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VOL 19 NO 3 VOLUME EDITORS **LANFRANCO ACETI, STEVE GIBSON & STEFAN MÜLLER ARISONA** EDITOR **ÖZDEN ŞAHİN**

Live visuals have become a pervasive component of our contemporary lives; either as visible interfaces that re-connect citizens and buildings overlaying new contextual meaning or as invisible ubiquitous narratives that are discovered through interactive actions and mediating screens. The contemporary re-design of the environment we live in is in terms of visuals and visualizations, software interfaces and new modes of engagement and consumption. This LEA volume presents a series of seminal papers in the field, offering the reader a new perspective on the future role of Live Visuals.

LIVE VISUALS

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The Encounter, Elif Ayiter, 2010, Screenshot of Cinematic Play Session in Second Life. © Elif Ayiter. Used with Permission.

Editorial Address
Leonardo Electronic Almanac
Sabanci University, Orhanli – Tuzla, 34956
Istanbul, Turkey

Email
info@leoalmanac.org

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Live Visuals

VOLUME EDITORS
LANFRANCO ACETI, STEVE GIBSON & STEFAN MÜLLER ARISONA

EDITOR
ÖZDEN ŞAHİN

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When Moving Images Become Alive!

"Look! It's moving. It's alive. It's alive... It's alive, it's moving, it's alive, it's alive, it's alive, it's alive, IT'S ALIVE!"
Frankenstein (1931)

Those who still see – and there are many in this camp – visuals as simple 'decorations' are living in a late 19th century understanding of media, with no realization that an immense cultural shift has happened in the late 20th century when big data, sensors, algorithms and visuals merged in order to create 21st century constantly mediated social-visual culture.

Although the visuals are not actually alive, one cannot fail to grasp the fascination or evolution that visuals and visual data have embarked upon. It is no longer possible to see the relationship of the visual as limited to the space of the traditional screens in the film theater or at home in the living room with the TV. The mobility of contemporary visuals and contemporary screens has pushed boundaries – so much so that 'embeddedness' of visuals onto and into things is a daily practice. The viewers have acquired expectations that it is possible, or that it should be possible, to recall the image of an object and to be able to have that same object appear at home at will. The process of downloading should not be limited to 'immaterial' digital data, but should be transferred to 3D physical objects. [1]

Images are projected onto buildings – not as the traditional trompe l'oeil placed to disguise and trick the eye – but as an architectural element of the building itself; so much so that there are arguments, including mine, that we should substitute walls with projected information data, which should also have and be perceived as having material properties (see in this volume "Architectural Projections" by Lukas Treyer, Stefan Müller Arisona & Gerhard Schmitt).

Images appear over the architecture of the buildings as another structural layer, one made of information data that relays more to the viewer either directly or through screens able to read augmented reality information. But live visuals relay more than images, they are also linked to sound and the analysis of this linkage provides us with the opportunity "to think about the different ways in which linkages between vision and audition can be established, and how audio-visual objects can be composed from the specific attributes of auditory and visual perception" (see "Back to the Cross-modal Object" by Atau Tanaka).

iPads and iPhones – followed by a generation of smarter and smarter devices – have brought a radical change in the way reality is experienced, captured, uploaded and shared. These processes allow reality to be experienced with multiple added layers, allowing viewers to re-capture, re-upload and re-share, creating yet further layers over the previous layers that were already placed upon the 'original.' This layering process, this thickening of meanings, adding of interpretations, references and even errors, may be considered as the physical process that leads to the manifestation of the 'aura' as a metaphysical concept. The materiality of the virtual, layered upon the 'real,' becomes an indication of the compositing of the aura, in Walter Benjamin's terms, as a metaphysical experience of the object/image but nevertheless an experience that digital and live visuals are rendering increasingly visible.

"Everything I said on the subject [the nature of aura] was directed polemically against the theosophists, whose inexperience and ignorance I find highly repugnant. . . . First, genuine aura appears in all things, not just in certain kinds of things, as people imagine." [2]

The importance of digital media is undeniably evident. Within this media context of multiple screens and surfaces the digitized image, in a culture profoundly visual, has extended its dominion through 'disruptive forms' of sharing and 'illegal' consumption. The reproducibility of the image (or the live visuals) – pushed to its very limit – has an anarchistic and revolutionary element when considered from the neocapitalistic perspective imbued in corporative and hierarchical forms of the construction of values. On the contrary, the reproducibility of the image when analyzed from a Marxist point of view possesses a community and social component for egalitarian participation within the richness of contemporary and historical cultural forms.

The digital live visuals – with their continuous potential of integration within the blurring boundaries of public and private environments – will continue to be the conflicting territory of divergent interests and cultural assumptions that will shape the future of societal engagements. Reproducibility will increasingly become the territory of control generating conflicts between *original* and *copy*, and between the layering of *copy* and *copies*, in the attempt to contain ideal participatory models of democracy. The elitist interpretation of the aura will continue to be juxtaposed with models of Marxist participation and appropriation. [3]

Live visuals projected on public buildings and private areas do not escape this conflict, but present interpretations and forms of engagements that are reflections of social ideals. The conflict is, therefore, not solely in the elitist or participatory forms of consumption but also in the ideologies that surround the cultural behaviors of visual consumption.

Object in themselves, not just buildings, can and may soon carry live visuals. There is the expectation that one no longer has to read a label – but the object can and should project the label and its textured images to the viewer. People increasingly expect the object to engage with their needs by providing the necessary information that would convince them to look into it, play with it, engage with it, talk to it, like it and ultimately buy it.

Ultimately there will be no need to engage in this process but the environment will have objects that, by reading previous experiences of likes and dislikes, present a personalized visual texture of reality.

Live visuals will provide an environment within which purchasing does not mean to solely acquire an object but rather to 'buy' into an idea, a history, an ideology or a socio-political lifestyle. It is a process of increased visualization of large data (Big Data) that defines and re-defines one's experience of the real based on previously expressed likes and dislikes.

In this context of multiple object and environmental experiences it is also possible to forge multiple individualized experiences of the real; as much as there are multiple personalized experiences of the internet and social media through multiple avatar identities (see "Avatar Actors" by Elif Ayter). The 'real' will become a visual timeline of what the algorithm has decided should be offered based on individualized settings of likes and dislikes. This approach raises an infinite set of possibilities but of problems as well.

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The life of our representation and of our visuals is our 'real' life – disjointed and increasingly distant from what we continue to perceive as the 'real real,' delusively hanging on to outdated but comfortable modes of perception.

The cinematic visions of live visuals from the 19th century have become true and have re-designed society unexpectedly, altering dramatically the social structures and speeding up the pace of our physical existence that constantly tries to catch up and play up to the visual virtual realities that we spend time constructing.

If we still hold to this dualistic and dichotomist approach of real versus virtual (although the virtual has been real for some time and has become one of the multiple facets of the 'real' experience), then the real is increasingly slowing down while the virtual representation of visuals is accelerating the creation of a world of instantaneous connectivity, desires and aspirations. A visuality of hyper-mediated images that, as pollution, pervades and conditions our vision without giving the option of switching off increasingly 'alive' live visuals. [4]

The lack of 'real' in Jean Baudrillard's understanding is speeding up the disappearance of the 'real' self in favor of multiple personal existential narratives that are embedded in a series of multiple possible worlds. It is not just the map that is disappearing in the precession of simulacra – but the body as well – as the body is conceived in terms of visual representation: as a map. These multiple worlds of representations contribute to create reality as the 'fantasy' we really wish to experience, reshaping in turn the 'real' identity that continuously attempts to live up to its 'virtual and fantastic' expectations. Stephen Gibson presents the reader with a description of one of these worlds with live audio-visual simulations that create a synesthetic experience (see "Simulating Synesthesia in Spatially-Based Real-time Audio-Visual Performance" by Stephen Gibson).

If this fantasy of the images of society is considered an illusion – or the reality of the simulacrum, which is a textual oxymoron at prima facie – it will be determined through the experience of the *live visuals becoming alive.*

Nevertheless, stating that people have illusory perceptions of themselves in relation to a 'real' self and to the 'real' perception of them that others have only reinforces the idea that Live Visuals will allow people to manifest their multiple perceptions, as simulated and/or real will no long matter. These multiple perceptions will create multiple ever-changing personae that will be further layered through the engagements with the multiple visual environments and the people/avatars that populate those environments, both real and virtual.

In the end, these fantasies of identities and of worlds, manifested through illusory identities and worlds within virtual contexts, are part of the reality with which people engage. Although fantastic and illusory, these worlds are a reflection of a partial reality of the identity of the creators and users. It is impossible for these worlds and identities to exist outside of the 'real.' This concept of real is made of negotiated and negotiable frameworks of engagement that are in a constant process of evolution and change.

The end of post-modernity and relativism may lead to the virtuality of truism: the representation of ourselves in as many multiple versions – already we have multiple and concurrent digital lives – within the world/s – ideological or corporate – that we will decide or be forced to 'buy into.'

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It is this control of the environment around us and us within that environment that will increasingly define the role that live visuals will play in negotiating real and virtual experiences. The conflict will arise from the blurred lines of the definition of self and other; whether the 'other' will be another individual or a corporation.

The potential problems of this state of the live visuals within a real/virtual conflict will be discovered as time moves on. In the end this is a giant behavioral experiment, where media and their influences are not analyzed for their social impact *ex ante facto*; this is something that happens *ex post facto*.

Nevertheless, in this ex post facto society there are some scholars that try to understand and eviscerate the problems related to the process of visuals becoming alive. This issue collects the analyses of some of these scholars and embeds them in a larger societal debate, hinting at future developments and problems that society and images will have to face as the live visuals become more and more alive.

The contemporary concerns and practices of live visuals are crystallized in this volume, providing an insight into current developments and practices in the field of live visuals.

This issue features a new logo on its cover, that of New York University, Steinhardt School of Culture, Education, and Human Development.

My thanks to Prof. Robert Rowe, Professor of Music and Music Education; Associate Dean of Research and Doctoral Studies at NYU, for his work in establishing this collaboration with LEA.

My gratitude to Steve Gibson and Stefan Müller Arisona, without them this volume would not have been possible. I also have to thank the authors for their patience in complying with the guidelines and editorial demands that made this issue one that I am particularly proud of, both for its visuals and for its content.

My special thanks go to Deniz Cem Önduygu who has shown commitment to the LEA project beyond what could be expected.

Özden Şahin has, as always, continued to provide valuable editorial support to ensure that LEA could achieve another landmark.

Lanfranco Aceti
Editor in Chief, Leonardo Electronic Almanac
Director, Kasa Gallery

1. 3D printing the new phenomenon will soon collide with a new extreme perception of consumer culture where the object seen can be bought and automatically printed at home or in the office. Matt Ratto and Robert Ree, "Materializing Information: 3D Printing and Social Change," *First Monday* 17, no. 7 (July 2, 2012), http://firstmonday.org/ojs/index.php/fm/article/view/3968/3273 (accessed October 20, 2013).
2. Walter Benjamin, "Protocols of Drug Experiments," in On Hashish, ed. Howard Eiland (Cambridge, MA: Harvard University Press, 2006), 58.
3. " The point here is not to issue a verdict in the debate between Adorno and Benjamin, but rather to understand the debate between them as representing two sides of an ongoing dialectical contradiction." Ryan Moore, "Digital Reproducibility and the Culture Industry: Popular Music and the Adorno-Benjamin Debate," Fast Capitalism 9, no. 1 (2012), http://www.uta.edu/huma/agger/fastcapitalism/9_1/moore9_1.html (accessed October 30, 2013).
4. Paul Virilio, *Open Sky*, trans. Julie Rose (London: Verso, 1997), 97.

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Visualization Technologies for Music, Dance, and Staging in Operas

by

Guerino Mazzola, David Walsh, Lauren Butler, Aleksey Polukeyev

University of Minnesota, School of Music,
2106 Fourth Street South, Minneapolis, MN 55455
mazzola@umn.edu

ABSTRACT

We discuss the creation of the opera Apocalypse Now...and Then*, whose libretto was written by two of the authors (G. Mazzola and D. Walsh) at the School of Music of the University of Minnesota. The music was composed by Manuela Kerer. A 15-minute scenic summary of the opera has been recorded on DVD in July 2012 and will serve as a basis for the realization of the full opera. The opera's actions involve God and his wife in heaven and Jesus with Mephisto on earth, each accompanied by a female dancer. To solve this time-critical double staging problem, we use the Arena 4 software to project still and moving images onstage. The music has various approaches: score-driven composition, played by a chamber orchestra, 'commercial' music, generated from a music file repertory on a laptop, free improvisation, played onstage by a jazz trio, and music generated by the two dancers using the Arduino body sensor system. Its wireless signals to a laptop became input for FM-synthesis on Max and for real-time control of the music on Ableton Live. We conclude on the systematic aspects of such a 'multimedia counterpoint' for the staging technicalities, the narrative implications, and the sound dimension.*

THE OPERA TODAY – THE ARTISTIC CHALLENGE OF A MULTIMEDIA COUNTERPOINT

In the year 1849, Richard Wagner introduced his concept of a 'Gesamtkunstwerk' (total artwork) in his concept of a staging of virtual reality in an artwork of the future. [1] Wagner's ideas paved the way for Filippo Tommaso Marinetti's 'Futuristic Cinema,' Laszlo Moholy-Nagy's 'Bauhaus Theater,' John Cage's 'Performance Experiments' and eventually the 'Art of Happenings.' However, the historical templates have been substantially overridden by the modern version of multimedia, and these new dimensions expand the possibilities of artistic expressivity and create a new understanding of what multimedia, and in particular opera, could be.

In key texts about digital media technology, Randall Packer and Ken Jordan [2] have characterized multimedia by five attributes:

1. integration of art and technology, generating hybrid forms of expressivity;
2. interactivity among users and media objects;
3. hypermedia usage, i.e. embedding of media in the reference trees of hypertexts;
4. immersion in a simulated or suggested 3D reality;
5. nonlinear narrativity, i.e. suspension of a thread of narration in favor of ramified narrative networks.

This characterization was born from the Canadian media theorist Marshall McLuhan's spirit: the essence lies in the media, without asking for the contents of the message, culminating in McLuhan's famous dictum "The medium is the message."

Although McLuhan's media-centered flattening of human expressivity favors a view of the world as a superficial children's game, materialized in joysticks and other funny machine-man interfaces, multimedia in the arts (and also in the physical sciences, which is excluded from the current discussion) has implications that transcend McLuhan's reductionism. His reduction of expressivity to messages consisting only of media disregards the semantic layer altogether and implicitly claims that beyond the 'how' there is no 'what' that must be said.

Our opera project is centered on this deeper aspect of multimedia in the arts. To begin with, the Wagnerian idea of involving different art forms in a Gesamtkunstwerk opera is further potentialized by modern digital multimedia technology. It is now technically feasible to integrate video, multi-speaker audio, dynamic light effects, electronic staging facilities, or sensors on humans. And it is possible to easily shift from one layer of virtual reality to another. The multitude and quality of media has dramatically increased.

Although such a repertory of advanced and often computer-driven multimedia technology deepens the artistic expressivity, it is not the main difference to the classical multimedia approaches in Wagner's times. It is just much more of the same, see, for example, recent contribution to multimedia opera. [3] [4]

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There is however a qualitative rather than quantitative milestone that is initiated by modern multimedia technology, namely the possibility of a differentiated interaction of media. The forms of media are no longer independent from each other, but can influence each other and can set up a multidirectional dialog across all media. Media can now 'talk to each other,' enabling a discourse which enhances the semantic loading of an opera's unfolding.

To understand this extension of significant mechanisms, Roman Jakobson [5] has given a famous and now classical identification of the poetical function: it is the projection of the paradigmatic axis onto the syntagmatic axis of a semiotic system. For example, rhyme poesy projects phonological paradigms onto the axis of the poem's syntax. Jakobson's principle can be applied to the intermodal situation of trans-media communication to generate poetical functions. For example, a dancer can use his/her dancing paradigms, such as a dancing figure, to be transformed to a sounding figure using body sensors, and to have these sound signs generate a poetical function in music, and not only in dance. Or an actor can influence the stage setup by hand gestures and thereby create a dynamic stage poetics that expresses a projection from human hand gestures.

It is obvious that this cross-media poetics creates a novel quality of artistic expressivity that adds to the 'game aspect' of multimedia the poetical enrichment of semantics that Wagner might have imagined when in *Parsifal* he set Gurnemanz's words "Zum Raum wird hier die Zeit."

Musically speaking, this extended 'poeticity' across the media modalities reifies a contrapuntal idea of a multitude of media voices, which relate to each other by 'intervals of media transformations' and thereby create a multimedia polyphony, a counterpoint of dance, gesture, music, theater, narrative, stage realities, light and sound. It is on this background of 'potentialized poeticity' that we have been working on our opera and its multimedia technologies.

Before discussing the specific opera project, we recall the general methodology of multimedia processes. Multimedia has a triple scheme of processing information:

1. We are first given a set of abstract knowledge items.
2. These items are then encoded in a (usually high-dimensional) parameter space.
3. The parametric representation of knowledge is now materialized in a space of high-dimensional multimedia objects, using colors, sound, shape, or dynamic behavior.

It is a challenging general task of multimedia science to find multimedia representations of abstract knowledge that materializes it in such a way that the original knowledge becomes accessible in the sensual media reality. In works of art, this challenge is of course primordial since the artist wants to communicate the poetical contents in an aesthetically pleasing manner.

Therefore, multimedia art has to first realize an appropriate trajectory through the processing scheme for each involved media, and then deal with the media transformation modes that generate the media counterpoint mentioned above.

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THE LIBRETTO OF OUR OPERA *APOCALYPSE NOW... AND THEN* AND ITS CONCEPT

To obtain a faithful description of our opera project, we first present a summary of the content.

Sketch of the Libretto

Four onstage persons (see Figure 1): Father God, Mother God Asherah, boy Jesus, dude Mephisto

Two female dancers onstage: The Jesus dancer (Caucasian), the Mephisto dancer (African American)

A free jazz trio onstage: grand piano, saxophones, drums

In orchestra pit: A chamber orchestra

Prolog in Heaven

Father God and Mother God in her kitchen (her lab) before the creation of the universe. While he is busy, rather self-importantly or self absorbed, dabbling in the creation of the universe, she is actually 'cooking up' some ideas of her own, in other words, getting something done! They are in the same space, because he actually doesn't have a lab, or a studio, but he has to make do with her kitchen where, however, he makes a mess with his experiments. Even the gods are not what they are cracked up to be!

Everything is a silent movie, no sounds yet. This scene can be realized as a real silent movie, creating another reality. Father God plays Bach on a psychedelic color piano/organ (clavier à lumière, Farbenklavier), producing wonderful colored light effects instead of acoustical events. He complains by gestures that he cannot hear anything. Asherah brings him fluorescent modeling clay, with which he wants to build sounding universes. After a number of failures, where the universal matter is splattered around (and which Asherah has to clean up), Father God succeeds with the Big Bang, the universe is created.

Act I: Boy Jesus' and Dude Mephisto's Trip to Earth

1. The music of spheres sounds, it is a "Jubilate," Father God now leaves to his supreme creation, the human being, the fate of music and of the earth.

2. By and by, the most beautiful works of music are created, whose laws and rules the humans (like Father God) may now shape, reject, and improve by their own initiative. However, the distrustful Father God has incorporated a safeguard to the system: if the humans carry their experiments with the universe too far and lose control, it may be destroyed by a Final Bang.

3. Father God is amazed by the wonderful human works of music and sends his son boy Jesus down to earth in order to record and collect these works in case something should go wrong. To this end, he uses Pandora boxes, a kind of iPod, which release music

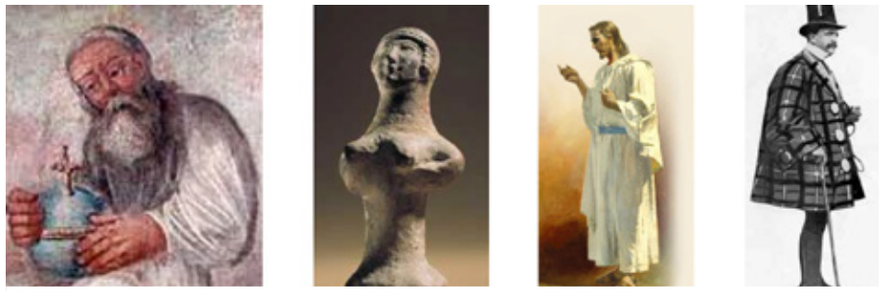

Figure 1. From left to right: Father God, Mother God Ashera, boy Jesus, and dude Mephisto. *Apocalypse Now.. and Then*, Guerino Mazzola, 2010. © Guerino Mazzola, 2010. Used with permission.

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upon being opened, and thereby produce funny effects of music collages. He does not realize that the major inspirations are secretly provided to the composers and musicians by his wife Asherah.

4. When boy Jesus arrives on earth, he is surprised that dude Mephisto is already there, waiting for him. It was Asherah who sent this devil in order to test her husband's world; half envious about his creation, half skeptical that it would work anyway, she told dude Mephisto to lead men into temptation. Asherah and dude Mephisto are the counterparts of Father God and boy Jesus. They stand for questioning an unrestricted positivity of the God concept: no questions, no doubts, nothing outside of God, his concept is 'omni-everything' – or rather would be such. Israel's Yahweh was a jealous god: "You shall have no other gods before me."

5. Boy Jesus and dude Mephisto start their trip; boy Jesus collects harmonies and consonances, while dude Mephisto is eager to record cacophony and dissonances. He, the spirit that denies, 'diabolus in musica,' incessantly seduces the humans to question established harmonies, to break symmetries and to heighten the tower of Babel of the music language. He succeeds in persuading humans that the transgression of established harmonies is the most challenging aspect of musical development and progress. Meanwhile, boy Jesus always wants to imitate his father by experimenting with small universes of perfection, and to persuade humans that this is an ideal target, however, always failing and producing small explosions, which makes dude Mephisto smile. These explosions can be realized on each opening of a Pandora box, some smoke, and a nice chord, like when one starts a computer.

Act II: Humans Playing God

6. Humans want to make the universe vibrate more and more and attempt at taking the full responsibility, although they should know that their inspiration stems from Asherah. In order to infuse human expressivity into the music of divine origin, they learn the dance of gestures which lets them shape the divine forms in a sounding movement. For an optimal control of music they invent devices for gestural embodiment: the clock's pointers, the baton and the metronome. To imitate the small universes suggested by boy Jesus, the humans progressively try to pass the dance of gestures to machines, to dancing puppets and robots. They are childishly delighted when these puppets dance like humans.

7. In their megalomania, humans succeed in having music being composed and performed by robots, and finally also sell it to robots and humans alike. This robotic business with music turns the profit from music into a music of profit. Money sounds sweet. A grotesque symphony of money emerges, played by robots on cash registers/desks and with the Swiss Appenzeller Fünfliber (five franc piece in a clay jug, called Talerschwingen) practiced by folklore groups, as in Figure 2.

Figure 2. Swiss Appenzeller folklore, making music with a five franc coin rotating within a clay container. Public domain image.

8. This music is complemented by images of the music-business stars, such as Elvis Presley, Michael Jackson, Madonna, etc., also showing the sacred instances of their funerals and/or mausolea. The music then dissolves in all its parameters and slowly fades out, parallel to the fading images, leaving a dark stage. The only sound left is the sound of time, empty time, a clock's ticks on the darkened stage. Although music of profit is omnipresent and is possessed by money, it still does not possess time: time is more than money. Time flies by. Time reminds us of our death, of the death of even the most molded and prestigious money-making musicians.

9. Dude Mephisto appears onstage; it is his own clock/watch that we just heard. He, the spirit that always negates, also negates life; he is the master of death. To challenge Father God's/boy Jesus' harmony, he introduces those crazy power-addicted revolutionary musicians (they are a faithful image of their constructor!), which invent the music of pure gesture, namely free jazz, in order to penetrate, control, and eventually halt time, the innermost musical substance. Jesus hates free jazz and becomes furious. He places his harmonious consonant Pandora boxes onstage, between the free jazzers in order to disturb them with his nice-music. The fight between the evil-doer free jazzers and boy Jesus' nice music boxes escalates. Each placing of boxes provokes an even louder, more intense free jazz response to that music, which is encased by niceties, consonances, and business. This time, to the astonishment of Father God and the anger of his spouse (this time, dude Mephisto is a bad uncle, an unreliable friend of the family), dude Mephisto's staging triumphs. The scene and the Act II terminate in a big and loud cacophony provoked by the clash of dude Mephisto's free jazz ('diabolus in musica!') and boy Jesus' nice-music.

Act III: The Final Bang

10. The final catastrophe reaches humanity, when they diabolically start perverting the power of music to the music of power. This music produces sounds of canons and bombs, an effect that causes a supreme delight to dude Mephisto. A first climax of such perversion is achieved by 9/11, an explosion, which gives Stockhausen a great pleasure. This really happened; he is one of those composers who has devoted their megalomaniac pursuit to God-like creations. Dude Mephisto seduces humans to construct a hyper bomb, whose explosion should produce the supreme of all musics. The Bomb will however generate such a great amount of energy that the atmospheric nitrogen will fuse to a rain of silicium crystals (a possibly fantastic visual effect), such that the earth's music will then be terminated by the destruction of the atmosphere. Dude Mephisto is eager to hear this supreme sound and wants to stay as near as possible when the bomb explodes.

11. Boy Jesus penetrates the devilish plan and seduces dude Mephisto to sit on the bomb in order to get the optimal recording. As the bomb explodes, dude Mephisto is destroyed. The bomb's ignition is induced by a mystical chord, which is sung in a common effort by the humanity and the opera's audience. This exterminates the music on earth.

Epilog in Heaven

Father God reflects with amusement on the crazy opus of his creatures, but knows that his son has collected the human music sounds. They are now being presented to Father God, but since no sound can be heard anymore, He, while absorbing the unique collection in his otherworldliness, performs a wonderful dance. This is a final scene with music of silence for a dancing Father God – while his spouse cleans up the whole mess. However, God's shadow shows defunct dude Mephisto and the sacrificed humans.

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The Libretto's Concept

The libretto's narrative is a global view of this universe as a creation and experiment. Humanity realizes God's desire to embody and hear music in physical reality. However, the Mephistophelian forces will eventually destroy humanity and Mephisto in a 'final big bang,' but God is nonetheless satisfied by the musical collection he ultimately received from Jesus. The reason for creating the universe (through the initial big bang) is music; this target has been achieved, but the humans did not succeed in keeping the beauty of music as their ultimate goal. The perversion of the power of music into the music of power, money, and egoistic perspectives terminates the universe's existence.

This global vision enforces an incessant, seamless and fast switch between God's heavenly site and the human reality on earth. We shall discuss the technological solutions for this staging challenge in the next section. The conceptual rationale for such a fluid reality is the fact that this opera is about 'everything,' be it in eternal divine layers or in our human physical realm. Separating these layers would destroy the universal view. On the musical side, the opera's concept enforces an equally fast switch between orchestral passages (played by the chamber orchestra in the orchestra pit), onstage free jazz parts, iPod-fed sound excerpts (produced by loudspeakers) from the Pandora boxes when opened by Jesus, and then the loudspeaker sounds generated by the dancers' body sensors and the connected computer software.

Beyond these requirements of 'universal omnipresence' the dancers also connect their bodily expression to music by the body sensor system they are wearing. We shall discuss the sensor system in detail in the next but one section. The conceptual idea here is that, following the libretto, the human gestures attempt a creational role of music. They don't want to play only God's eternal harmonies, but to make their own music via dancing embodiment. The intermedial connection dance-music is therefore a conceptual mandate, not just a nice addition. The evidence of gesturally generated music as opposed to the reproduction of given scores must be realized directly onstage and without textual explications.

It would not be wrong, but oversimplified, to call these intermedia transformations visualizations. Evidently, producing music by dance and switching seamlessly from heaven to earth is a visual communication, but the point is another: Recall that we had described the present approach a multimedia counterpoint in our introductory section. The idea is to connect media in such a way that no one anymore would be the dominant thread, but carrying an artistic message that was created in another media, and thereby distributing media semantics simultaneously over distributed media, much as counterpoint is more than the sum of voices, it is their creative interplay and dialog. Perhaps it is adequate to cite Jean Cavaillès, the French mathematician and philosopher, [6] who said that understanding is catching the gesture and being able to continue. Here each media-specific gesture is caught by an answering gesture living within other media.

A LIQUID SPACE STAGING STRATEGY USING PROJECTION TECHNOLOGY: RESOLUME ARENA 4

The general idea of liquefaction of stage space was to replace objects or static images by projected items, where the projection can map onto surfaces of arbitrary shape and size. If the light quality is satisfactory, this enables the staging to become dynamic without any delay, if the projection technology is flexible enough.

The projection technology of this opera was manipulated with the following setup: a single Macbook Pro running Resolume Arena 4, [7] connected to three

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Figure 3. A graphic user interface from the Resolume Arena 4 software for audio-visual projection. © Guerino Mazzola, 2013. Used with permission.

individual projectors (~3000 lumens each) via Matrox TripleHead2Go (see FIGURE 3 for a user interface screenshot). Resolume Arena 4 is an audio-visual performance application that allows full control and live manipulation of the content projected onto the crafted surfaces incorporated into the stage. It has a horizontal session layout composed of channels for video and audio content and an intuitive interface to control both the triggering and effects applied to individual clips as well as sets of clips.

Arena 4 is an ideal software environment for adding an interactive element to stage design. The three projectors connected together create a uniform space in Arena 4 which could then be sliced and masked to project independent content to the three projectors. The masking allows the projected content to be tailored to any given shape of surface (ex. Stars, Half Circle, Arrow). One example of a Wurlitzer image projected onto a semicircle surface above God's heavenly bed is shown in Figure 3.

Figure 4. A video sequence over God's bed, being projected using Resolume Arena 4. *Apocalypse Now.. and Then*, Guerino Mazzola, 2012, video screenshot. © Guerino Mazzola, 2012. Used with permission.

Figure 5. A Wurlitzer still image over God's bed, being projected using Resolume Arena 4. *Apocalypse Now.. and Then*, Guerino Mazzola, 2012, video screenshot. © Guerino Mazzola, 2012. Used with permission.

The BPM sync feature, MIDI capabilities and Syphon built into Arena 4 allow for interaction with external software and hardware for full integration of the different pieces of software and hardware that generally manipulate the sound, lighting, and visual content on a stage into a single environment. This means that in an opera such as *Apocalypse Now..and Then*, it is possible to create a stage environment that is manipulated during the performance by the individuals present on stage, such as dancers, singers, and musicians adding a dynamic and improvisatory spirit to the production. Figure 4 show a second image, this time video sequence, being projected onto the semi-circle surface above God's bed.

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THE MUSICAL INTEGRATION OF DANCERS' MOVEMENTS USING THE ARDUINO SENSOR SYSTEM WITH MAX AND ABELTON LIVE

In this opera, music is generated by five sources: the singers, the chamber orchestra, the free jazz trio, the loudspeakers for the Pandora boxes when opened by Jesus, and the dancers. The two dancers generate different sound effects. Jesus' dancer has a binary light sensor which, upon being covered by the dancer's hand or shadow, sends a signal to generate recorded music, such as required when Jesus opens the Pandora boxes. The straightening of her arm, via a flex sensor, can also generate musical sounds from prerecorded music when pointing to the stars, as shown in Figure 5, while the stars would spark light upon this dancer's gesture. The second dancer, the Mephisto dancer, wears sensors that measure continuous numerical input, such as angles and position or acceleration data, and sends this data to a sound generator producing complex sounds via Frequency Modulation. This dancer carries the free jazz paradigm and has to make sounds from inside, as opposed to the Jesus dancer who only reproduces music from 'outside.'

Figure 6. The Jesus (left) and Mephisto (right) dancers in action, the Arduino sensors of the Jesus dancer are visible. *Apocalypse Now.. and Then*, Guerino Mazzola, 2012, video screenshot. © Guerino Mazzola, 2012. Used with permission.

Both dancers are shown in action from the opera's rehearsal on Figure 6.

The performers have a control board attached to their clothing (see Figure 7 for the flow chart of this setup). This communicates wirelessly with a computer program which affects the sound that accompanies the performance. On a more technical level, the board attached to the dancer is a battery-powered (battery is also attached to the performer) Duemilanove Arduino microcontroller. [8] The sensors are a LilyPad light sensor, a LilyPad accelerometer, and a one-directional flex sensor. The signals are sent wirelessly, via radio waves, to a laptop using an Xbee sheild attached to the Arduino, and an Xbee wireless module attached to the shield. Plugged into the laptop's USB port is an Xbee Explorer with the second Xbee wireless module attached to that. An Arduino sketch was written and loaded onto the microcontroller that sends the data packages to the Max 6 software package. [9] The data is then scaled to become midi data and sent with Max for Live into Ableton Live, [10] where each sensor is mapped to one or more dials that affect the music. Some sections (the Jesus dancer) of the performance use pre-recorded music that is affected by the sensors, and in other sections it started only as a single midi note or FM synthesis. Each sensor has a different role and effect during different parts of the piece.

One of the authors (L. Butler) has tested this system in a successful previous dance project *Voices of Fire*, premiered on May 12, 2012 at the TekBox Theater in Minneapolis, and could apply her experience for the present opera project.

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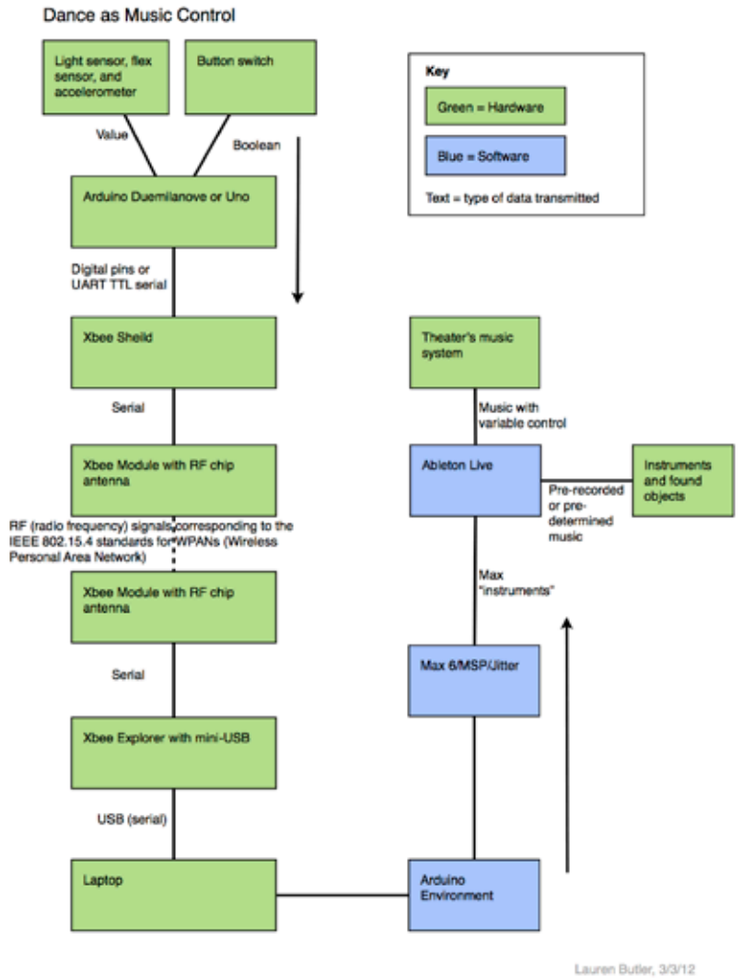

Figure 7. Flow chart of Arduino system. © Guerino Mazzola, 2013. Used with permission.

ANALYSIS

Unique challenges and opportunities arise when using this system. The dancer becomes an instrument, and therefore must have a higher level of movement awareness. The movement affects the visual and audio components of the piece. This project is a proof of concept, and it successfully proved that this can be done and produce interesting results. This project has moments where the dancer is acting as an instrument: however, there is more possible with this, in that all the movement could be created in conjunction with the music. This is possible primarily if the movement is created while wearing a finished system. There is also more to be developed so that the music fully represents and captures the complexities of the movement.

When analyzing this intermodal communication between music and dance, one learns that the gestural signification of music can be strongly augmented. Recall that the musical score notation is a massive abstraction from performative human action. A score is a collection of 'frozen gestures.' Unfreezing those gestures is mandatory for any valid performance. It was a major concern of the spectral composition method to rebuild the gestural origins of music within spectral sound spaces. The gestural movement in such spaces was however still abstract and not perceivable in performance. With our direct coupling of dance gestures to the space of musical spectra using FM synthesis on Max 6, the gestural origin of musical dynamics has

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become immediate, the traditional delay between composer's elaboration and performer's action could be eliminated in favor of a direct communication of gestural contents.

TOWARDS A SYSTEMATIC FRAMEWORK FOR OPERA SCORES

It is obvious that writing an opera with multimedia counterpoint features requires an adequate score form. Such a form requires the following score types that denote the opera's activities as a function of time (symbolic time and/or physical time where appropriate):

» Score 1: Narrative: Text about who performs which action,
» Score 2: Music with text: Classical score notation,
» Score 3: Dance: Typically a Laban notation score, but now enhanced by software-driven action such as enabled by the Arduino system described above,
» Score 4: Stage objects: commands about when real world objects are positioned and moved onstage or removed,
» Score 5: Visual media: Classical light commands, but now all projection commands controlled by software environments such as Resolume Arena 4 as described above,
» Score 6: Acoustic media: The sound events generated on loudspeakers according to the Arduino system input and prerecorded music chunks.

This multiple track system must however be completed by contrapuntal transformation information that specifies which track is transformed into which other track according to which specific transformation. Graphically, this would be notated by arrows across score tracks, indicating what type of transformation they convey. For example, the dancer will control visual media by hand gestures, generating transformation arrows from score 3 to score 5, or the dancer will generate acoustic events via Max 6 when sending body sensor data to a FM synthesizer within Max 6. Dance notation software is available for Laban notation, e.g. from the LabanWriter application. [11]

It goes without saying that such multimedia counterpoint scores would be best realized on a GUI with standard touchscreen features. This would enforce the integration of music notation software (such as, for example, Finale, Sibelius) with software that manages visual and acoustic and body control in-ad output scores, such as Max, Arena, or LabanWriter. Such integration would not only merge the existing components, but also enable implementing and editing of contrapuntal transformations as described above.

A CHALLENGING PROGRAM FOR FUTURE THEORIES OF MULTIMODAL COUNTERPOINT

This dramatic enrichment and deepening of the core idea of the opera art form becomes more tangible if we try to understand the extended intermodal counterpoint which is required by the six-fold score system. Observe above all that classical Fuxian counterpoint in music is a core theory for polyphonic composition. That theory is complex and crucial for artistic sophistication in any style. Our proposed extension would require a vastly extended set of counterpoint theories, managing a polyphony between music, dance, stage objects, visual and acoustic media.

To such an end, the musical category of consonances and dissonances would be extended to concepts of 'consonances' and 'dissonances' between dance movements and visual dynamics, between music and visual dynamics, and so on. – This plan is difficult, mandatory, and still unsolved. In fact, it is well known that most multimedia works of art, especially when enriching music with visual media, suffer from the annoying Mickey Mouse effect of simple parallelism between these modalities. In other words: We propose a challenging project for a future intermodal counterpoint theory, tackling the deep question of how the multiple threads of human sensual expressivity could be interwoven to what Wagner had vaguely addressed as a Gesamtkunstwerk. It is essential to understand that such an endeavor can only succeed with a strong support by advanced multimedia technology. ■

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