GIVING THE RESONANCE A FORM

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formResonance

ART MUSIC DESIGN THEORY

Audio-visual digital synaesthesia: audio-driven image generation as a performative and artistic visual appearance for an electronic music label, or: giving the Resonance a Form

by

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> *"Just before an airplane breaks the sound barrier, sound waves become visible on the wings of the plane." (Marshall McLuhan: The Medium is the Message)*

What makes my eyes magically drawn towards the bright, digital canvas while attending the live show of the experimental audiovisual artists of raster-noton? Why is it that I often like to see abstract or concrete film and animation while listening to straight 4/4 house music? Why is the whole – light, film and video together with music – experienced as something greater than the sum of its parts?

Music and images have the potential to fit together quite well. Although fundamentally different in perception, their combination in form of *visual music* has a magnetic attraction or (in lack of aesthetic convergence) repulsion to a person that is attending such a format. It is obvious that both sensory perceptions combined can have a wider, more intense effect on the experience of the listener or viewer. In practice, film music has demonstrated that to most people. Music videos are, or at least used to be, an established art form of its own and sometimes a good example for aesthetic interaction between image and music. Synaesthesia, nature's own visual music shows us that there is more than an invisible connection between both forms of perception, a neurological clue to the interconnection of the senses. There are many reasons to assume that visual music can achieve the state of an integrated experience or even an independent art form. There are many examples of low-quality interaction between sound and music as well, where the image is more or less a side dish for the "lazy eye" and there is no effort made to create a real addition to the experience of music.

In most cases shown by art history and contemporary developments, music is the point for departure for visual creations. This has many reasons. One reason might be that for some artists, music was regarded as the highest art form and delivered the highest potential for inspiration. The painter František Kupka was convinced of the inner contradiction of music regarding its systematic composition and its emotional effect.[1] In the face of the technological and artistic developments of the nineteenth century, Walter Pater, English critic and essayist, stated that "all art constantly aspires to the condition of music."[2] Painters have developed

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[1] see Strick, Jeremy: Visual Music. In *Visual Music,* p.16 (Note: See bibliography for the full statement of all sources.)

[2] Gottdang, Andrea: Painting and Music. In *See This Sound*, p.248 & footnote 3

abstract forms since the modern age, forms that have suited the abstract nature of music better than, for example, a still life. Another reason might be the fact that technological developments have made it easier to precisely map musical parameters onto complex forms, which better suit the form of the underlying music. This is reflected in the emergence of VJs in the last 20 years – "Video Jockeys", who accompany the DJs (Disc Jockeys) with visual impressions. Both parties most often seem to be not equally important in their role in creating an integrated experience. The DJ is still the center of the performance, a fact that elevates the central role of music in this certain conjuncture. Related to VJing, another established and common audiovisual form is called *live cinema,* where the aim is to highly integrate both art forms equally. Both forms' boundaries are fluent, as often seen in emerging art forms.

Visual music, the synthesis of those two contradictory terms, is a phenomenon that has been especially easy to observe with its emergence in popular culture in the last 50 years. The history of visual music shows that it actually has been a long road to today's digital mappings of musical information to visual expression. While some art forms and art movements came and went, visual music remained one of the most persistent forms of artistic expression in the last 100 years.[3] Technological advancement opened the doors to more elaborate visual attempts. Though the last decades proved to provide fitting tools for the establishment of visual music, early ideas of the interaction between music and image are much older. Isaac Newton believed that there was a connection between the color spectrum and musical scale.[4] In 1734, the "clavecin oculaire", an organ-like instrument played to create colored light (instead of tones), was a first attempt at creating a tool for the connection of image and music. Its concept was inspired by Newton's assumptions and other scientific developments of the era.[5] Abstract painters from the early twentieth century explicitly depicted strong musical analogies. This is the case in many of Kandinsky's and Mondrian's paintings. In the 1920s, the works in absolute film by Hans Richter and Oskar Fischinger directly refer to musical structures. Postwar artists such as the Whitney brothers laid the foundation for a sophisticated, highly mechanized production of audiovisual pieces. It was very common in the 1960s for psychedelic rock bands to perform live shows accompanied by light shows to invoke hallucinatory effects in the audience. Today, live cinema, and especially digital

[3] see Strick, Jeremy: op. cit. p.18

[4] Zilczer, Judith: Music for the Eyes: Abstract Painting and Light Art. In *Visual Music*, p.70

[5] ibid.

generative visualizations, are almost a static agent in live performances of contemporary music.

It is interesting to see that generative visualizations, or *live visuals*, the visual music of today, are an expressive medium used especially in the context of electronic music (that is, music mainly produced by digital and electronic means, *synthetic* music). This shows a common acceptance for this art form, culturally integrated from of the idiosyncratic claim to create music with highly developed technology. The affection of the subculture around electronic music with digital processing seems to originate from the understanding of the computer as a universal tool for cultural productions of any kind. Ideas for those processes do not solely correlate within a self-contained hemisphere; rather, they incorporate ideas of the so-called "real world": recreating and interpreting phenomena for a digital means. The title of this work introduces the term *digital synaesthesia*, a term which might not be uncritical in relation to the understanding of synaesthesia as a neurological phenomenon, but it will become obvious that the combination of those two "phenomena" can be regarded as a rapprochement to the ideas of generative music visualization.

We will explore those ideas by finding expressive means for the electronic music label FormResonance. With this collaboration, we will have a chance to discover how generative visualizations can be integrated in a context of a small, emergent institution in the electronic music scene. These will serve as a visual appearance for an otherwise audio-dominated institution.

The works introduced within the course of this thesis all have an experimental character. That must be said, because there is no school, theory, or comprehensive guideline to visualize music. Although visual music has existed for at least a century, the technical potential has only existed (at least for the common user) in the last couple of years. Thanks to the widespread availability of digital tools (in forms of computers, software, languages, frameworks, etc.) many works and ideas have emerged recently. Some show us that digital mappings have an inherent danger of being arbitrary,[6] a danger in a sense that a mapping of data becomes aesthetically incoherent or meaningless. To provide aesthetically integrated live visuals, one might relate to the understandings and works from artists who explicitly referred to music in their works in the early and later phases of visual music. Concerning that, we will start with a survey of the history of visual music.

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[6] see Großmann, Rolf: *Farbklavier, Oszilloskop, Sequencer. Technische Transformationen von Ton und Bild,* p.111

Historical Developments

When studying the history of visual music, one fact is inevitable: there is no elaborate culture of historical examination of visual music. This is not the case just because visual music is a continually self-reinventing phenomenon. Some find its origins in the "clavecin oculaire" of the eighteenth century. Others find it in the theories of abstract painters and classical composers beginning in the nineteenth century.[7] The reason for this incoherence lies in its specific nature. Visual music inhabits a hybrid position. It aims to connect two arts that were (and still are) institutionally separated from each other. This hybrid character has led to a rather non-uniform exploration of this phenomenon that has become so present in the last decades.[8]

A short contemporary view on visual music

To determine the precise origins of visual music is impossible. What can be said is that Central and Eastern European artists (and technicians) provided important elements for the development of it.[9] Thanks to its hybrid character, a history of visual music is an endeavor yet to be accomplished (and certainly not the aim of this thesis). To write about it, "one would need to include opera, dance, theater, performance art, orchestral scores with visual components, and even amusement parks."[10] A history of visual music is a meta-history, inflatable or deflatable, depending on the context.

The artistic development of visual music has always depended heavily on technical constraints. In this context, the invention of the "clavecin oculaire" is often mentioned introductorily. It shows a great dependency of realizing (very early) multimedia concepts on the basis of contemporary technology. The *clavecin*, a color organ, existed only as an idea most of its time[11], because the lack of cultural and technological means prevented its

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[7] Daniels, Dieter and Naumann, Sandra: Introduction for *See This Sound*, pp.5f.

[8] Rifking, Ned and Strick, Jeremy: Forword / Preface to *Visual Music*, p.10

[9] Zilczer, Judith: op. cit. p.27

[10] Alexander, Amy: Audiovisual Live Performance, in *See This Sound*, p.198

[11] Jewanski, Jörg: Color Organs: From The Clavecin Oculaire to Autonomous Light Kinetics, in *See This Sound*, p.77

inventor, French mathematician and Jesuit priest Louis Bertrand Castel, from establishing a new form of "popular domestic entertainment".[12] This was followed by at least one other approach, the first attempt that might be labeled *popular*, the color organ by Alexander Wallace Rimington (Figure 1). He successfully demonstrated such an instrument (which itself produced no sound, but was meant to be accompanied by music) in front of an audience at St. James Hall in London in 1895. The technological advancement, especially in the area of electric illumination, proved crucial for a feasible solution. Rimington's success was the starting point for a number of artists who became interested in the so-called "color music", and the technique became widely known in the modern age.[13] Like every new medium, color music gave its practitioners various technical problems. Despite these problems, they started to actively use the technique in their artworks. Alexander Scriabin might be one of the most prominent figures in the early phase of visual music. In 1908, he wrote a part for colored lights in his symphony "Prométhée, Le poème du feu". Unfortunately, technical difficulties prevented the use of any light instruments at its premiere in Moscow in 1911.

In the early twentieth century, approaches to visual music intensified.[14] Presumed synaesthetes like Scriabin and Kandinsky developed a new language in painting and music, making use of their potential for abstraction gained with their physical condition. Kandinsky's stage composition "Der gelbe Klang" ("The yellow sound") from 1911 contains directions for colored lights. Hand in hand with modern approaches, romantic, theosophical movements and theories formed around color, pure shape, music, and the general unity of all arts based on common principles.[15] Kandinsky devoted one essay (Concerning the Spiritual in Art, 1911) to that topic. Technological inventions and improvements evolved as artists and technicians developed more elaborate devices to project light. Kandinsky explicitly used musical analogies not only in his work but also in his terminology ("Improvisation", "Komposition", dark blue as an analogy to the tone of a contrabass, etc.).

Later that century, avant-garde artists and early experimental filmmakers such as Hans Richter and Oskar Fischinger developed the genre of "absolute film". Their forms and especially their rhythmic structures have musical qualities, although their movies were mainly silent. Fischinger's abstract films (*Studien*) were described as a fusion of cosmic and

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[12] Zilczer, Judith: op. cit., p.70

[13] see ibid.

[14] Jewanski, Jörg and Naumann, Sandra: Structural Analogies between Music and the Visual Arts, in *See This Sound*, p. 390

[15] see Großmann, Rolf: op. cit. p.111

Figure 1 **Alexander Wallace Rimington and his color organ, 1893**

Image taken from *The Hidden Sense*

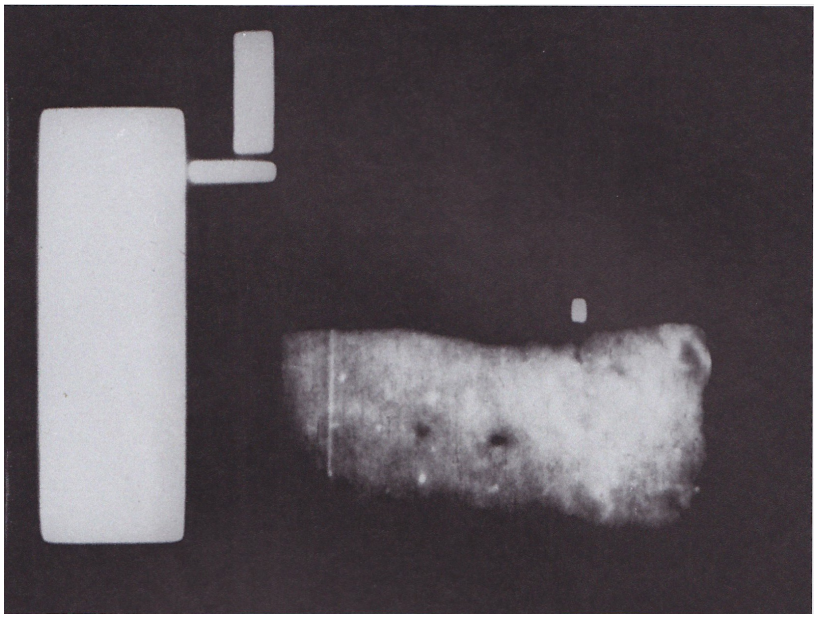

Figure 2 **Rhythmus 21 (1921 / 24) by Hans Richter**

contemporary, characterizing modern times, yet still arbitrary in linking shapes, color, and sound.[16] Whereas Fischinger was also a creative artist occupied with commercial works (he canceled his experimentation in visual music because the results left him unsatisfied, lacking an open aesthetic strategy[17]), Richter remained an explorer of emerging forms of art like experimental film. His works "Rhythmus 21" and "Rhythmus 23" are silent and display a very pure development of geometric rhythms (Figure 2). He also remained a painter; his "Orchestration of Color" (1923) is a painting reminiscent of other abstract artists of his time and, as the name suggests, tries to connect with musical notions and ideas in its abstractness.

Since the 1930s, visual music has developed from a "relatively obscure output of a handful of avant-garde artists, color-organ inventors, and color-sound theorists to a more public oriented phenomenon with mass appeal".[18] Disney's animated feature length movie "Fantasia" (1940), in which Fischinger was involved, is an example of the institutionalization of visual music in mass culture.

A number of following abstract painters found inspiration and motifs in the structure of music. In the 1940s, Mondrian devoted a series of his works, the "Boogie-Woogie" series (Figure 3), to the music he used to listen to in his later years, played in local jazz clubs in New York. Art critic James Johnson Sweeney described his paintings as he could see the musical structures and movements in them, and Ernst Gombrich simply stated that he does not "know what Boogie-woogie is, but Mondrian's painting explains it to me".[19]

As technological developments continued to allow even more sophisticated and multi-medial creations, the history of visual music is obviously bound to that development.[20] The relationship between music and visual arts was a subject for even more exploration with the new emerging media and shifted from film to installations and even happenings, "a trend in which the further expansion of the concept of what is music (and what is art) also played its part."[21] Brothers James and John Whitney and groups of light show artists in the 1960s and 1970s were already highly trained, mainly because they made an effort to develop new techniques and machines. Their work is described as a step towards the "musical inner mind",

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[16] Brougher, Kerry: Visual Music Culture, in *Visual Music*, pp.110 & 145

[17] Großmann, Rolf: op. cit. p.112

[18] Brougher, Kerry: op. cit. p.96

[19] van Campen, Cretien: *The Hidden Sense. Synesthesia in art and science*, p.59

[20] see Strick, Jeremy: op. cit. p.18

[21] Gottdank, Andrea: op. cit. p.252

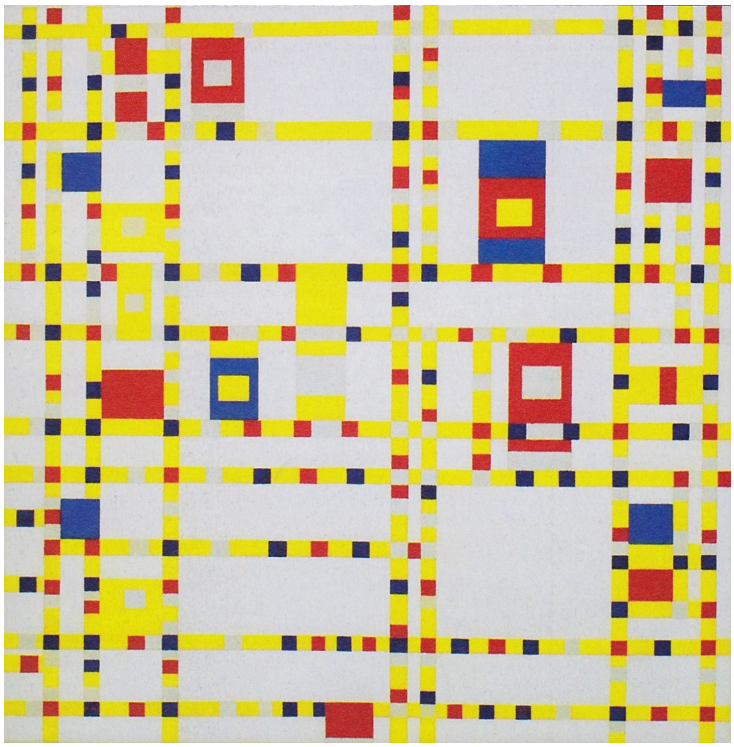

Figure 3 **Broadway Boogie Woogie (1942 / 43) by Piet Mondrian**

Figure 4 **The Joshua Light Show with Frank Zappa and the Mothers of Invention, The Mineola Theater, Long Island, New York, 20 December 1967**

Image taken from *Visual Music*

especially when comparing their works with Fischinger's "relatively arbitrary links" and Kandinsky's "reconstruction of landscape", departing from the real world.[22] In popular music, collaborations of light artists like "The Light Sound Dimension" and the "Joshua Light Show" (Figure 4) were as important as the bands that played in front of the walls and curtains onto which visuals were projected. With their psychedelic visualizations, they aimed to "replicate the interior aurora borealis caused by ingesting LSD".[23]

In the 1960s and 1970s, portable video equipment made the transition to video art possible.[24] What artists such as Nam June Paik anticipated in the 60s[25] was now to be tackled by a number of emerging artists experimenting with new, relatively low-cost and widely available equipment. Like in early absolute film, the experimental efforts made in this era were soon to establish an aesthetic language. Today's VJs still refer to and further develop this language, although technically, the vast majority have already switched to digital devices, allowing easier variation and alteration of video source material.

The visual music of today creates "exciting references to visual arts while trans-disciplinary approaches play an important role".[26] Although history shows us a long tradition of visual music, it has been in the last few years that artists, visualists, and musicians alike now have the potential and tools at hand to fully implement the ideas of visual music that had been the goal for decades of artists. In 1975, John Whitney anticipated the age of digitalization with optimism when he saw the potential in the coming age of the computer: "The computer is the coequal of the entire repertoire of musical instrumentation and heir to that domain of musical sound. At the same time, the computer is the ultimate kinetic image generative instrument."[27] Digital media "truly" unites music and art, "not only by the experiencing subject, the listener/viewer, but by the artist. They are created out of the same stuff, bits of electronic information, infinitely interchangeable."[28] Digital tools allow the full mapping from digital audio in every of its fine details to a digital canvas that can display virtually anything. However, those data mappings pose a danger in that very digital characteristic. Because of these techniques, the artist can run into conceptual or aesthetic

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[22] Brougher, Kerry: op. cit. p.145

[23] Shaughnessy, Adrian: Last night a VJ zapped my retinas - The Rise and Rise of VJIng, in *Audio-visual art + VJ Culture*, p.11

[24] Alexander, Amy: Audiovisual Live Performance, in *See This Sound*, p.200

[25] e.g. Nam June Paik: *Electronic Video Recorder*

[26] Harenberg, Michael: Virtuelle Instrumente zwischen Simulation und (De)Konstruktion, in *Sound Cultures*, p. 93 (translation by the author)

[27] Whitney, John: *Computational Periodics*

[28] Strick, Jeremy: op. cit. p.20

arbitrariness of what is to be displayed. Because everything can be displayed in any way, it is now even more important to focus on what should be displayed, i.e., to decide on the characteristics of the mapping. How to fill the blank canvas with *live visuals* will be discussed in a subsequent chapter. Beforehand, why visual music was and is appealing to the mentioned artists and their audiences is discussed.

Digital Synaesthesia

"We never see the same thing when we also hear; we don't hear the same thing when we see as well." (Michel Chion: Audio-Vision. Sound on Screen xxv)

When we ponder the introductory question of why the eyes are drawn to the bright canvases on the stage where visual music is shown, we come across a fundamental issue, the issue of why visual music works (or sometimes doesn't). The last chapter described that visual music has obviously appealed considerably to artists and musicians alike. Were those reasons founded in the idealistic, romantic aim for the unity of the arts? In fact, this might only be one of the various explanations for the potentiality of visualizations in connection to music. Mitchell Whitelaw refers to the audiovisual work "Photosynthesis (AOR)" (2005, Figure 5) by the artist Robin Fox when he tries to explain his impression, "The work itself seems to somehow induce synaesthetic experience. The correspondence between sound and image is immediate, agile and intense; the audiovisual relation is completely consistent, somehow self-evident, yet continually surprising."[29] What creates this *consistency*? Does *self-evident* mean that there is an immanent quality within the connection of audio and video? Does everyone else feel the same while seeing this particular artwork?

Visual music is often accompanied by a certain phenomenon, which is also connected with the ideas and biographies that constitute the field of visual music: synaesthesia. Synaesthesia is a neurological phenomenon that can be observed in a small percentage of the world's population. Synaesthetes perceive with their senses in an interconnected way: they see color tones for music, taste colors, hear an image, and so forth – in the literal meaning. It is generally agreed that its basis lies in the "increased connectivity between normally separate neural regions or modules"[30]. The phenomenon occurs involuntary and is reproducible in each individual but varies among individuals.[31] It is known and speculated that quite a few

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[29] Whitelaw, Mitchell: *Synesthesia and Cross-Modality in Contemporary Audiovisuals,* p.262

[30] ibid p.264

[31] see ibid. p.265

artists and musicians (some of them among the aforementioned) were synaesthetes and made use of their abilities to create their artworks (either conscious of their condition or not). For instance, Scriabin, an assumed synaesthete, was certain that sounds and their *matching* colors would create a "powerful psychological resonator".[32]

Particularly interesting for our means is music-form synaesthesia, because it directly refers to the visualization of music:

> *"When it is silent, I see a black space, somewhere at an angle above me, but it looks different from the thing that I perceive with my eyes. The forms that I perceive are often colored lines that disappear from the left and right of the image. […] For instance, I see plop-sounds as circles, which is entirely logical of course. That's why I always thought that everyone perceived sound in this way. All of them look so logical."*[33]

Synaesthete Patrick Heller, one of the various exemplary individuals whom Cretien van Campen interviewed for his book "The Hidden Sense", very figuratively describes how he literally sees his synaesthesia. French composer Olivier Messiaen described his music-color synaesthesia as something he always took for granted,

"When I hear music – and it was already like that when I was a child – I see colours. Chords are expressed in terms of colours for me – for example, a yellowish orange with a reddish tinge. I'm convinced that one can convey this to the listening public."[34]

Which effects does this hard-wired natural phenomenon have for audiovisual artists? First, there is a concept that explains and interprets the idea and its immanency in our perception. Although most people are not synaesthetes, and in this particular case, not music-form synaesthetes, there is proof that non-synaesthetes and synaesthetes make similar mappings between two occurrences in the visual domain.[35]

In the case of music visualizations, i.e., the mapping of music, there is a certain analogy between synaesthesia and live visuals. On the one hand, we have a hard-wired *neurological* "visualization", on the other we have a hard-wired *computational* visualization. Simply put: with the same input (music), we will have the same result (image). How this mapping occurs from subject to subject is based on the individual and the algorithm. It must be noted that

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[32] van Campen, Cretien, op. cit. p.50

[33] Patrick Heller's brief description of his synesthesia, cited in van Campen, op. cit. p.11

[34] Olivier Messiaen, cited in Jonathan W. Bernard, Colour, *The Messian Companion*, ed. Peter Hill (Portland: Amadeus Press, 1995), p.203, cited in Brougher, Kerry: op. cit. p.121

[35] see Whitelaw, Mitchell: op. cit. p.264 & van Campen, Cretien, op. cit. p.145

this analogy is quite simplified. Science has not yet uncovered the inner workings of synaesthesia. However, it points out the idealistic potential synaesthesia bears, an ideal to which visual music can strive. Digital synaesthesia is a notion that unites the effort made in this field with the help of digital means. The use of the term *synaesthesia* in this context is to be understood rhetorically, describing the phenomena of musical-visual effects in the context of visual music. Nevertheless, the actual neurological-phenomenological synaesthesia, its characteristics, and immediate expressiveness will provide inspiration for the practical parts of this work.

Cross-modality and synaesthesia

As Whitelaw notes, the analogy of live visuals and synaesthesia "provides a mapping that aligns subjective sensation with audiovisual signals; it maps perceptual or even neurological structures onto technical structures."[36] In fact, close correlations between sound and image are "an everyday perceptual occurrence".[37] Whitelaw remarks that the bindings of different sensory perceptions, such as the sound of glass which shatters and causes a crashing noise, are bound into groups by our perceptual system "that often correspond to objects in our physical environment […] The act of making a binding is pleasurable in itself […]"[38] Consequently, "our limbic system apparently rewards us for detecting sensory correlations in our environment, even in advance of the final recognition of an object […]"[39] Furthermore, it has been proposed that more abstract relations (like the relation of sound and image) are "reinforced by a limbic reward".[40]

Different terms are applied to this phenomenon. Whitelaw proposes "cross-modality", while Robert Hulsman, a neuropsychologist from the University of Amsterdam, introduces the term synchronaestesia for multisensory perceptions, "such as when the simultaneous perception of a melody and a visual animation on a screen evoke the feeling of a match of music and image in a person."[41] Michel Chion uses the term "synchresis" for the "natural

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[36] Whitelaw, Mitchell: op. cit. p.261

[37] ibid. pp.262f.

[38] ibid. p.268

[39] ibid p.269

[40] ibid. p.268

[41] van Campen, Cretien: op. cit. pp.146f.

psychological automatism of a motivic connection of simultaneous sounds and images".[42] The systematic difference between synaesthesia and cross-modal perception lies in the fact that only one perceptional modality is stimulated and causes its effect, whereas cross-modal perceptions need at least two modalities. The phenomenology of the two effects is profoundly different. It is here where a *digital* synaesthesia might connect. It is important to cut a line (at least for this work) for the use of the terms cross-modality (respectively synchronaestesia or synchresis, but we will adhere to cross-modal in this work) and digital synaesthesia to point out its layers of use in the context of live visuals.

In a cross-modal context, the pleasant effects of live visuals are founded in the perceptual apparatus of the human brain. Here, it is important to distinguish between cross-modal bindings or emotional, associative links between the two perceptions and genuine synaesthesia.[43] Audiovisual works are objects of perception rather than perceptions. In contrary, synaesthesia is perception, "to put it bluntly, synesthesia, by definition, occurs in the perceptual system of a synaesthete, not in the crossed connections of a video synth. […] We can use the gap as a provocation, rather than an obstacle."[44] The idea of genuine synaesthesia is, again, freely interpreted by the artist, the composer and "conductor" of a *digital* synaesthesia – the synaesthesia which lies within programmatic logic, algorithms, and graphical mapping of one musical modality into a visual one. The reproducibility of synaesthetic effects have their digital metaphor in the algorithm. Synaesthetic effects are *not* transferred onto the perceiver of the results (technologically, that is not yet possible), who rather enjoys the limbic rewards of cross-modal bindings and might create associative links between his perception and his memories.

Cross-modality and intersubjectivity

Is there any common ground on which live visuals are perceived by individuals?

"The intersubjective congruence is so small, that the strive of 'pre-romanticists, romanticists and new-romanticists' […], 'to mutually enlighten the arts not with rationally performed comparisons, but with the help of intuition' resulted not in a culturally established language of sound and image, but still is coined by arbitrariness."[45]

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[42] Daniels, Dieter; Naumann, Sandra: op. cit. p.10

[43] see Daurer, Gerhard: Audiovisual Perception, in *See This Sound*, p.328

[44] Whitelaw, Mitchell: op. cit. p.267

[45] Großmann, Rolf: op. cit. p.111 (translation by the author)

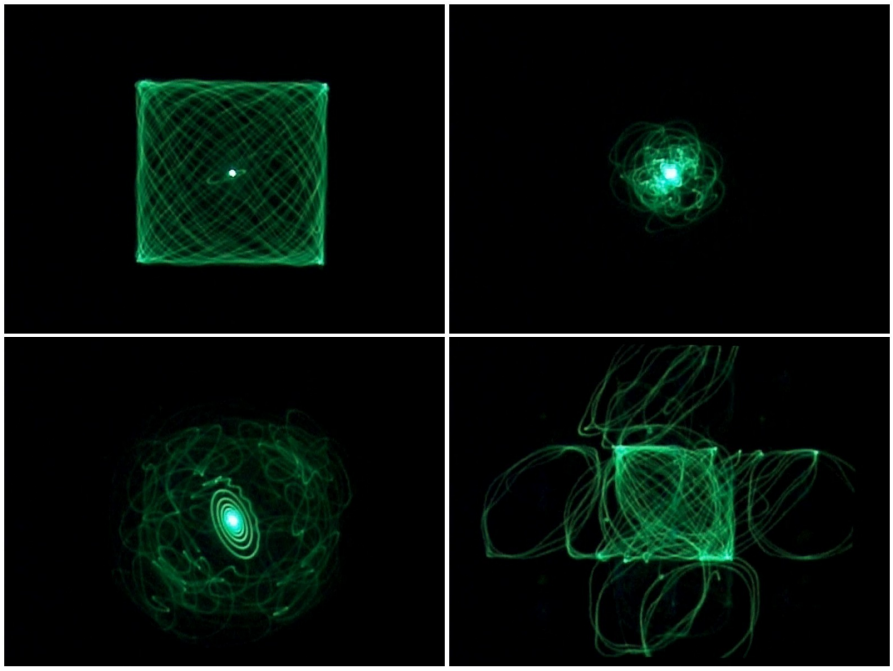

Figure 5 **Photosynthesis (2005) by Robin Fox**

Image taken from *the teeming void*, http://teemingvoid.blogspot.com/2008/10/synesthesia-and-cross-modality-in.html, accessed. January 27, 2011

Figure 6 **Corridor (2003) by Jim Hodges**

Addison Gallery of American Art, Andover, Massachusetts, 2003

There are some indications for a common intersubjective perception, e.g., the connection of brightness and volume with musical pitch.[46] However, it is presumed that there is no "universally accepted synesthesia of color and tone"[47] – these correspondences are different for each individual.[48] Jim Hodges' artwork "Corridor" (2003, Figure 6) shows that color is a culturally induced quality rather than a common indicator for the existence of an intersubjective ground. Especially regarding the different cultural aspects with which an individual has grown, we cannot say that there is any strict evidence for intersubjective perception, merely hints and limited analogies.

Those facts do not diminish the circumstance that there are effects – the contrary is the case, as we have shown before. It rather points out that visual perceptions are interpreted differently and that the results vary from subject to subject. Color, for instance, still remains a "core element of sensory perception, […] it requires no interpretation or decoding, yet can act directly upon the emotions, like a musical note".[49] Like listening to music, where the effects will "provoke different images in everyone, an accompaniment that each draws from his own visual memory"[50], live visuals may have the potential to suggest images, create an integrated atmosphere, and "evoke (for some at least) a similar sense of revelation or noesis [in comparison to synaesthesia]."[51] Factors like time and space are critical for that creation, furthermore. "[…] analogies across boundaries between the senses: intensity, brightness, volume, density, roughness."[52] The setting must somehow be coherent in its aesthetics, i.e., the sensual modalities have to be compatible as far as one has control over them: video, audio, space, time, size of the screen, loudness, ambient lightning, etc.

What meaning do those sensual circumstances have in the context of electronic music and its performance? We will elaborate on those cultural contexts in the following chapter.

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[46] see Daurer, Gerhard: op. cit. pp.332f. & Whitelaw, Mitchell: op. cit. p.264 & van Campen, Cretien: op. cit. p.145

[47] Friedemann, Dähn: Visual Music. Forms and Possibilities, in *Audio.Visual,* p.149,

[48] see Whitelaw, Mitchell: op.cit p.265

[49] Strick, Jeremy: op. cit. p.18

[50] Kupka, František: *La création dans les arts plastiques*, p.132

[51] Whitelaw, Mitchell: op. cit. p.267

[52] Daurer, Gerhard: op. cit. p.332

Filling the visual void: meaning and potential of live visuals

"I really wanted to incorporate visuals into musical presentation, partly because I think that people standing in front of laptops can sometimes look like people checking their e-mail on stage." (Video interview with Chris McNamara, MUTEKMAG)

With the dawn of laptops as a musical instrument during a live performance in the widespread genre of electronic music, performers have addressed the question of performativity[53] and its aesthetics. Until the twentieth century, every musical sound was created by a human, or sometimes, a mechanic movement.[54] The invention of audio recording was a first step in replacing the physically present musician. Nowadays, the use of electronic instruments, usually with the laptop as the central musical instrument of the performance, does not incorporate the physical work and the transparency of live music making in genres such as classical music, jazz, and rock. This lack of visual stimulus in performances is regarded as a shortcoming in the genre of electronic music.[55] For the perception and for the sensory allocation cross-modal gaps begin to unfold, "which can only be partly compensated through the reanimation of situational experiences of the past."[56] This form of performativity negates the unity of perception regarding sound and movement.[57] Instead of waving guitars, beating on drums, sweeping strings and most other physical actions, the performer stands (or sits) behind his equipment, often only consisting of an unfolded laptop, his face lit by the display, his fingers carrying out seemingly arbitrary actions: pressing buttons, moving the mouse, etc. This stands in sharp contrast to rock music,

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[53] see Shane Walter cited in Shaughnessy, Adrian: op. cit. p.46

[54] Harenberg, Michael: Klang (ohne) Körper. *Der Verlust der Körperlichkeit in der Music und die Entgrenzung klanglichen Gestaltungspotenzials*

[55] Cascone, Kim: Deterritorialisierung, historisches Bewusstsein, System. Die Rezeption der Performance von Laptop-Musik, in *Sound Cultures*, p.101

[56] Großmann, Rolf: op. cit. p.110

[57] ibid. p.109

for instance, where the physical movement and the self-staging is actually a fundamental part of the performance. Rock music is bound to visible hand gestures, "it fetishizes the live-event and denigrates recordings, studio effects, synthesizer and drum machines – everything which is not immediately visible, recognizable and present."[58] In contrast, most electronic music incorporates the latter qualities. Thus, it is perceived as rather cold, impersonal, de-humanized, and abstract.[59]

A reluctance to accept electronic music and the anxiety and distrust towards the use of (new) machines in general is the consequence and a common concomitant of electronic music and its specific conditions. "The composing and music making body is consequently negated, imaginary replaced with media technologies of its respective epochs […]."[60] Eventually, by investigating and experimenting, the anxiety of "the world misplaced" by machines flows into the creation of new potentialities, levels, and environments.[61] Marshall McLuhan stated, "The new media are not bridges between man and nature, they are nature."[62] McLuhan might have suggested to overcome established categories and invites to embrace not only the potential but also to deal with the necessity and absoluteness of technical developments. The experimentation that goes with new media technologies, in this case, in the field of music visualization and integration in a performative context, bears the potential to create new procedures and understandings of performativity. Early examples of idiosyncratic performativity in electronic music can be found in the presentation style of Kraftwerk. In their works, they coquet with the dissolution of the individual and the adaption to the machine, not vice versa (Figure 7). Their alter egos lack emotions and remain stoic while acting. Contemporary artist Atom TM (who also successfully plays in the mainly acoustic ensemble Señor Coconut) follows a similar approach in his 2008/2009 "Atom Heart" shows. Instead of conducting elaborate dance maneuvers, he stands behind his groovebox wearing a formal suit and performing the act with the quick wittiness of a bellhop, presenting the grooveboxes' display content alongside abstract, edgy, or geeky visualizations of the music on large screens (Figure 8). Obviously, experimentation with new conditions plays an important role: what is the machine and what can we do with it? More importantly: what will it do with us? For one, as we see with the given examples, it categorizes the cultural

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[58] Cox, Christoph: Wie wird Musik zu einem organlosen Körper? Gilles Deleuze und die experimentelle Elektronika, in *Sound Cultures*, p.179 (translation by the author)

[59] see ibid. p.172

[60] Harenberg, Michael: Klang (ohne) Körper, op. cit. (translation by the author)

[61] Hartmann, Frank: Instant awareness. Eine medientheoretische Exploration mit McLuhan, in *Sound Cultures*, pp. 44f.

[62] McLuhan, Marshall: The Medium is the Message, Audio CD, Prod. Nelson Thall (Toronto: Time Again Productions, 1994), cited in ibid.

conditions and filters them.[63] Those media machines allow us to shape new or altered modes of perception and creation, while we have a head start with the familiar conventionalities of the older, past iterations of a medium.

Obviously, the aim of live visuals is not necessarily to compensate for the lack of human warmth (though it might be used for that purpose depending on content and context of the images). To be coherent with the qualities of electronic music, it would not be inconsequent to approach the cold and artificial aesthetics in the visual domain as well. It is not a sole question of filling the vacuum produced by the artist who operates the laptop in the act of sound generation[64] or to create a "suitable background, the best possible backdrop for a trip to a club or festival."[65] The cultural conditions of electronic music are profoundly different in comparison to rock or classical music. Electronic music is rather anonymous, there is hardly any cult of personality; the DJ and/or act is the executor of musical algorithms developed by thousands of people in collaborative efforts since decades. It is the fascination in sound and the individuals' way of celebrating that sound, rather than the celebration of physical skills, celebrities, images, gender ideals and hierarchies, which gives electronic music its fast momentum. In conclusion, the ideas of electronic music could find their visual counterpart in that very relationship between sound and ideas. It would be consequential: while the physical act of making music is skipped with the help of computers which are *generating* music, why shouldn't the visual part of the *performance* be *generated*?

Generative Visuals

While most VJing has roots in the culture of the music video [66] (enriched with ideas of film and forms of abstract art), generative music visualization may be regarded as predominantly inspired by digital arts such as algorithmic art and the creative use of real-time computer generated imagery. Transdisciplinary approaches and visual relations, departing from the music, play an important role in the search for adequate techniques of digitalization.[67] With this very digitalization of audio and video signals, both had become "de facto calculable, transformable, and manipulable at will" and theories of the *Gesamtdatenwerk*

63 Hartmann, Frank: op. cit., p.47

64 see Frank, Tina and Lia: Audiovisual parameter Mapping in Music Visualizations, in *See This Sound*, p.377

65 Völker, Niklas (aka Codec): The Evolution of the Court Jeser, in *Audio.Visual,* p.237

66 see Wichmann, Heiko: *Die Farbe des Klangs ist der Klang der Farbe*

67 Harenberg, Michael: Virtuelle Instrumente zwischen Simulation und (De)Konstruktion, op. cit. p.93

(an analogy to "Gesamtkunstwerk", the romantic idea of the unity of all arts) may become technically realizable.[68] Instead of a synthesis of the arts as a "cosmological correspondence", the synthesis of live visuals starts with the coupling of technical signals.[69] With the help of digitalization, the algorithm becomes an intermediary between sound and image.[70] Bound to the algorithms' set of rules, images are created as a digital metaphor, a more or less strict mapping between commonalities of data. The "in-between" becomes malleable, and the chosen forms can be almost arbitrary. Normally separate streams of data can be intertwined.[71] Though the arbitrariness is described as the "built-in existential angst" of digital media,[72] the universality of digital data is a basic fact – it is most important how to configure the mapping. Its aim should be to cause revelation, the fact that a new but coherent meaning is transported through the result of the mapping. "The affect is central to the aesthetics of fused audiovisuals; though I would argue it offers more than a neurological hit; it brings us into contact with the abstract but *culturally crucial terrain of the map itself*."[73] The map apprehends questions about its conditions and limits and at the same time tries to answer them, "offering a sense of the abstract transformations that underpin contemporary digital culture."[74]

Based on generated visuals, the new discipline of generative design has been established. Generative design aims to drive graphic and moving image design with the help of algorithms to provide immediate and continuous adaptation for mappings of huge quantities of data. The act of mapping digital quantities generates a new output in the same or a different medium. They are based on mathematical formulations, calculation specifications that form a set of rules of how to graphically *interpret* a given set of data into another medium. The aim is to transform abstract numbers into a "human-readable" form, such as analytic graphics (information visualization) or abstract artworks (live visuals). In the case of live visuals, the output consists of moving images, always changing to the character of the music. "A spiritual automata is mediating between music and performance."[75]

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[68] Daniels, Dieter and Naumann, Sandra: Introduction to *See This Sound,* p.8, p.12

[69] Großmann, Rolf: op. cit. p.111

[70] Whitelaw, Mitchell: op. cit. p.260

[71] Großmann, Rolf: op. cit. pp.114f.

[72] Whitelaw, Mitchell: op. cit. p.273

[73] ibid. p.274 (emphasis mine)

[74] ibid.

[75] Wichmann, Heiko: op. cit. (translation by the author)

Figure 7 **Kraftwerk performing in the 2000s**

Image taken from their website, http://www.kraftwerk.com, accessed January 27, 2011

Figure 8 **ATOM TM, Live in Montevideo, October 18, 2010**

Image by Carolina Faruolo, http://c1.ac-images.myspacecdn.com/images02/139/l_720316949ae34ee494567692590690f0.jpg, accessed January 27, 2011

In contrast to the visual music of decades ago, today we are able to create moving images that are not statically bound to an artistic idea.[76] This new "Syn(c)ästhetik" offers entirely new possibilities of creating visual music.[77] Live visuals which are generated (with their qualities mainly or completely not based on source material such as found footage videos, photos, etc.) can be regarded as an implementation of algorithmic art, i.e., the visualization of a principle, not the end result.[78] The technical question for the graphic designer is, "How do I construct the visual form out of primitive form elements?" The question for the live visual artist is, "How do I translate the principal into an algorithm, a digital synaesthesia?"

In practice

"[By the example], which tries to represent a subject that is abstract and at the same time of compelling reality, one can learn a number of things. In the first place, the possibility of this new representation by itself." (Paul Klee: Beiträge zur bildnerischen Formlehre, in Großmann, Rolf: op. cit. p.116, transl. by the author)

As we have pointed out before, live visuals can be regarded as a "manifestation of the [limbic] pleasure principle in the media arts";[79] they have the potential to increase the joy of attending a performance. They might be used to substitute a lack of physical action by adding their immanent potential, perhaps towards a new idea of live performance. Can it make sense to integrate visuals into the general concept of performance? Along with the establishing identity of a music label, in this case FormResonance, we will address this question. [80]

Live visuals have become an indispensable part of club culture and are celebrated "more excessively than ever before".[81] Though "VJing [live visuals in general] has been about to become the next big thing for a very long time now, maybe even since the first light organ was invented",[82] live visuals have become a common addition to clubs worldwide. It could be

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[76] ibid.

[77] Fischer, Eva and Rommel, Julia: *Syn(c)ästhetik. Sound-audio-Konvergenzen,* p.54

[78] Nake, Frieder: *Die Algorithmische Revolution,* p.57

[79] Whitelaw, Mitchell: op. cit. p.271

[80] Unfortunately, as of now, there was no opportunity to test the visuals in a club context.

[81] Daniels, Dieter and Naumann, Sandra: op. cit. p.7

[82] Graham Daniels in Scholz, Alexander: *What you see is what you hear*, p.22

more prolific for the whole performance if not only the music, but also a visual identity were communicated while those events are happening.

There are various points of departure for the actual role of live visuals in the club context. Live visuals can be regarded as an individual quality of a performance. Some argue that there should not be any narrative nor dramaturgic viewpoints, that it should not draw all the audiences' attention to itself, and that live visuals are not a performance of their own but rather provoke performance.[83] This attitude seems to support the argument of live visuals being only "digital wallpaper" in a club. This expectation of the audience being absent-minded (as Walter Benjamin described the state of mind of the audience regarding film[84]) is thought to be idiosyncratic for a furthermore "jaded post-modern culture that claims to have seen everything." [85] Nevertheless, visual music in general can still be regarded as "visible music, music made visible or, to expand the term, an equal and meaningful synthesis of the visible and audible" [86] and therefore exists in its own right. It is instead a question of conditions to which the visual music is bound, including perceptional peculiarities of the music itself, as well as pragmatic features such as the club space or the audience and their specific attitudes and expectations. Regarding the pragmatics of electronic music, live visuals may be particularly critical and fruitful. One is tempted to say that the artwork is something that might exist in the music itself.[87]

The live visuals, in this case, will be generated and to some extend *designed*. Design in this context means a design out of primitive forms, their relationship amongst each other and their single aesthetic properties. Though a *corporate design* of the label FormResonance is not to be discussed in this work, the live visuals may have the effect of creating an identity which experiments with the notion of *corporate identity*, a conceptual persona which constitutes the self-understanding and way of communicating ideas of FormResonance. In a visually dominated environment, the visual appearance is crucial for a platform which communicates ephemeral subjects like music. In this context, images become a carrier of identity and feature a conveying role; they somewhat become an *after-image* of the music:

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[83] Weiß, Matthias: Images of Performances – Images as Performances. On the (In-)Differntiability of Music Video and Visual Music, in *Audio.Visual*, p.96

84 Benjamin, Walter: *Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit*, p.47

85 Shaughnessy, Adrian: op. cit. p.10

86 Dähn, Friedemann: op. cit. p.149

[87] artist Beck cited in Downs, Mike: New formats / new futures. Technologies and advances in consumer formats, in *Audio-viusal art + VJ culture*, p.44

"As soon as you have music without words, everything else gets substantially more important than before: the label, the sleeve, the picture on the cover, the image on the flipside, the titles. They all become a starting point for your journey through music, or for how music grabs you and drags you into its world."[88]

Live visuals may be added to that list.

[88] Kleiner, Marcus S.; Chlada, Marvin: Tanzen Androiden zu elektronischer Musik? Eine Reise durch das Universum der Sonic Fiction, in *Sound Cultures,* p.224 (translation by the author)

In search of an aesthetic language

"A nerve stimulus, first transposed into an image—first metaphor. The image, in turn, imitated by a sound—second metaphor. And each time there is a complete overleaping of one sphere, right into the middle of an entirely new and different one." (Nietzsche: On Truth and Lie in an Extra-Moral Sense)

Although VJs, having their historical background in music video, are composers of mixed media, flicker films, and generative visuals, we decided to focus the work on the latter aspect. The abstractness of pure and simple geometric forms seems to be congruent with the abstract experience of music. In contrast, music videos serve as a "point of entry for cultural stimulation and distinction".[89] It is yet to be discovered in what way pure generative visuals can serve in this manner, if at all. That makes generative visuals especially interesting as an open field of experimentation, unencumbered by clichés and preoccupations and connected to the pure form of music. The connection with ideas of socio-cultural significance and distinction is rather a distraction than a catalyst for the audiovisual experience. Experimental filmmaker Jordan Belson said,

"I don't want there to be any ideas connected to my images, and if there are any there, if anybody sees any, those are entirely in the eyes of the beholder…. Actually, the films are not meant to be explained, analyzed, or understood. They are more experimental, more like listening to music." [90]

How is the form, the "outer expression of the inner content",[91] supposed to look like? What constitutes the relationship between sound and form? To apprehend this question, we can refer to the idea of the body (in our case the body of visual representation, moreover the

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[89] Wichmann, Heiko: op. cit. (translation by the author)

[90] Jordan Belson, interview by Scott MacDonald, in a critical Cinema 3: Interviews with Independent Filmmakers (Berkley: University of California Press, 1998), p.71, cited in Brougher, Kerry: op. cit. p.128

[91] Kandinsky: On the Question of Form, p.149, cited in Judith, op. cit. p.34

body of music itself) in a Deleuzian sense. Therefore, a body is not defined by its mere form, its function or substance. A body is rather a map which describes the relationship of its "particles" such as movement and rest, slowness, and velocity.[92] This definition anticipates the central aesthetic criteria of live visuals: the fluctuation of single forms over a period of time and the movement and interplay of *multiplicities* which painters such as Mondrian approached in their works.[93] The aesthetic appeal of the body does not originate from single forms, but from their relationship to each other. In interaction with music, we are able to create an audiovisual choreography with forms and instruments, particles and sounds, an ongoing mapping of one modality to another, a digital time-based cartography.

To display this cartography, we are not bound to instrumental (physical) conditions anymore, which compels us to find new answers for the questions raised by the aesthetics of digital technologies.[94] Digital mappings of audio onto an electronic canvas are more than just a contemporary display of visual music; they have the potential to intensify the audiovisual dialogue in terms of precision, complexity, and emergence. A mapping can be precise as long as there is enough computing power. In the terms of Gestalt theory, the *rule of time* demands that the occurrence of different modalities at the same time is crucial for the integrity of the mapping.[95] Therefore, we analyze sound and create the correspondent graphics in realtime. Mappings allow a high complexity of an ongoing, ever changing visual representation and thus can create emergent, unpredictable configurations of visual forms. The challenge is to find a *digital synaesthesia* that appeal to the listener and viewer, that intuitively make sense, and to mediate between physical fact and psychological effect – the cross-modal match.

The personal creative process

The understanding of those basic principles of form and the analogies to music, its rules and ideas recedes us from the permanent danger of falling into arbitrariness. Principles such as space and the interplay of the elements can indeed be understood and transferred to musical ideas and vice versa. It is here where the interrelation between sound and form can begin. However, it is still open as how to proceed in the actual visual formulation. This is where we begin with the creative process of finding *structural analogies*. Because there is no

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[92] Cox, Christoph: op. cit. p.191

[93] van Campen, Cretien, op. cit. p.57

[94] Harenberg, Michael: Klang (ohne) Körper, op. cit.

[95] Whitelaw, Mitchell: op. cit. p.331

unambiguous aesthetic system in which sound can be mapped into visuals,[96] we must find an idiosyncratic and at the same time personal aesthetics which is not exclusively linked to the very music, but also to its surrounding conditions, general musical metaphors (e.g., techno = precise, mechanic movement) and personal interpretations. The visual representation is as subjective as the underlying music and "only subject to a subjective interpretation or personal perception"[97], probably insofar as intersubjective as the cross-modal modes of action give us (only) clues of how human perception works.

First person account

In the course of creating the actual visualizations, the points of departure were always simple. First, there was the idea of a form, followed by the gestalt of the configuration and then the principle of the mapping in which the configuration would change to be in correspondence with the music. I tried to adapt the aesthetics to the underlying ideas and permanently iterated the interpretation until I felt there was nothing more to add and nothing more to remove. Generative design does not necessarily follow a narrative character, especially in such abstract domains of (mostly) vocal-less electronic music. The algorithm gives us a deterministic pattern which reflects musical quantities such as amplitude, frequency, and duration. Therefore, transformations of the design occur, though those transformations will not change the basic character of the algorithm itself. This is somewhat important because I always tried to implement visual points of reference for the audience, points that might allow them to make sense of the visuals, that is, to make the visuals easily understandable in their basic principles.

From the beginning, I followed an approach to create single visualizations that were meant to be universal, but it turns out that they are limited in their use regarding their aesthetic congruency with the underlying music. My visualizations are created in respect to electronic music, nevertheless, this fact is rather an aesthetic point of reference than a technical one. The ideas introduced later are, thanks to the universality of digitally encoded music, also applicable to genres such as rock or folk. But it probably would create an aesthetic discrepancy (also because of the points that are detailed in the latter part of this work), mainly because those music styles have their roots in completely different social and performative environments.

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[96] Jörg Jewanski and Sandra Naumann: op. cit. p.396

[97] Winko, Ulrich: Architecture and Music, in *See This Sound*, p.44

Moreover, even with electronic music, a lot of musical pieces will not work; but here their functions are depicted more by the algorithmic mapping than the aesthetic appeal. That means that certain aspects which stand out and make an individual piece interesting will not be visually represented in the same way as its importance in the piece demands. Therefore, I decided to implement various forms of visualization that not only try to approach the inherent aesthetics of the music, but also its particular musical qualities.

First experiments

I had no practical experience with music visualization before I started this work, though I was aware of the appeal musical visualizations have thanks to visuals for music players such as *Winamp* or *iTunes* when I saw them for the first time a few years ago. When I had the idea to use generative music visualizations for the music label FormResonance, we had already decided on different categories for the types of music we would like to release and support. Those types were allegories for the way in which we could systemize different impressions of musical pieces and musical pieces as a whole. We used the names for the three basic aggregate phases, namely *solid*, *fluid,* and *aeriform* (aerially) to describe music which was danceable (solid), dense, yet dynamic (fluid), or music which was free of an established form and experimental (aeriform). Those allegories gave me a point of departure for my first basic mappings onto simple structures. Figures 9 to 11 demonstrate two different approaches for visualizations meant for *solid* music, whereas Figure 10 shows how I try to extend the concept into the third dimension. For the final works, I abandoned the idea of adding a third dimension (to display on a two-dimensional canvas), because I wanted to first discover how much was possible in two dimensions. My actual starting point for later visualizations was intentionally chosen in simple forms, which take on an emergent quality and complexity in their interplay.

Nonetheless, the creation of those primitive visualizations was a crucial point in the understanding of what can and should be conveyed. Those *maps* provided too much space or simply failed to show the important aspects of a musical piece, because they took almost the whole audible frequency spectrum into account and did not prioritize certain spectrums, especially those in which the most prominent part of the music takes place (to my experience the frequencies below 2000 Hz). I started to focus on specific areas of the frequency band – the areas that were mainly used in the music I would assign to the three different aggregate phases. Further techniques for audio processing and mapping signals onto computer graphics are described later. The first three visualizations in the following gallery show the final results.

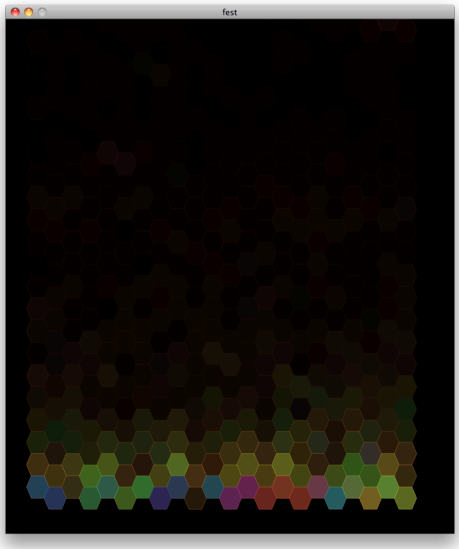


Figure 9 **An early draft of a solid visualization...**

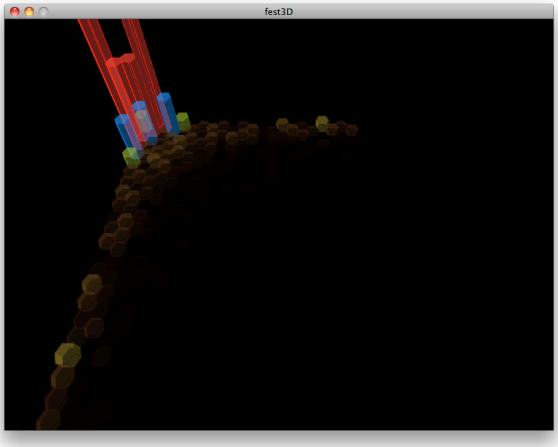


Figure 10 **...and its 3D version.**

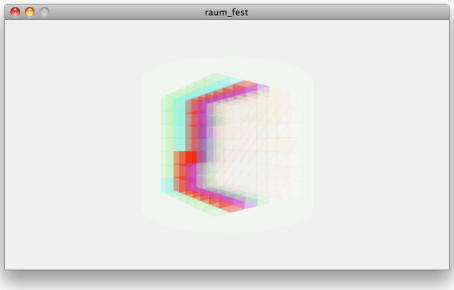


Figure 11 **Another approach for a *solid* visualization as a 3D cube.**

Circumstances and conclusions for the future

In addition to these technical difficulties, problems on the aesthetic plane were encountered. I noticed that the allegories might have helped me in the artistic process, but ultimately were too restrictive. The aggregate phases kept me circling around concepts which were too obvious, yet to impalpable to realize. With the visualization of *aeriform*, I already started to abandon obvious assumptions and interpreted the phenomenon more freely. In the following visualizations, I completely abandoned the connection to any real world phenomenon. In most of the visualizations, I instead started with the idea of a *gestalt* and a principle of how to alter it in the course of musical events. Their origin is of a much more abstract nature. Those ideas were partly inspired by existing works and my own understanding of electronic music, and are therefore rooted in a very personal history of electronic music.

In this course, a process of making the visualizations my very *own* from the beginning – and not a FormResonance visualization first – I was finally free to interpret a wide range of music outside of the repertoire of the label. Therefore, it raises the issue of how effective the visualizations will be in live shows under the label FormResonance – or if I already *left the building*. Nevertheless, it was a necessary process and it might bear the potential to lead me back to my roots with the means and experience I have gained while I was gone.

It is still possible to integrate a great amount of additional techniques in the domains live visuals make use of. Since techniques from two separate disciplines are used which can be regarded as very elaborate – musical audio analysis and generative design – it is important to investigate both fields with thoughtful curiosity. An elaborate generative design concept only works insofar as the audio analysis is appropriate. Many visualizations tend to distract from musical qualities by adding too many visual effects.

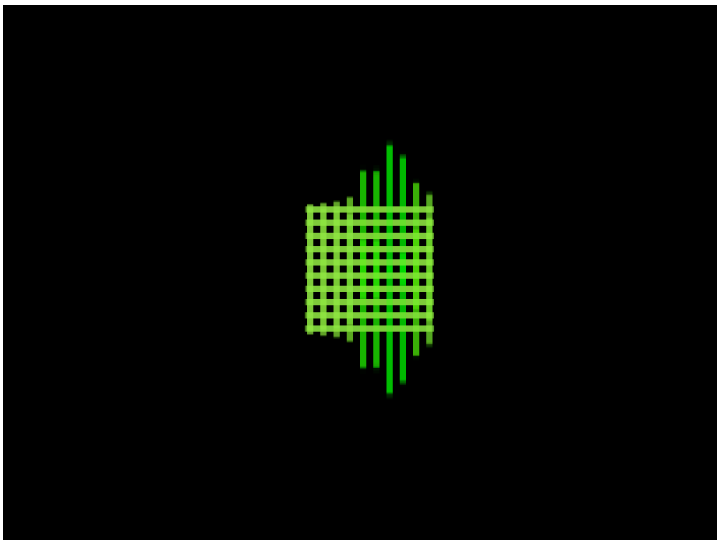
A vast choice of tools and frameworks for live visuals is available already. For my work, I did not make use of them (except for the audio framework for very basic analyzation). This encouraged me to understand the basic principles in music and its reflection in the audio spectrum. The same is valid for the graphics part. From a technical viewpoint, I likely will intensify my skills in both areas for future implementations of live visuals. Nevertheless, I am still more interested in a meaningful expressivity of generative design than to decorate the obvious.

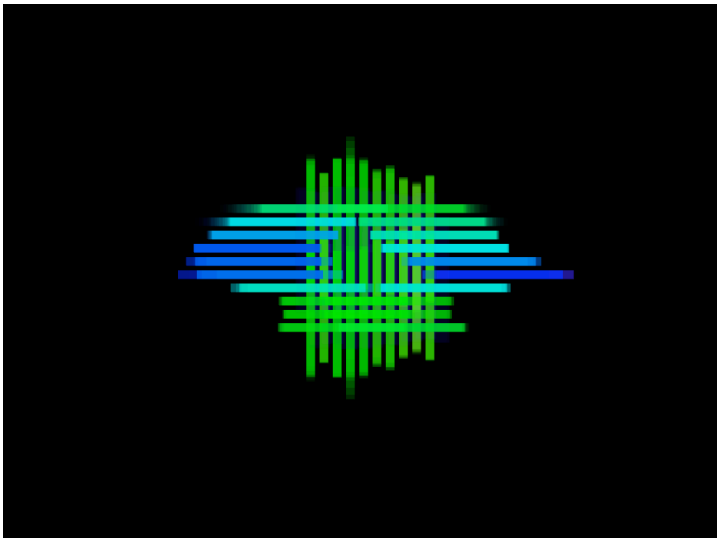
Gallery

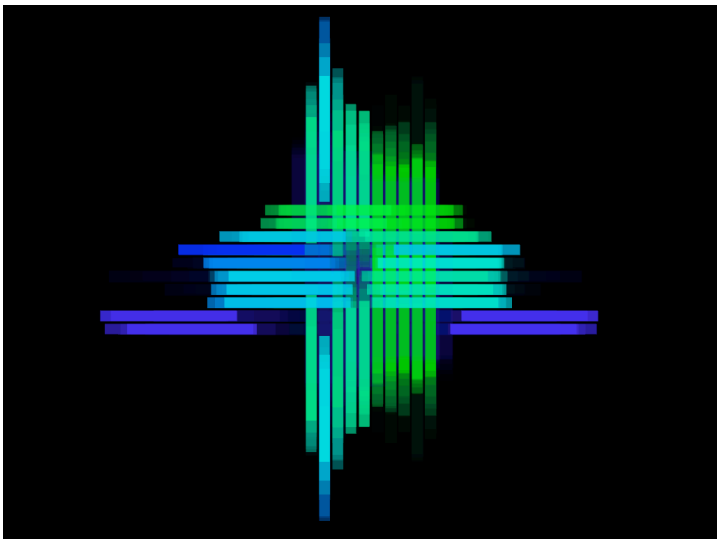
Solid

A solid fiber, intertwined when calm, loosened when there is sound, but always falling back to its natural state. The view is distorted with higher frequencies, which would not move the single threads alone.

This type of visualization is best used with danceable music that has a prominent bass drum and prominent sounds in the middle spectrum.



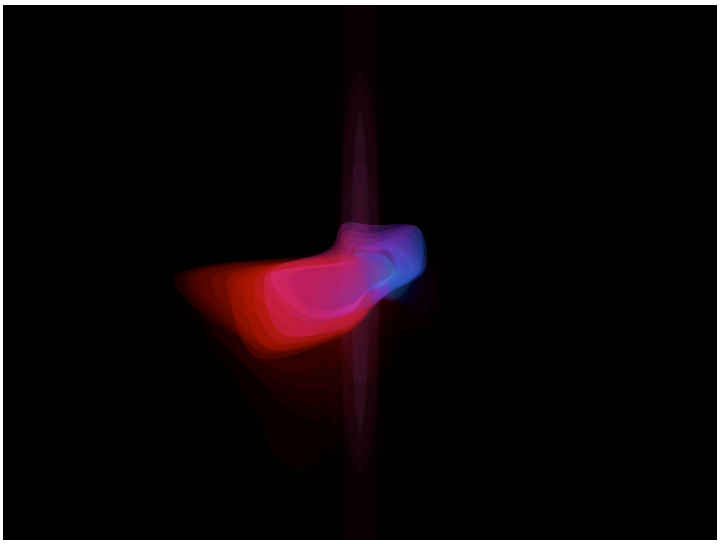


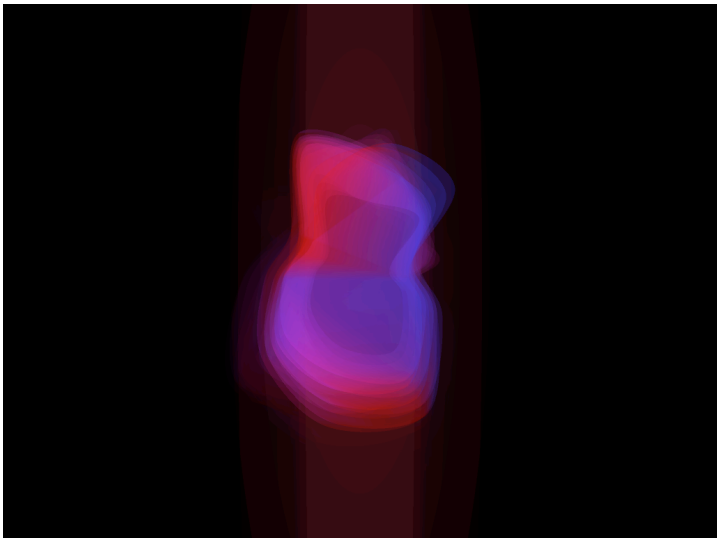


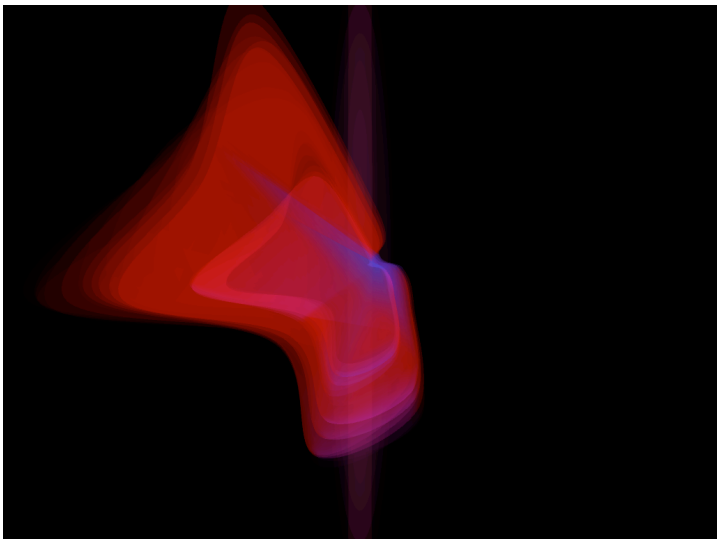
Fluid

A flexible, amorphous mass which deforms its appearance according to frequencies in the lower and middle spectrums. Drums and higher frequencies create a spontaneous flash, a vague shadow of quicker and more subtle transitions than the mass can display.

This visualization works well with music which has prominent lower and middle band spectra.



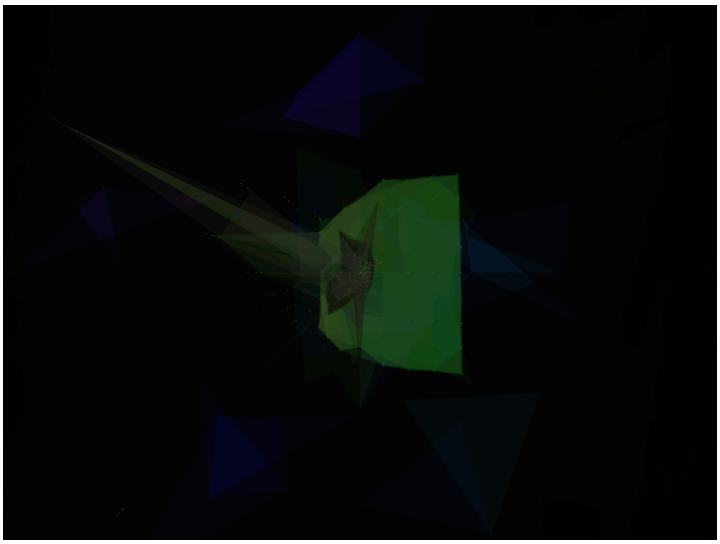


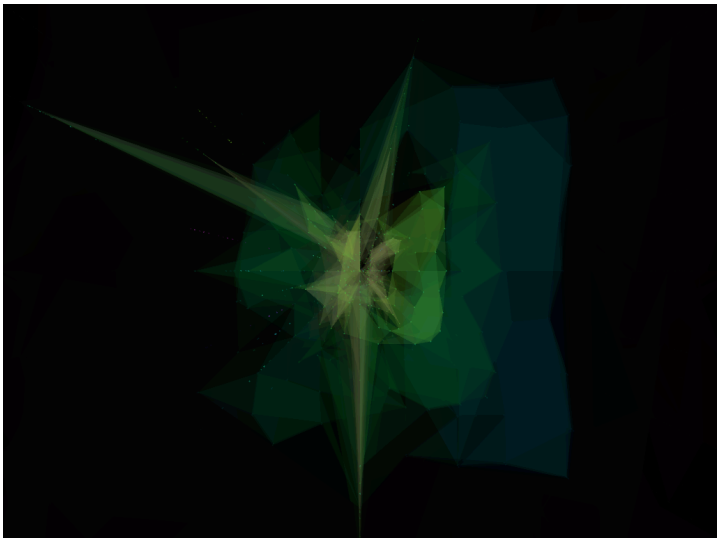


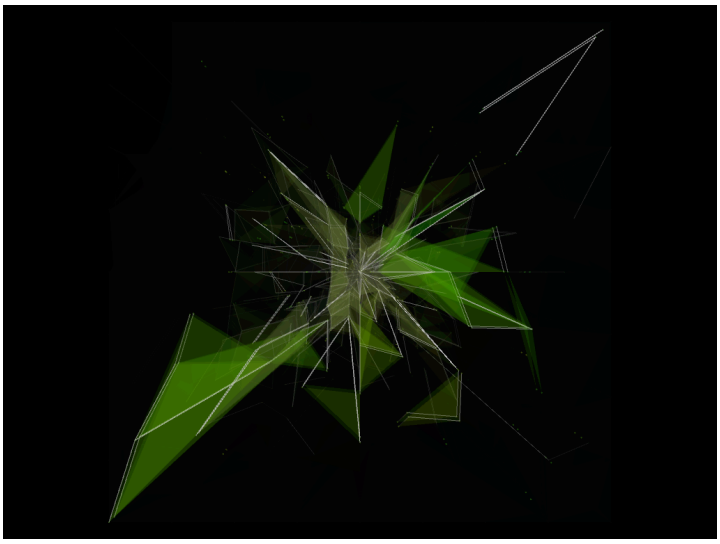
Aeriform

Particles drift towards their ideal positions on a grid if enough musical energy is provided, or else remain in a common resting position. If they are in proximity based on their individual energies and their position in the grid, they react with each other. If a group of particles are reacting with each other, shapes will span between their regions.

This visualization works best with music which has repetitive and prominent amplitudes in any frequency range up to the lower high spectrum. Usually, it does not respect single instruments with weaker overtones.



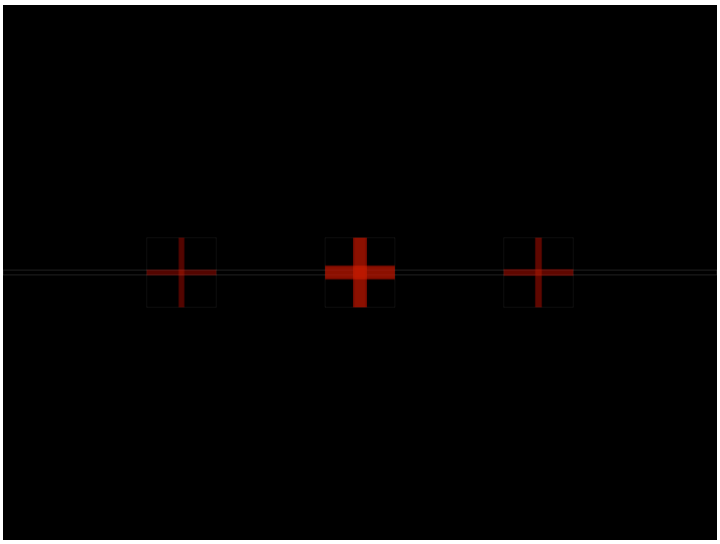


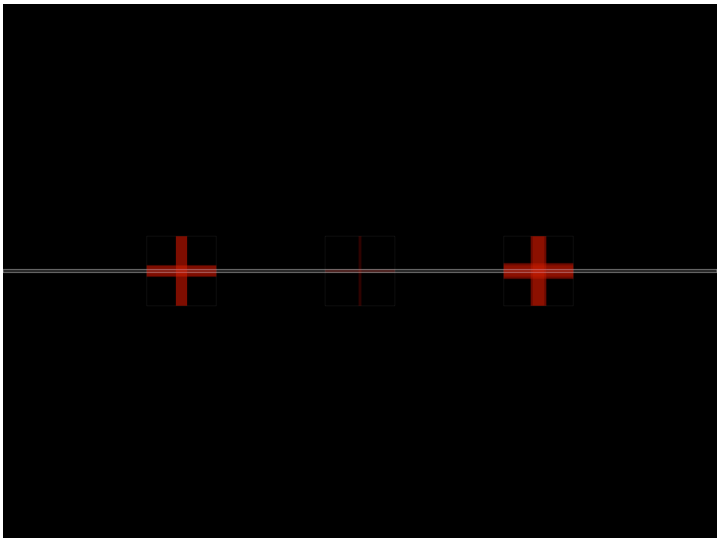


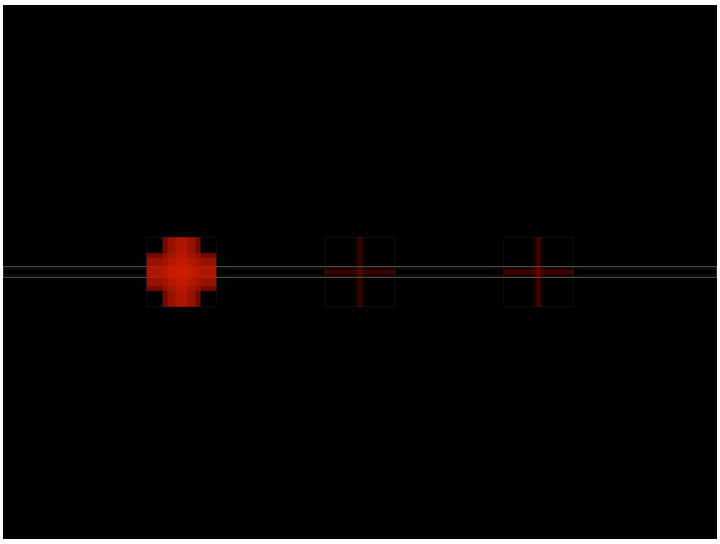
Bandcubes

Probably the simplest visualization, three shapes represent the lower, lower middle and middle bands. The generated crosses suggest a visual concentration on their respective shape, interrupted by occasional flashes generated by steep frequency slopes. This visualization was inspired by regular visits to ophthamologists.

This visualization works best with minimalistic, repetitive, and strongly rhythmic music with regular prominent slopes in amplitude.







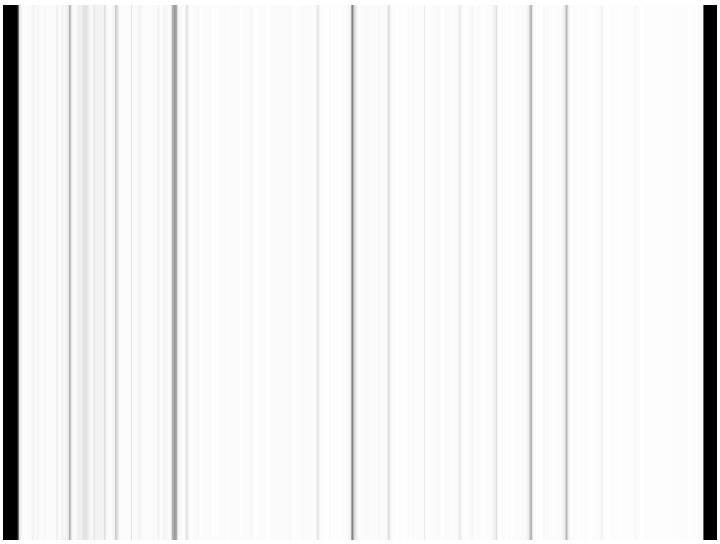
Agnes

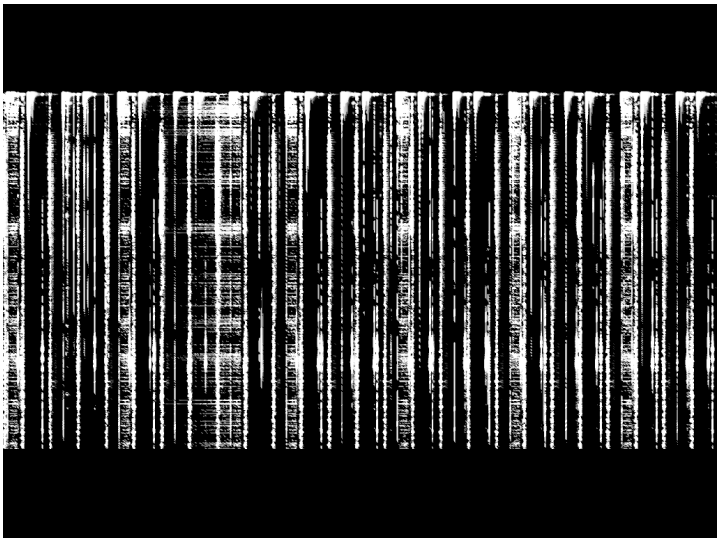
Inspired by the calm and repetitive structures in Agnes Martin`s paintings, this ensemble of three simple visualizations represents the basic idea of dense fabric.

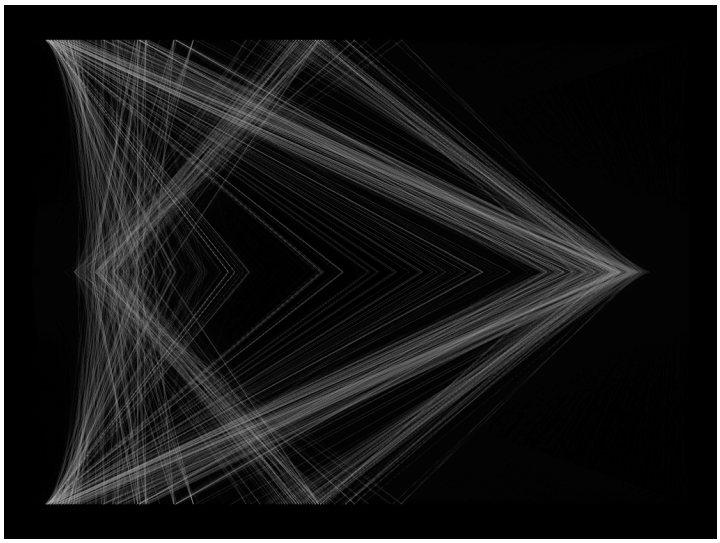
Agnes 1 displays the spectrum as vertical seams, permeating the original structure. It works best with all music which has prominent amplitudes in the whole spectrum up to about 7800 Hz.

Agnes 2 works with all music. It is reminiscent of a common sound visualization, the Sonogram. This mode of display creates complex textures which have their very own aesthetic quality, similar to a loose fabric.

Agnes 3 is a variation of Agnes 1. The seams are now wrapped around two loose joints in the middle, while their beginning and ending is fastened on the two ends of the screen, creating the impression of an ongoing process of weaving. This visualization works well with most music with a large frequency spectrum.



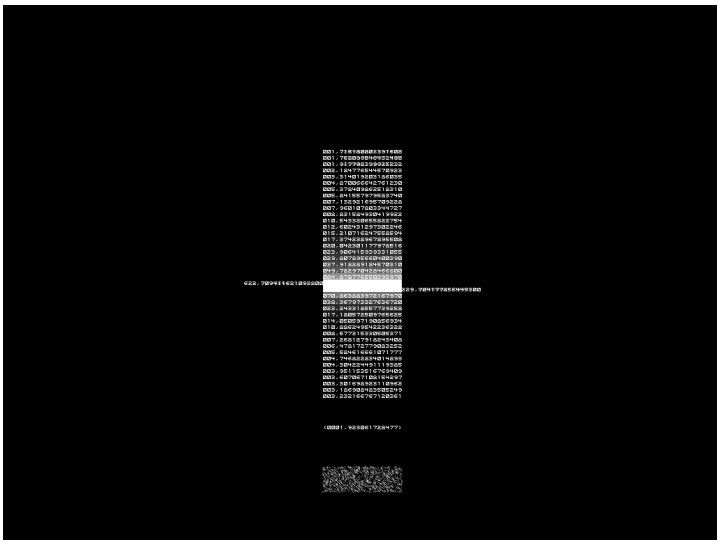


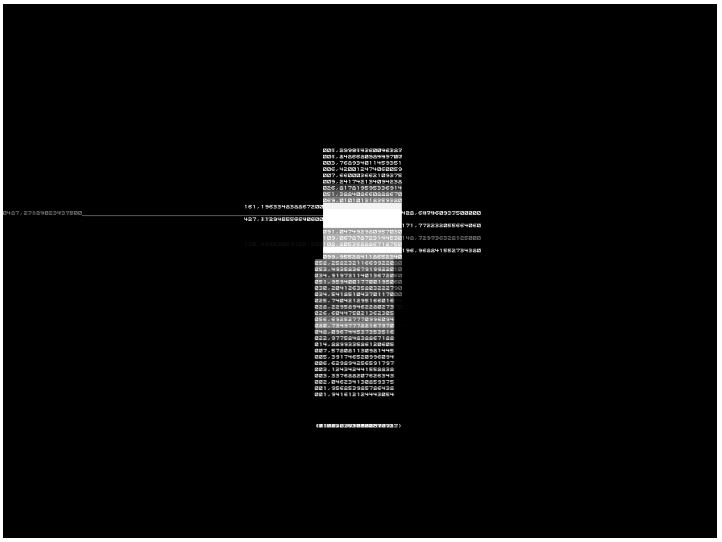


Ryoji

Ryoji is inspired by the installation "data.tron" by audiovisual artist Ryoji Ikeda. data.tron displays collections and vast arrays of alienated numbers, ever changing, coquetting with the communication of raw data, but creates an overstimulation for anyone who tries to follow the actual information. In Ryoji, the amplitudes of the music are displayed but remain useless in thier detail. It is only the sensation of speed and volatility, and furthermore the overall impression, which create the visualization's basic aesthetic quality.

Ryoji works best with music from the low to lower middle spectra. It is the only visualization which needs some manual supervision in the course of its presentation.



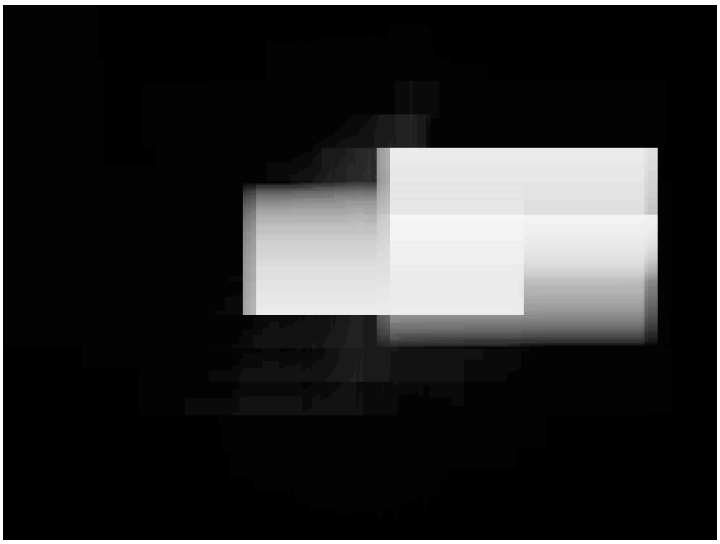


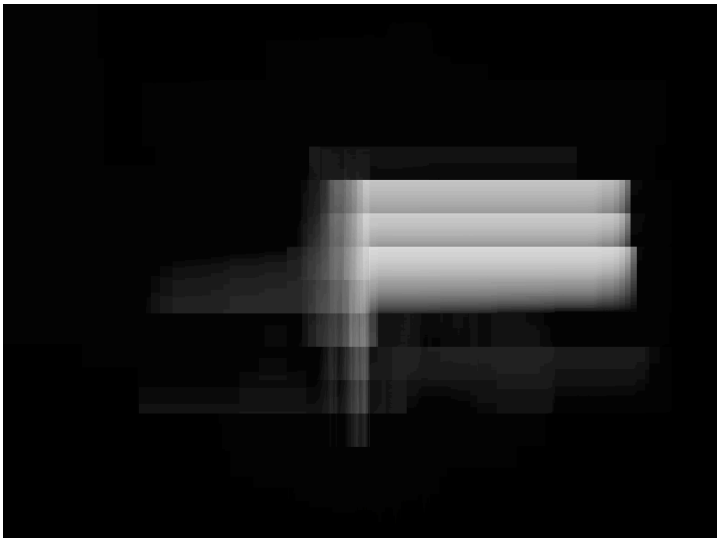

1.5

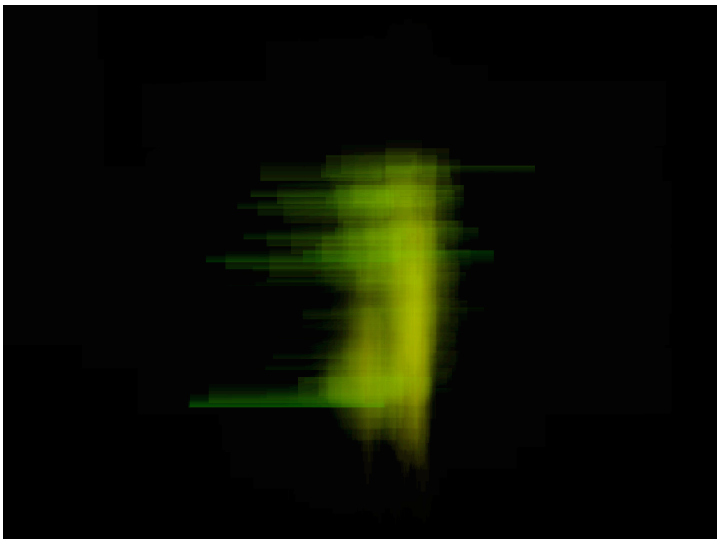
Rhythmus

What would Hans Richter do? The creator of the *Rhythmus*-Series would probably use computers if he had them back in the beginning of the 20th century to show his animated collages of very basic geometric forms. Rhythmus creates ephemeral forms which arrange themselves with a given configuration. Rectangles are intertwined with each other, but their sizes are still dependent on the frequency spectrum each one represents.

Rhythmus works best with sparsely instrumented music.







Technical Notes

Application

All visualizations can be evoked and controlled through a single application that is executable on every Java-capable machine running on Linux, Mac OS or Windows. The application is divided into two windows. One is the window for the visual output, the other one (Figure 12) provides general control and visualization -specific functions.

Implementation

For the implementation, I used Processing, which is a Java-based programming environment aimed at artists and media creatives. The reason I chose Processing was to see results as soon as possible. With very little preparatory work the programmer has to accomplish, he is able to quickly realize ideas of visualizations of any kind. Processing encourages focusing on the main elements of a visual implementation.

Fortunately, this does not necessarily mean that implementations are cumbersome with growing complexity, if more elaborate tasks are pending. I tried to delegate around 2000 lines of code into a clear structure.[98] Each visualization has its own implementation file and is split into a designated setup and drawing method. The main project file (fr_visualizer.pde) controls the audio processing and some necessary program logic. The GUI.pde file creates the user interface and controls functions connected to the interaction with the interface like audio playback.

Audio Analysis

In the implementation I made use of the audio framework “minim” which provides a range of different audio analysis techniques. On the basis of the given methods it provides, I derived some further types of value processing. In order to reflect qualities of the music, it is often not sufficient to exclusively rely on the linear output of the audible audio spectrum of

[98] see attached CD-ROM

20 to about 20000 Hz. Therefore, in some cases, it is much more useful to analyze the spectrum divided into octaves, which is deduced from the linear spectrum. Octaves provide a way of analysis which better fits human audition, because it is more differentiated in the lower parts of the audible spectrum. Most recorded music reflects this fact. The frequencies above 4000 Hz often only reflect the overtones of instruments which have their base frequency in much lower areas. Nevertheless (and for certain types of music), the higher bands are deliberately used as a musical means of accentuation.

Sound is always temporal. The analysis results often reflect this temporality too precisely. The human hearing apparatus sometimes has a certain inertia, and musical tones continue to have an effect long after they have occured. That is why I implemented a "gravity" function, which is some kind of simple interpolation of analysis results. The audio information is not reflected momentarily, but the frequencies are added to a pool of values, each spectrum with its own spot. Those values are continually summed, so that any given sound will not totally evaporate in the "memory" of the audio analysis method just after the moment it has sounded. Instead, a gravitation function is applied to the pooled values: each time after an analyzation step (one per frame, for each pool of frequencies in its respective type of spectral range) they are multiplied by a number below one. Using a gravity of one would cause the pool to grow steadily, using a number of zero would cause the pool to drain immediately after the number was fetched. Therefore, choosing a number higher than zero and lower than one creates a inertia in the end results, the generated images.

I created a couple of pools for frequencies which represent different spectrums and even audio channels. This way, I was able to divide the visualization in different parts and have an appropriate input that fits in an least one of the visualizations. I also implemented a function which will detect sharp transients in the three main spectrums. Often, sharp transients are very prominent for the ear and should have their visual counterparts.

Graphics Processing

Processing is a tool that provides easy access to more elaborate graphical methods in order to enable the programmer to start right away creating complex two- or three-dimensional forms. I only use standard methods for the graphics and tried to keep the creation as simple and comprehensible as possible. Because I later ran into computing power related problems, I quickly decided to use the integrated OpenGL renderer in order to remain fluent in execution of the application. The OpenGL renderer directly forwards

graphical instructions to the graphics card instead of the CPU. Because Processing is based on Java, the overhead of computation is quite large; a lot of the processing is opaque to the programmer in order to allow concentration on the essential parts of the implementation. Those circumstances easily cause Processing to run at less performance than other languages which offer a more machine-oriented programming.

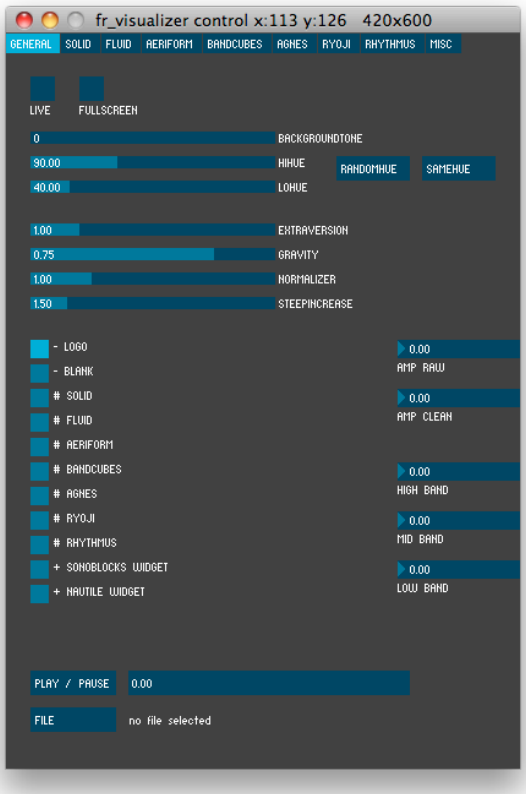


Figure 12 **The fr_visualizer application control window**

Appendix

List of Figures

Note: Figures without the statement of a source in the text are created by the author. Gallery figures are not listed.

List of References

Footnotes referencing edited titles are itemized here, the contributing author(s) is (are) mentioned in the respective footnote.

Audio.Visual

Lund, Cornelia and Lund, Holger (eds.) *Audio.Visual – On Visual Music and Related Media* (Stuttgart: Arnoldsche Art Publishers, 2009)

Audio-visual art + VJ culture

Faulkner, Michael (ed.) *audio-visual art + vj culture* (London: Laurence King Publishing, 2006)

See This Sound

Daniels, Dieter and Naumann, Sandra *SEE THIS SOUND. Audiovisuology. Compendium* (Köln: Verlag der Buchhandlung Walther König, 2010)

Sound Cultures

Kleiner, Markus S. and Szepanski, Achim (eds.) *Sound Cultures. Über elektronische und digitale Musik* (Frankfurt am Main: Suhrkamp Verlag, 2003)

Visual Music

Wiseman, Ari and Zilczer, Judith; Brougher, Kerry and Strick, Jeremy (eds.) *Visual Music. Synaesthesia in Art and Music Since 1900* (London: Thames & Hudson, 2005)

Further sources:

Benjamin, Walter: *Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit* (Frankfurt am Main: Suhrkamp Verlag, 2007)

van Campen, Cretien *The Hidden Sense. Synesthesia in art and science* (Cambridge, Massachusetts: The MIT Press, 2008)

Chion, Michel *Audio-Vision: Sound on Screen.* (New York: Columbia University Press, 1994)

Fadden, Robyn *Chris McNamara presents nospectacle.* Video interview with nospectacle, MUTEKMAG001, 2010

Fischer, Eva and Rommel, Julia: *Syn(c)ästhetik. Sound-audio-Konvergenzen.* de:bug magazine, issue 141, April 2010, pp.54f.

Großmann, Rolf *Farbklavier, Oszilloskop, Sequencer. Technische Transformationen von Ton und Bild.* In Helbig, Jörg (ed.) *Intermedialität: Theorie und Praxis eines interdisziplinären Forschungsgebiets* (Berlin: Schmidt Verlag, 1998)

Harenberg, Michael: *Klang (ohne) Körper. Der Verlust der Körperlichkeit in der Music und die Entgrenzung klanglichen Gestaltungspotenzials* (Telepolis, August 1st, 2010), http://www.heise.de/tp/r4/artikel/32/32966/1.html

Kupka, František: *La création dans les arts plastiques* (Paris: Editions du Cercle d'art, 1989) (translation by Erika Abrams)

McLuhan, Marshall: *The Medium is the Message,* in: Wardrip-Fuin, Noah and Montfort Nick: (eds.) The New Media Reader (Cambridge, Massachusetts: The MIT Press, 2003), pp.203ff.

Nake, Frieder: *Die Algorithmische Revolution*. VIER Magazin 07, University of the Arts Bremen 2009, pp.56ff.

Nam June Paik: *Electronic Video Recorder*, Flyer dating from 1965 for the first public presentation of videotapes at the New York Café Au Go Go, http://www.medienkunstnetz.de/source-text/35/, accessed December 11, 2010

Nietzsche: *On Truth and Lie in an Extra-Moral Sense,* 1873, http://oregonstate.edu/instruct/phl201/modules/Philosophers/Nietzsche/Truth_and_Lie_in_an_Extra-Moral_Sense.htm

Scholz, Alexander: *What you see is what you hear*. sceen magazine, issue #2, 2007, pp.22ff.

Whitelaw, Mitchell *Synesthesia and Cross-Modality in Contemporary Audiovisuals*. Senses & Society, Volume 3 (2008), Issue 3, pp.259ff.

Whitney, John: *Computational Periodics* (California, November 1975), http:// www.atariarchives.org/artist/sec23.php, accessed February 27, 2011

Wichmann, Heiko: *Die Farbe des Klangs ist der Klang der Farbe* (Imagomat, 2004), http://www.imagomat.de/writings/klang.htm, accessed January 13 2011

DECLARATION BY CANDIDATE

I hereby declare that this thesis is my own work and effort and that it has not been submitted anywhere for any award. Where other sources of information have been used, they have been acknowledged.

EIDESSTATTLICHE ERKLÄRUNG

Hiermit versichere ich, die vorliegende Arbeit selbstständig und unter ausschließlicher Verwendung der angegebenen Literatur und Hilfsmittel erstellt zu haben. Die Arbeit wurde bisher in gleicher oder ähnlicher Form keiner anderen Prüfungsbehörde vorgelegt und auch nicht veröffentlicht.

Ort, Datum / Place, date

Bremen, ...

Unterschrift / Signature

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The attached CD contains the implementation and a showreel. Please refer to the readme.txt file in the implementation folder for further details.

This work was prepared in Scrivener 1 and 2 and finalized in Pages 09. Fonts used were Adobe Garamond and Avant Garde.

I would like to thank my family and my friends for supporting me during the course of the thesis. The visualization Rhythmus is dedicated to the memory of Frank Limberg.

– this page holds a CD-ROM –