD recording (Hajdu 2007).

In *Swan Song*, for violoncello and percussion (2011), the composition is, admittedly, not generated in real time, but the computerized notation system afforded a novel composing and editing process.

Like some of my earlier pieces, *Swan Song* is based on transcriptions of preexisting sonic materials: speech, music, and noises. For this piece I have chosen the final scene of a masterpiece of Chinese cinema called *Farewell, My Concubine*, by Chen Kaige, a movie that had a great impact on me when it was released in 1993. The movie revolves around a complicated love story and features scenes from an eponymous Peking opera. Life and theater blend dramatically in the final scene. My rendering of transcribed materials by the cello and percussion, mimicking the voices and instruments of Peking opera, is accompanied by processed video from the movie, as well as electronic and prerecorded sounds. The first two tracks of the master score (written with MaxScore running inside my multimedia performance environment Quintet.net) are being used for real-time part extraction and sent to the players over the network, a third and fourth track are used for the control of audio and video playback, and the fifth is a click track, synchronizing the musicians to the audio and video playback (Hajdu 2012, preface to the score).

MaxScore not only allows the real-time generation of scores, but also the editing of already fixed

documents (Hajdu and Didkovsky 2012). Because the extraction and distribution of parts could now take place on the interpreters' computers in real-time, the composition process and rehearsal phase could henceforth coalesce, and interpreters' annotations be included in the score in situ.

Conclusion

Disposable music is defined herein as an authorless artifact produced by the dispositif of real-time composition and notation. Its concept is a response to social and cultural developments in the ever-tightening entanglements of human and machine and our everyday lives, realized in its smallest ramifications in electronic media. Due to changed circumstances and the damage caused by the Internet's collapsing of time and space, a new value system is created in the global village where intellectual property, as sanctioned by the bourgeois era, is less respected and rights are conceded. The associated socioeconomic shifts force musicians to adapt new strategies, leading to new dispositifs as well as narratives reflecting those changes. A suitable dispositif is real-time composition and notation of music generated for a man-machine network, seemingly without author, and performed by musicians in a top-down model. The resultant scores are like the sounding out of ephemeral music, which is to be interpreted as an adequate response to the devaluation of the artifacts of contemporary high culture. This should not, however, be equated with a devaluation of the dispositif itself. On the contrary, the actual achievement of the author, and therefore of the artifact, is to establish the real-time composition and notation system that, however, resorts to another discourse, whereby the system's inherent concept is primary and the aesthetic experience of the audience is of secondary nature—an issue that was discussed by Arne Eigenfeldt (2014), remarking that the “greatest dilemma . . . was one inherent in generative music: there is no guarantee that . . . the generated material for performance will be of its highest quality.”

Carefully selected algorithms and musical starting materials, as well as exciting narrative and dramatic compositions, have the potential to more

than compensate for the differences from traditional concert experiences though.

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