

eXploring audiovisual Environments

Marie Schacht | FGTIS colloquium | august 27th 2013

Topics

- Hello
- Visual Music
- Generative Design
- Audiovisual Environment AMVIS

introductory example

CHET installation Cynetart Festival, Dresden, 2011

<http://www.intolight.de/blog/2011-unser-jahr-der-interaktiven-raeume>

<http://www.youtube.com/watch?v=MWGRJOj7zwg>

participatory clubbing night: 4 physical interfaces to manipulate music and immersive visuals



Dance Activity Game



Step Sequencer



Laser Harp



Balloon Filter



Visual Music

image - sound relationships, classification proposal

music is

physics.

philosophy.

mathematics.

physiology.

anthropology.

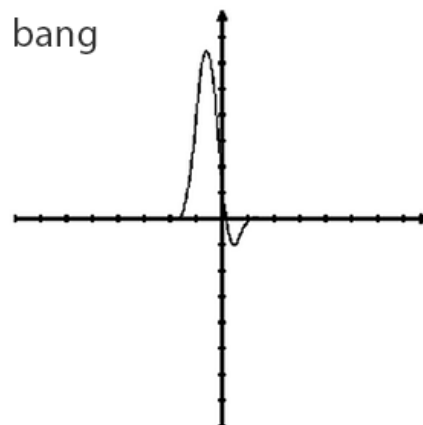
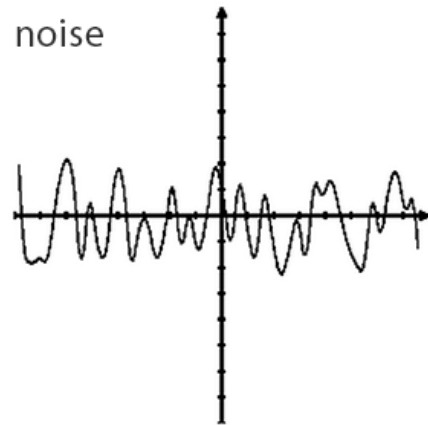
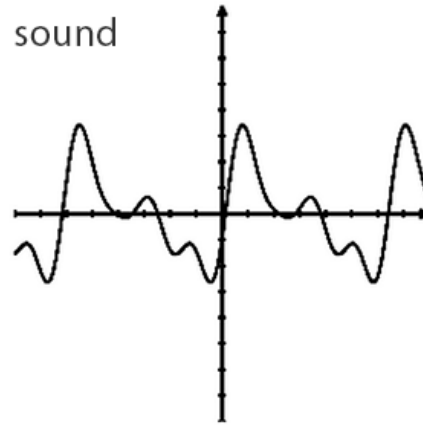
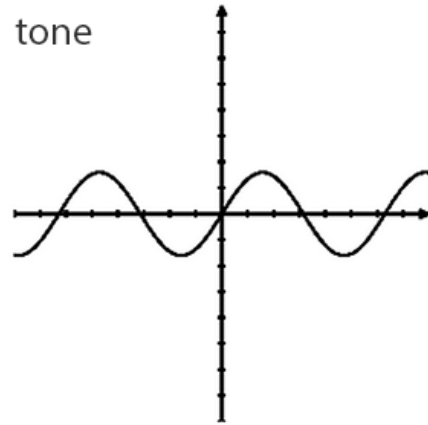
art.

cognition.

aesthetics.

and so much more.

music are consciously created, organized acoustic events.



”

Music enables not only the auditory nerve, but the whole body to vibrate.

[...] When listening to music, the body is music and music is the body.

”

[Vilém Flusser 1991]

visual music

- visual music is an art that explores any interaction between sound and image
- notable history, with beginnings leading back to Greek antiquity
- influenced by scientific insights, technological progress, perception studies and artistic creations
- digital technologies offer diverse ways for the investigation of audiovisual knowledge exchange

visual music >> classification proposal

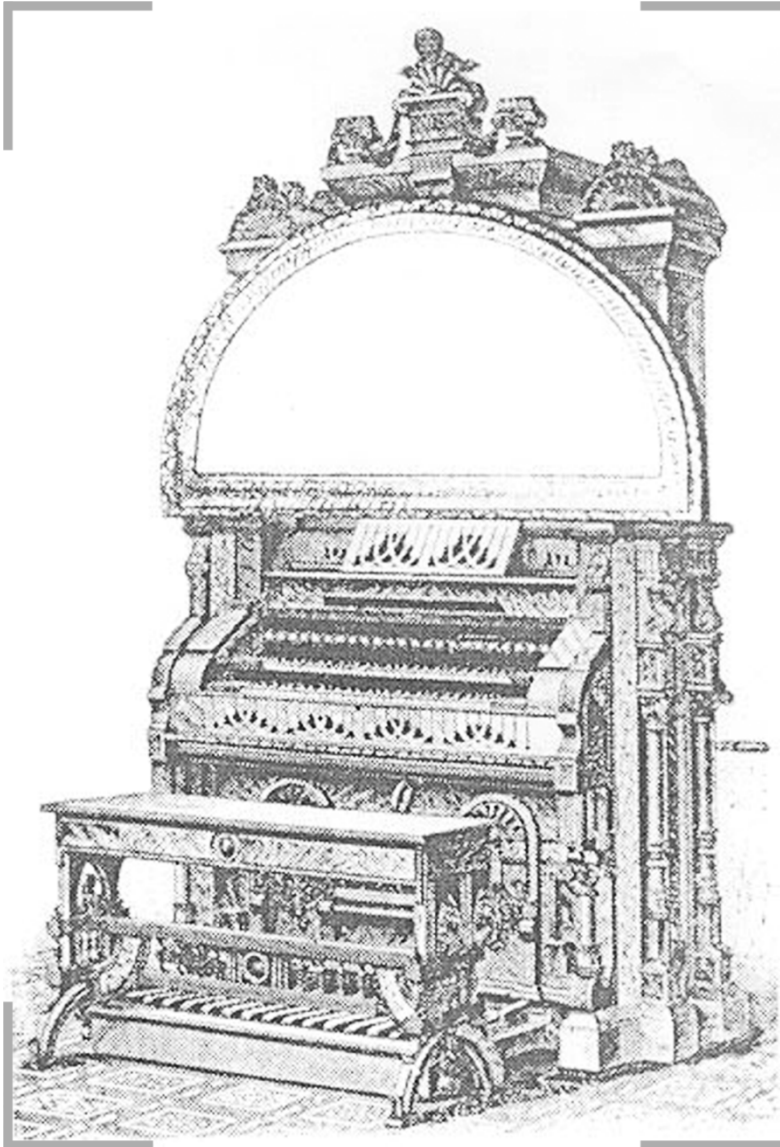
- inspired by publication of JACK OX and CINDY KEEFER, 2008
 - the determining factor for distinction is the nature of the audiovisual relationship
-
- i. A piece of music leads to an image.
 - ii. Sound or music lead to moving images.
 - iii. There is an equal audiovisual recognition and exchange.
 - iv. Imagery leads to noise or sound.

- I. A piece of music leads to an image.



PAUL KLEE: "Fugue in red", 1921

II. Sound or music lead to moving images.



BAINBRIDGE BISHOP,
Color Organ, 1877

visual music >> classification proposal

- i. A piece of music leads to an image.
- ii. Sound or music lead to moving images.
 - a) analogue, mechanical color organ
 - b) digital color piano
 - c) abstract visual music – a contemporary art
- iii. There is an equal audiovisual recognition and exchange.
- iv. Imagery leads to noise or sound.

Sound or music lead to moving images.

video examples

b) digital color piano

<http://vimeo.com/23449490>

c) abstract visual music

<http://vimeo.com/20258559>

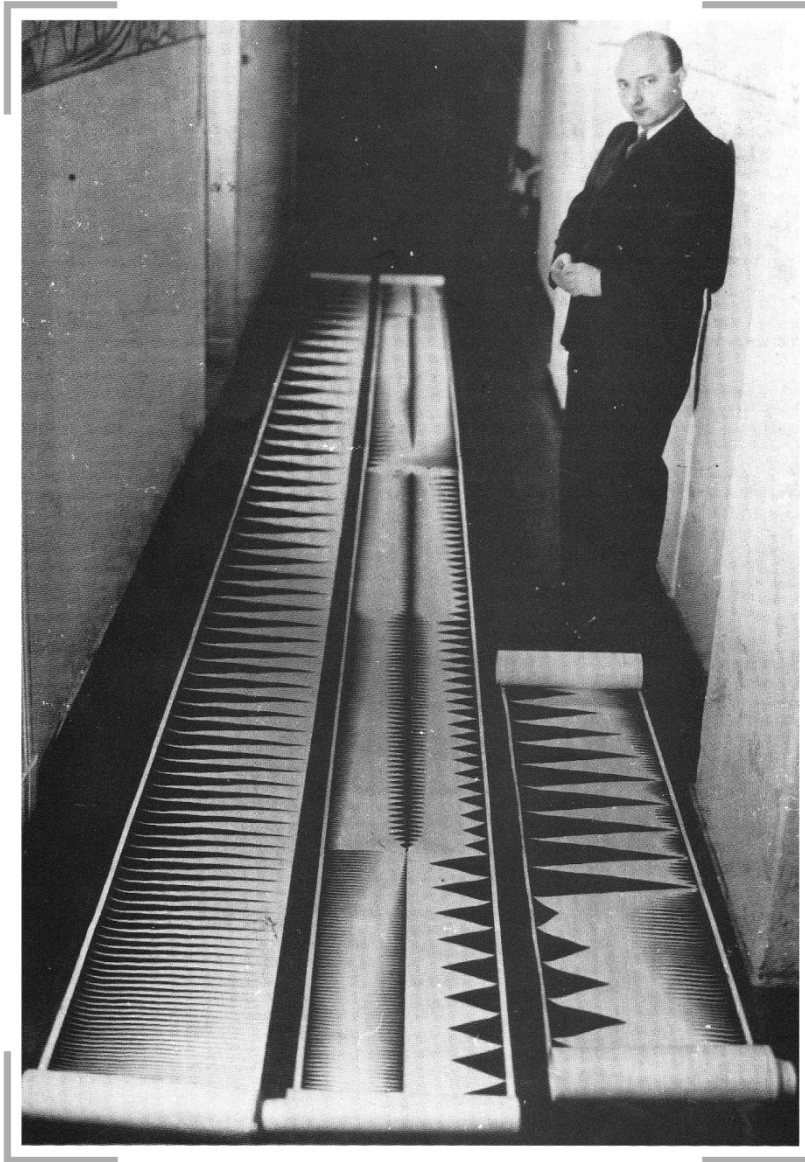
III. An equal audiovisual exchange.



<http://vimeo.com/1582964>

MEMO AKTEN
Pi, Glastonbury, 2008

IV. Imagery leads to noise or sound.



OSKAR FISCHINGER
with ornamental roles for synthetic
sound generation, 1932

parallel structures in Music & Painting

- "The layer model in musical art", a theoretical study by WOLFGANG RUTTKOWSKI, 1979
- several layers can be distinguished, in musical and in painted work alike
- his aesthetic considerations are compared in the following table

	MUSIC ARTWORK	PAINTING
Layer 5 MOVEMENT and LIVELINESS <i>abstracted background</i>		
Layer 4 EMOTIONAL Layer <i>abstracted background</i>		
Layer 3 FIGURATIVE Layer <i>middle layer</i>		
Layer 2 COORDINATION of MATERIAL <i>concrete foreground</i>		
Layer 1 MATERIAL <i>concrete foreground</i>		

	MUSIC ARTWORK	PAINTING
Layer 1	Properties of tones:	Qualities of colors:
MATERIAL <i>concrete foreground</i>	- pitch (tone frequency)	- hue (color frequency)
	- intensity (loudness)	- intensity
	- timbre (tone color)	- color shading
	- tone duration	[no equivalent] <i>unlike music, painting does not design time but space</i>
	opposite poles of tones:	negating colors is similar:
	- no tones: PAUSE	- no color: BLACK
	- mutual occlusion: NOISE	- mutual neutralization: after refraction: GREY before refraction: WHITE

Layer 2
**COORDINATION
of MATERIAL**

*concrete
foreground*

MUSIC ARTWORK

tones bond *horizontally* to melodies



tones bond *vertically* to harmonies
and dissonances

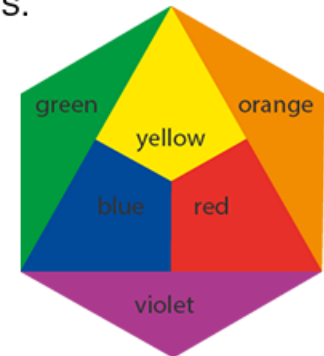


pauses and respective overtones
benefit experiencing the tone itself

PAINTING

[**empty**]: colors can not bond
horizontally because painting
doesn't design time

colors bond *vertically*:
primary colors bond to secondary
colors, tertiary colors, ... or to
grey tones.



contouring and shading defines
limits that let colors emerge
individually

	MUSIC ARTWORK	PAINTING
Layer 3 FIGURATIVE Layer <i>middle layer</i>	<p>[empty]: Music has no such ,object' layer. What painting, sculpture and poetry want to convey through this layer, music succeeds to transport in other ways.</p>	<p>Representational painting is trying to portray the world in order to reach the viewer on an emotional level by being close to reality</p> <p>[empty]: Abstract painting, however, strives to convey the emotional content through leaving out the object layer, like music does.</p>

”

In music the language is gathered so closely [...] that words merge and pure meaningless tones remain. From this point music seems to be the highest, the densest poetry.

”

[Vilém Flusser]

	MUSIC ARTWORK	PAINTING
Layer 4 EMOTIONAL Layer <i>abstracted background</i>	Music immediately triggers emotional experiences such as moods and feelings, more intense than painting. Its non-representational character enables various connections with other arts. Thereby music amplifies their emotional layer.	Emotional experiences are to be triggered via the object layer.

	MUSIC ARTWORK	PAINTING
<p>Layer 5</p> <p>MOVEMENT and LIVELINESS</p> <p><i>abstracted background</i></p>	<p><i>direct, real movement:</i></p> <p>Movement is more direct and more realized in music as it is in painting and poetry. The sounds itself are moving in time and unfold to melodies. The impression of the movement is generated by the musical time structure. In addition, music is recorded directly and exclusively in the time of hearing.</p>	<p><i>Associated Movement:</i></p> <p>Figurative painting maps liveliness. Concreteness creates an impression of living things. However, its expressiveness gets lost due to its timelessness. One has to associate vividness and motion into the image.</p> <p>Abstract painting leaves only traces of motion in the image, for example through the stroke. But these are not experienced directly. Shapes, contours and color combinations in the image are to produce vivid impressions.</p>

Generative Design

generative art, generative designing

”

Generative art is as old as art itself. [...] It refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is set into motion with some degree of autonomy contributing to or resulting in a completed work of art. [...] Generative Art preceded computer art. New forms of generative art will come after the computer as well.

”

[Galanter 2003]

Generative Art

- ~ is the idea realized as a dynamic complex system, able to generate endless variations of music, visual art, moving images, ...
- each Generative Project is a concept-software that works producing unique and non-repeatable events
- computer is simply a tool, not necessary, but enables efficient processing of the procedural creation

non-digital, visual Generative Art



Floor mosaics in St. Mark's Basilica,
Venice, 1204 - 1450

musical Generative Art

WOLFGANG AMADEUS MOZART,
muscial game of dice, published 1793

table of numbers

	1. Takt	2. Takt	3. Takt	4. Takt	5. Takt	6. Takt	7. Takt	8. Takt
2	19	58	73	32	5	56	75	44
3	72	33	18	57	74	45	6	55
4	59	20	71	4	31	54	43	76
5	34	3	30	17	46	77	88	7
6	29	60	21	70	53	42	15	78
7	22	35	2	47	16	87	8	41
8	61	28	23	86	69	52	79	14
9	36	1	62	27	48	13	40	9
10	63	24	85	12	39	68	51	84
11	80	37	26	65	82	49	10	67
12	25	64	83	38	11	66	81	50

basic composition



random generator



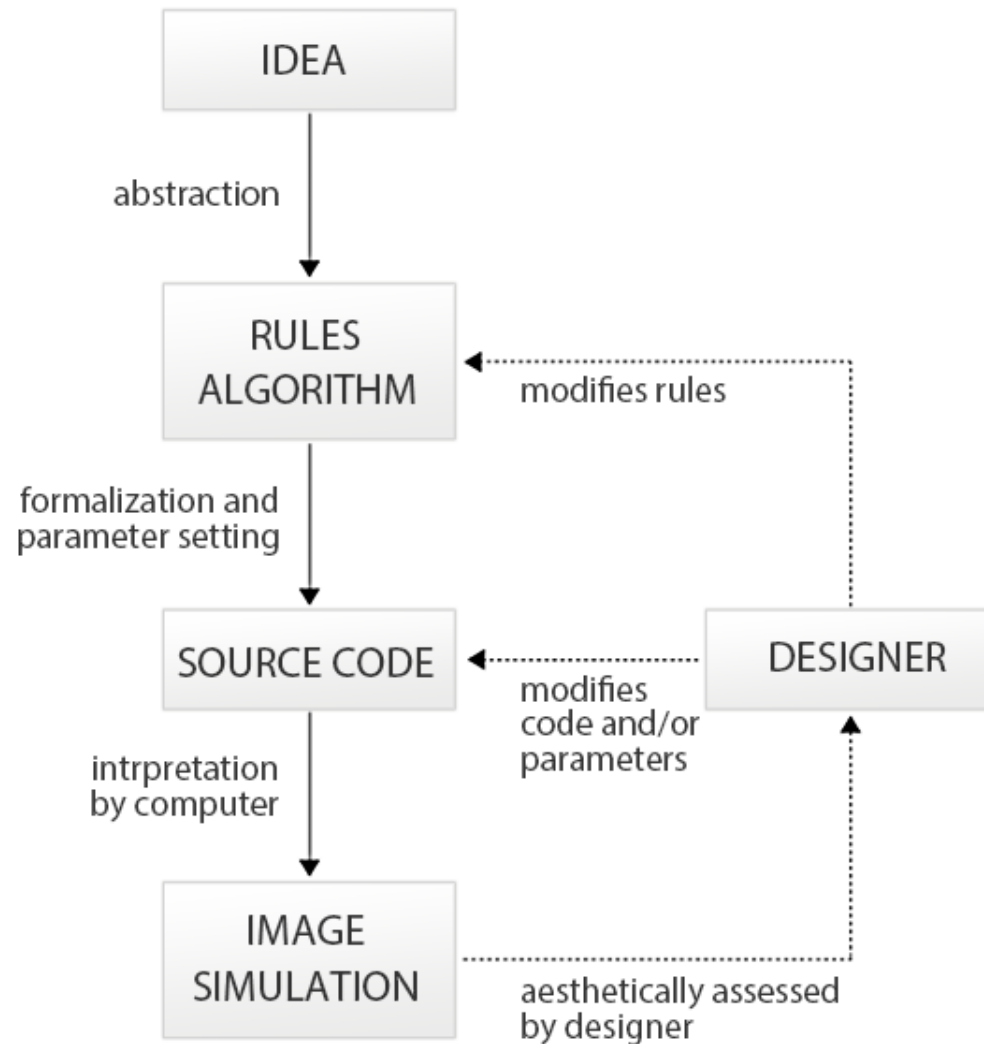
diced Waltz melody



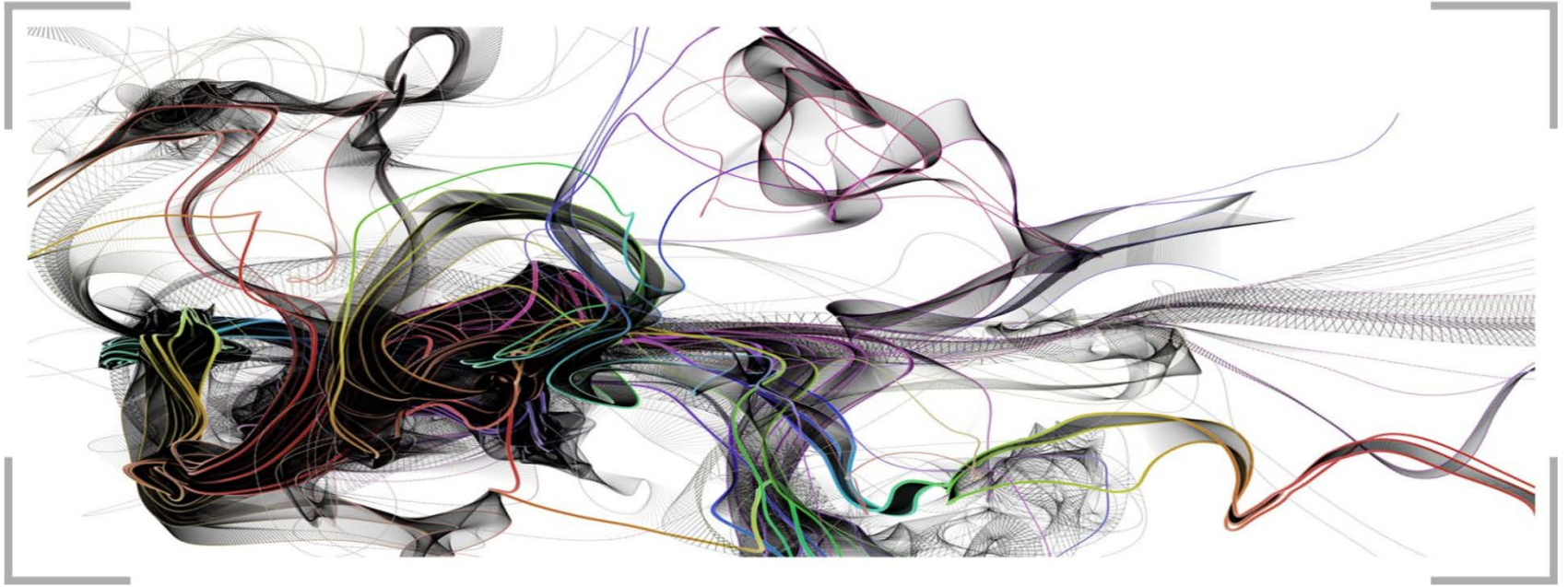
Generative Designing

- ~ is a procedural design technique
- aesthetics and algorithms interweave
- partly results-driven, partly experimental used
- opens novice imagery worlds
- e.g. for data visualization

The Process of Generative Designing



Generative Design



[ANTHONY MATTOX: "Spinal Network", 2009]

generative design plus temporal element

ABSTRACT BIRDS, QUAYOLA: "Partitura", 2011

<http://vimeo.com/23316783>

AMVIS

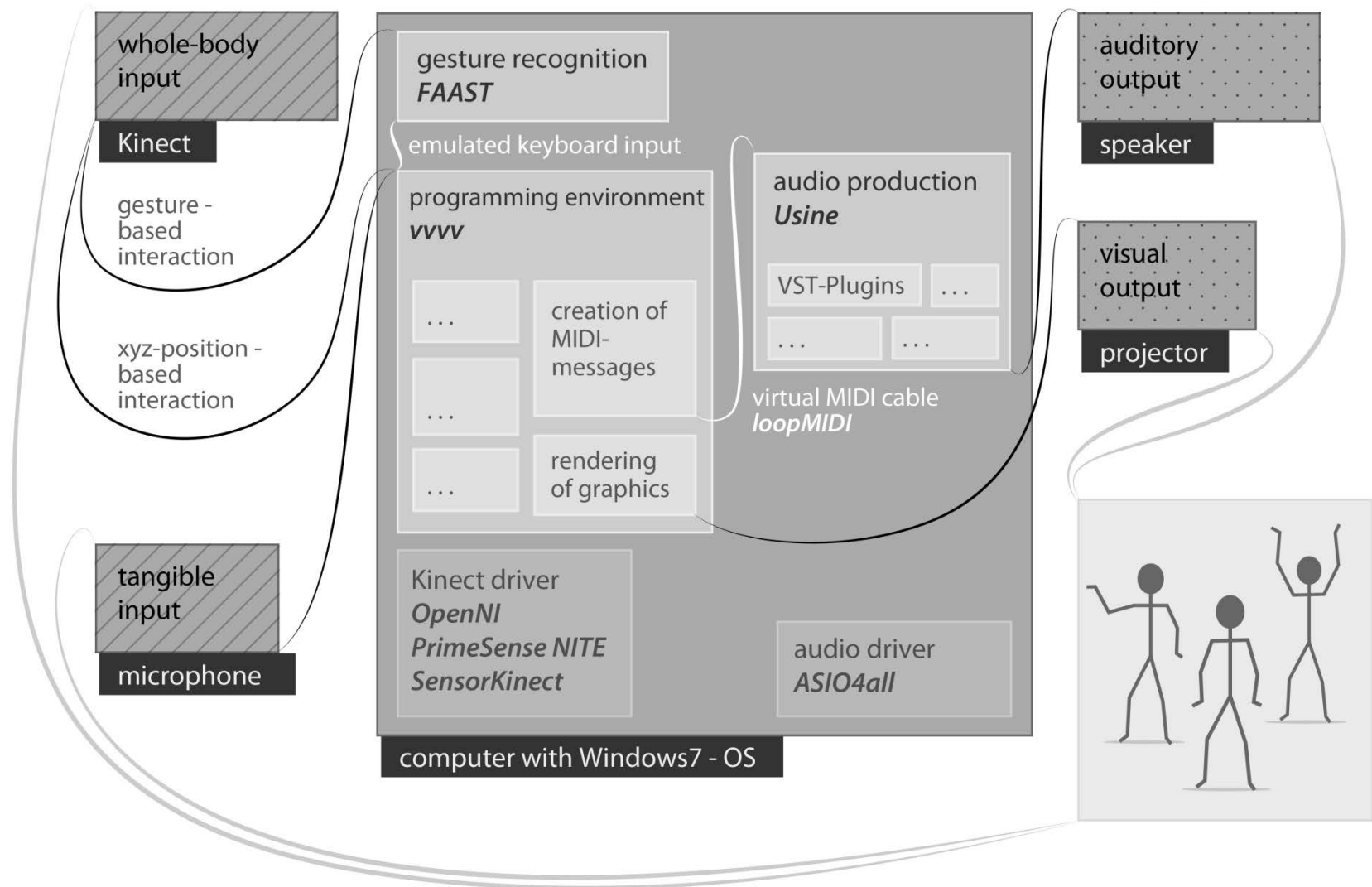
Audible, Motiondriven, VISual environment

AMVIS >> objective

- conception and implementation of a Natural User Interface (NUI) for collaborative music-making
- whole-body interactions trigger audiovisual events immediately
- interplay of audible and visible material
 - their joint presence leads to mutual enrichment
- joyfully explorable and perceivable interface
- support of untrained users to experience own music-making, however, without demanding too little from skilled musicians

AMVIS >> result

- multi-user environment
 - musically and visually perceivable
 - motion-controlled, via different natural interaction methods
- digital musical instrument (DMI)
 - control module plus tone generation module
 - mapping concepts relate those to one another
 - the users' interaction with the system and with each other creates the musical artwork, which is partly compositional and partly improvisational
- audiovisual installation
 - gestural parameters are converted into parallel sonic and visual parameters
 - favors multi-sensory perception
 - users actively co-design the environment
- modular programmed and extensible software
 - processes whole-body and tangible user interactions in real time
 - generates parallel audible and visual output



chosen SDKs

- **vvvv** for the entire installation
 - runs in real-time
 - supports various input and output technologies
 - generates images and sounds
 - sends & receives MIDI and OSC messages
- **Usine** for audio production
 - processes audio data in real-time, with low latencies
 - supports MIDI and OSC protocols for data exchange

”

Music is the art of arranging tones with regard to

melody, harmony and rhythm to a group of sounds. “

[German dictionary]

AMVIS >> approach

- the definition was taken as the functional principle for collaborative music-making with AMVIS
- it is reflected in 3 different user roles:

MELODY, HARMONY, RHYTHM

- users interact with the system and with each other
- computer aids ensemble playing

1st user role >> melody

- **DEFINITION:**

Melody is a succession of tones with different pitches and durations, which are connected to each other by intervals.

- **FUNCTION:**

- protagonist of a musical piece
- independent
- follows its own impulse

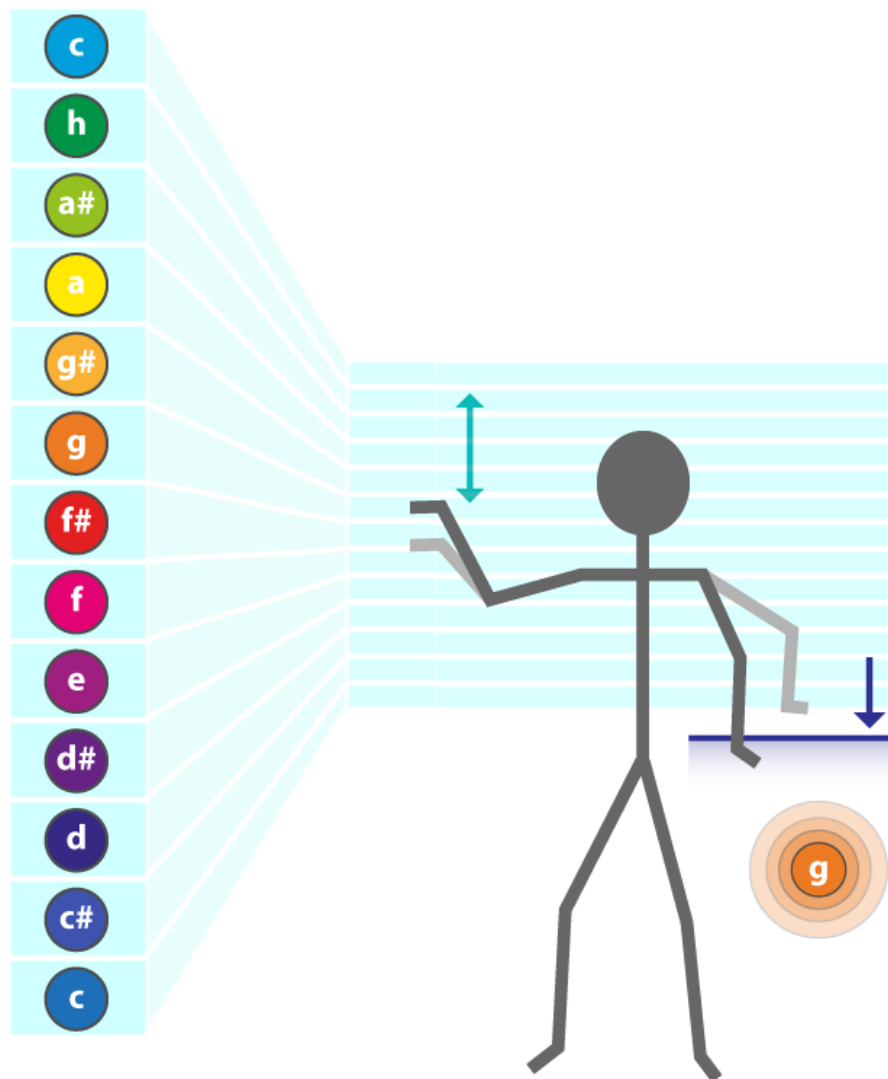
- **FUNCTION IN AMVIS:**

- represents the virtualized musical instrument
- user plays tones and defines pitches and durations
- the range of tones covers two octaves, including all semitones

1st user role >> melody >> demands

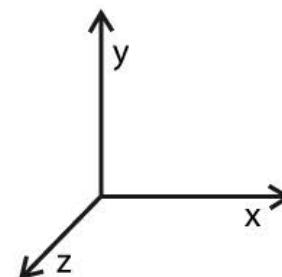
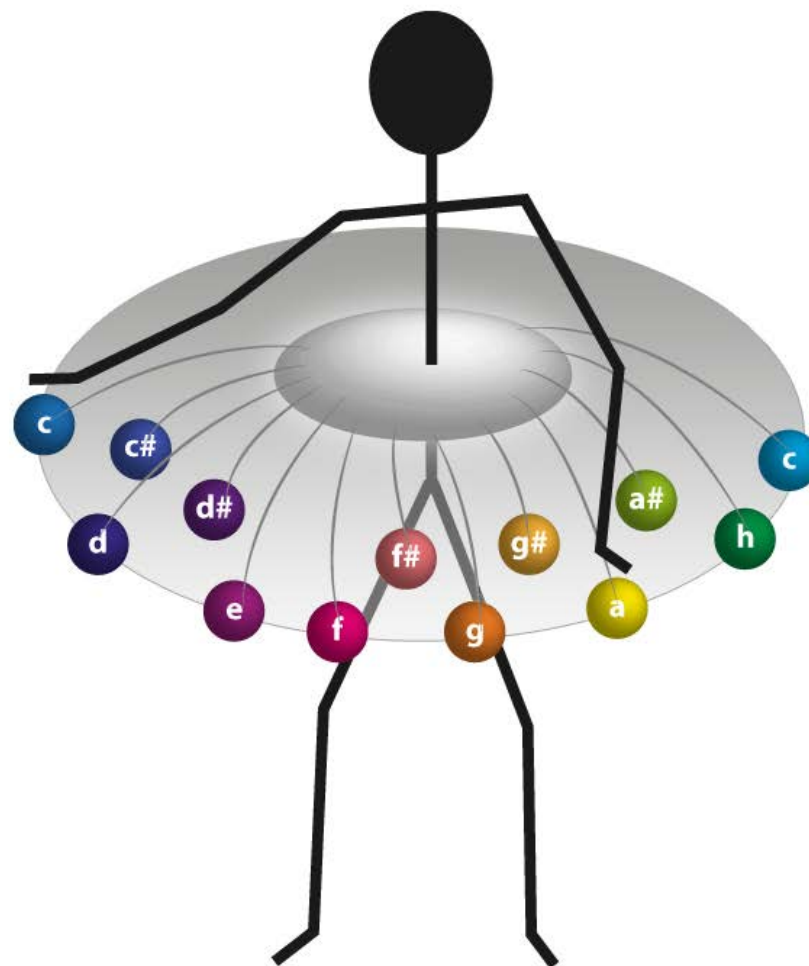
- every tone and half-tone must be reachable on purpose
 - no sound installation, but a music-making environment
 - NOT playing a tone is equally important
- sufficient range of tones (2 octaves min)
- tone duration should be adjustable

1st melody concept [vertical interaction]



sound velocity and duration

2nd melody concept [tones orbit the frontal body]



2nd user role >> harmony

- **DEFINITION:**

Harmony means balance. Harmony, in music, is the simultaneous combination of notes in a chord and the study of their relations.

- **FUNCTION:**

- repeating series of chords establish harmonical relations to the melody section by section
- chords are parallel or sequentially played groups of single notes

- **FUNCTION IN AMVIS:**

- user establishes chords from up to 4 single notes and arranges a chord sequence
- the system's task is to play the chords in a uniform and repetitive manner

3rd user role >> rhythm

- **DEFINITION:**

Rhythm is the pattern of musical movement through time.

- **FUNCTION:**

- regulates the progression of sound events
- chords sound to the beat of the rhythm
- independent rhythms arise in melody, due to the linear sequence of different tone durations

- **FUNCTION IN AMVIS:**

- the user is enabled to set the global ground tempo

4th user role >> conductor

- **DEFINITION:**

A conductor is the manager of a musical ensemble.

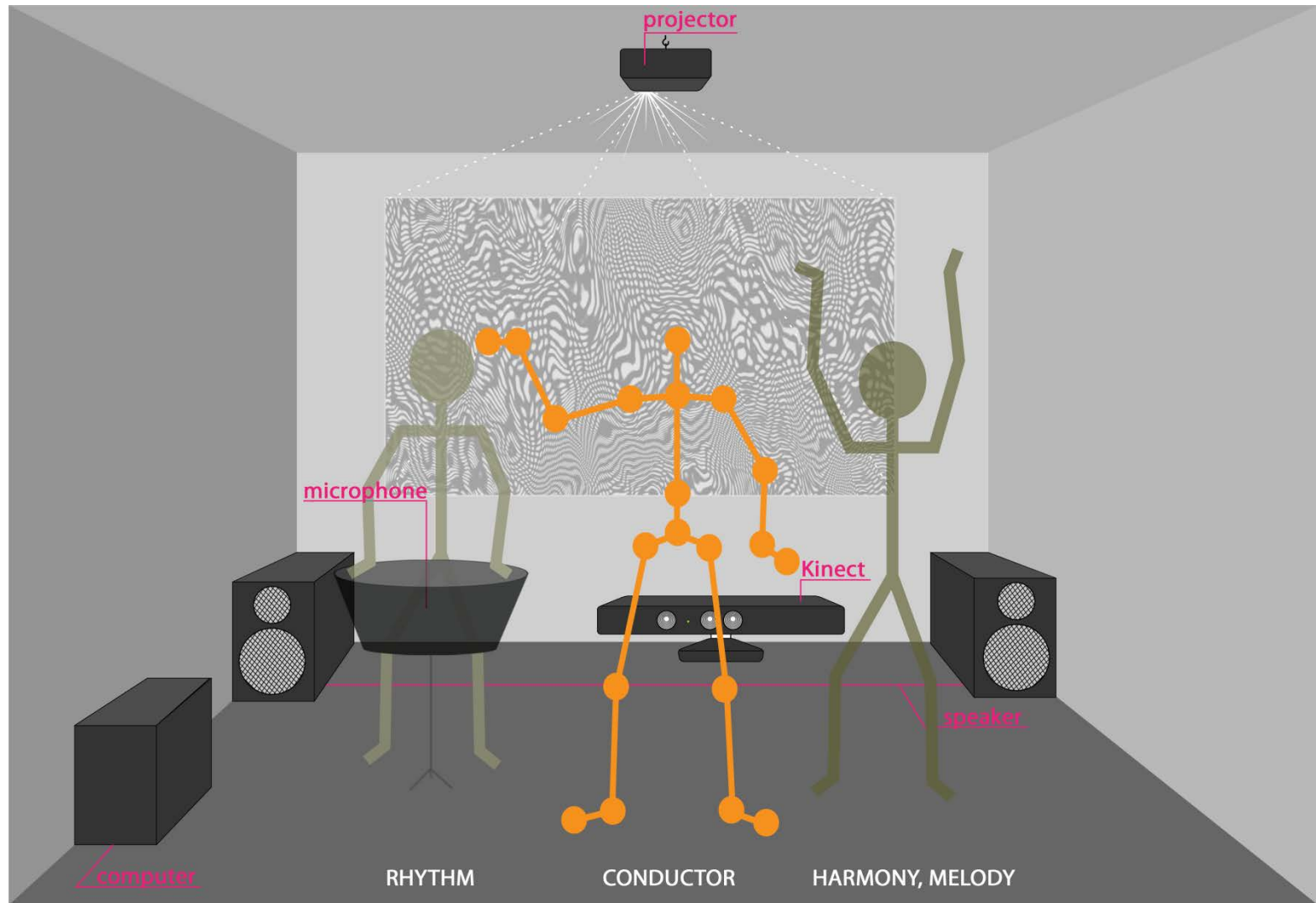
- **FUNCTION:**

- coordinates the interaction of involved musicians
- serves as mode switcher

- **FUCNTION IN AMVIS:**

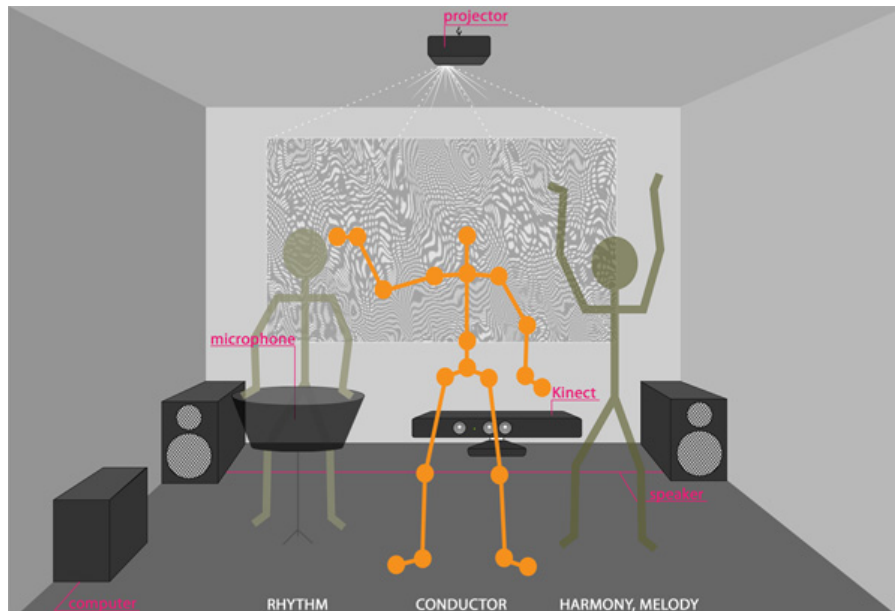
- chooses the audiovisual atmosphere
- gives clearance for chord establishment and rhythm synchronization
- is music teacher: can show and hide supporting text layers

user roles



Hardware: computer,
Kinect, microphone, (*peripheral input device*)
speaker, projector (*peripheral output devices*)

Stick-Figure model of the Kinect SDK



harmony

- movement of hands selects and plays single chord tones

melody

- movement of hands selects and plays tones
- movement of the body is demanded to access the entire range of tones

rhythm

- percussive gesture

conductor

- whole-body gestures

computer-aided music-making >> usage concepts

autopilot

- sound-producing-machine
- user pushes the start button

train driver

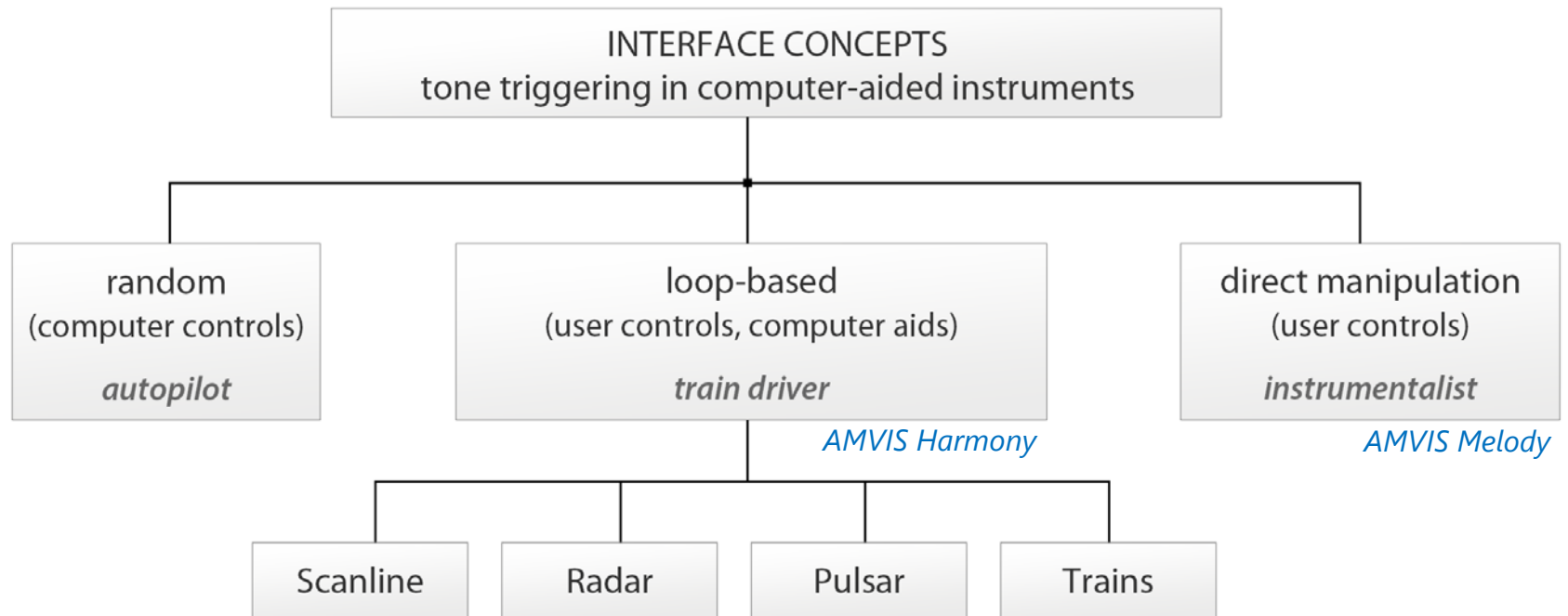
- pre-defined routes
- user chooses destination and parameters

instrumentalist

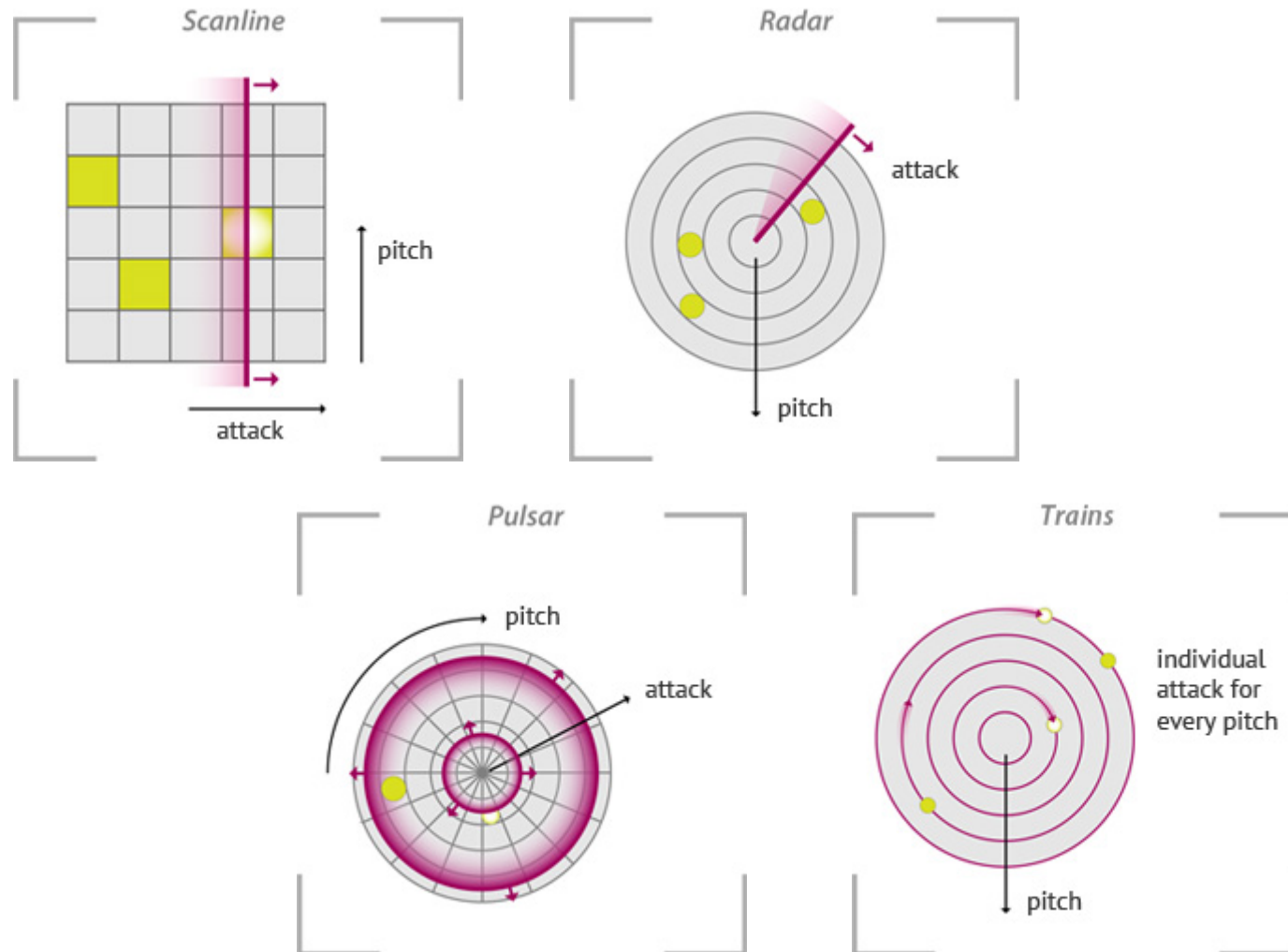
- user is in control
- software is the virtualized musical instrument

[Karlheinz Essl, 1999]

computer-aided music-making >> interface concepts



loop-based interface concepts for tone-triggering

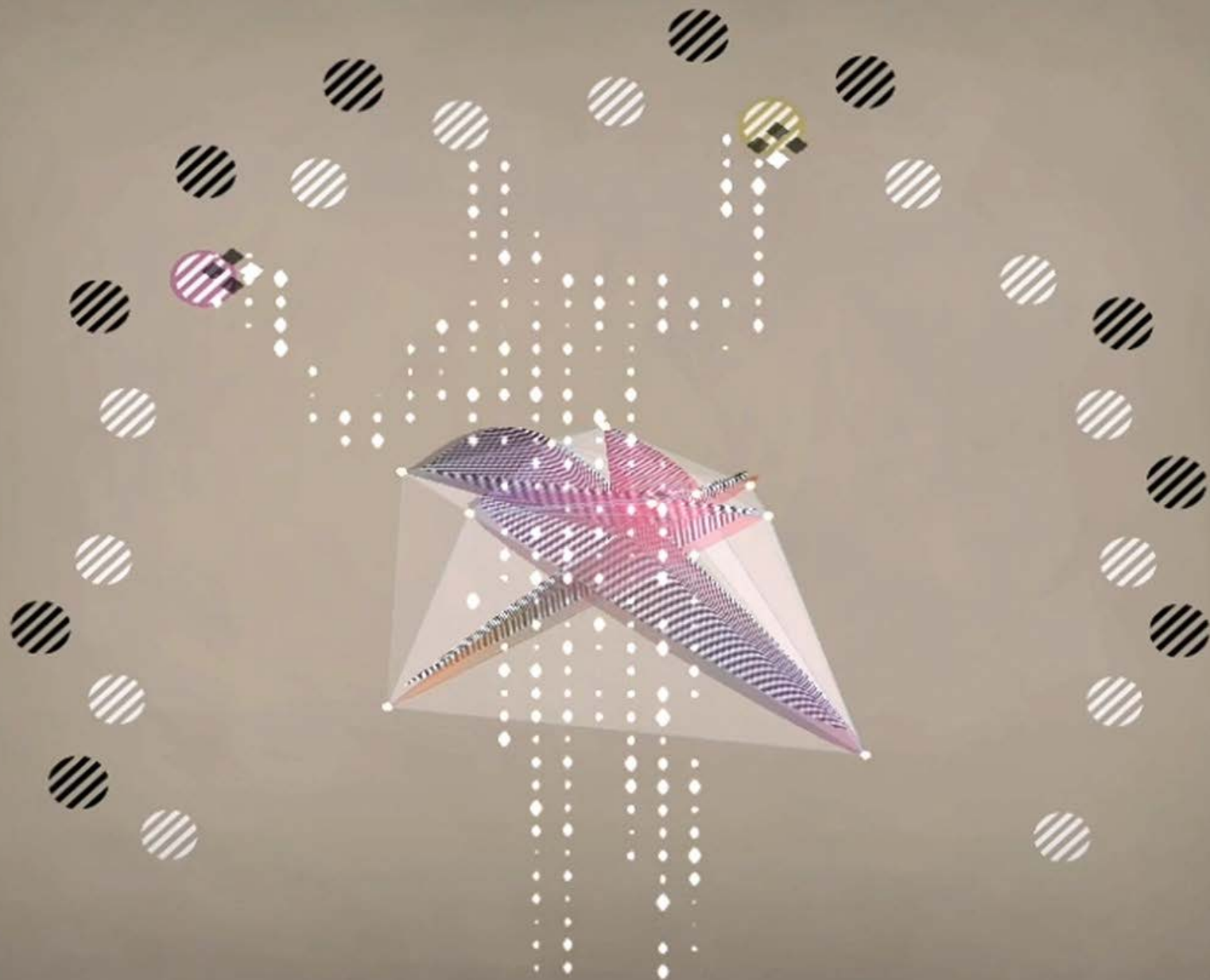


AMVIS

an Auditory, Motiondriven, VISualizing Environment

<http://vimeo.com/29770159>

playing a melody



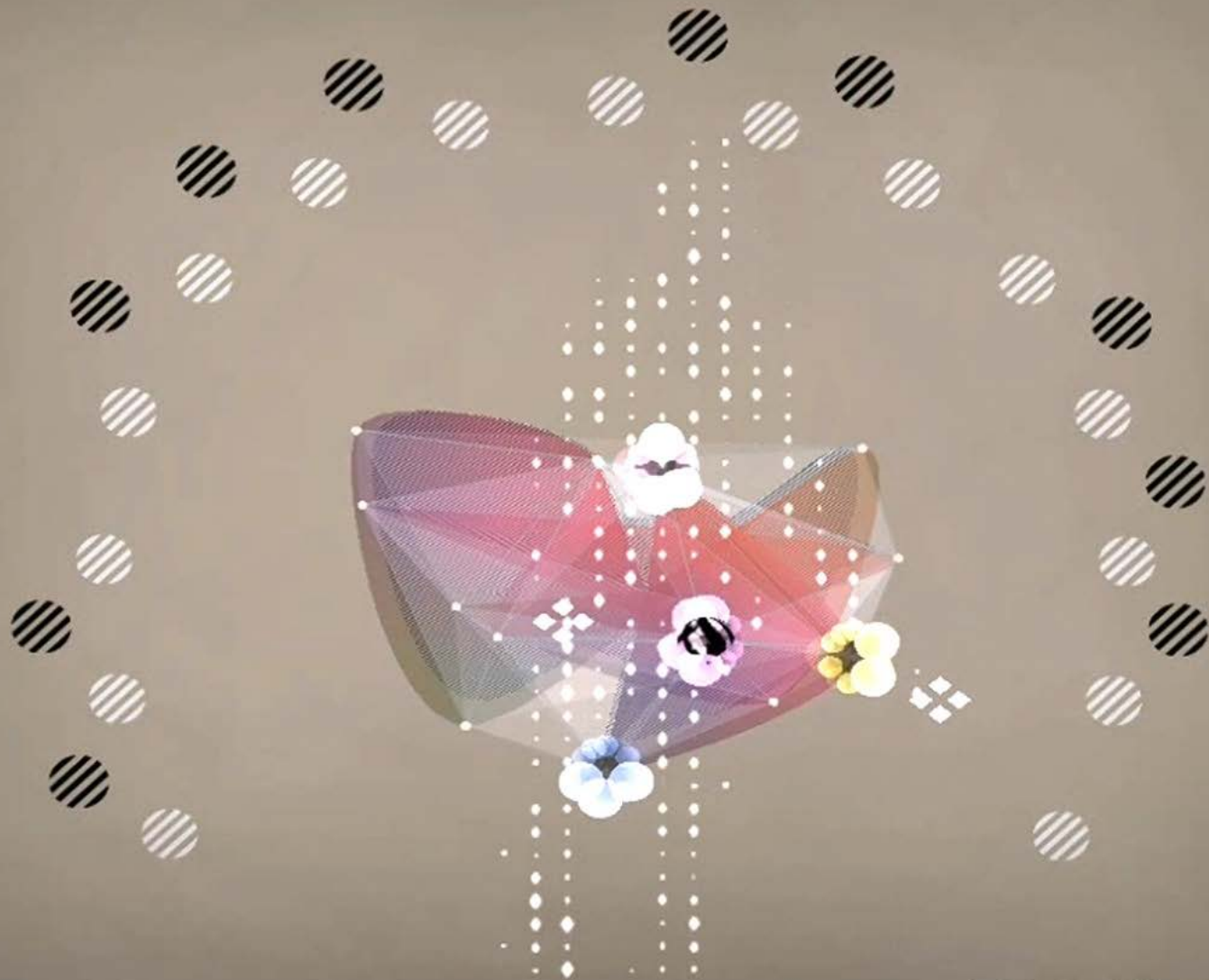
choosing single chord tones



playing a melody while the system strikes the chords autonomously

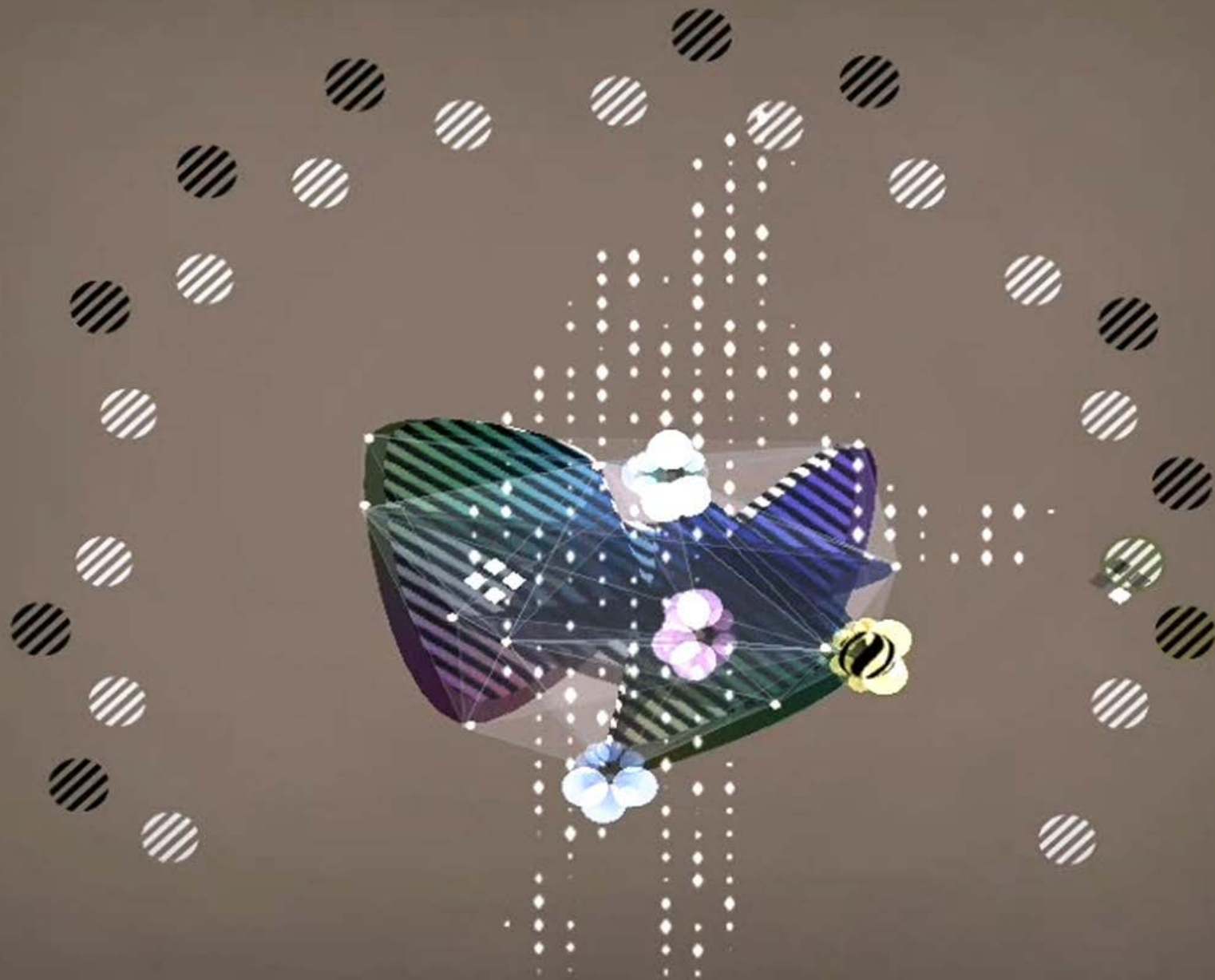


changing the global beat

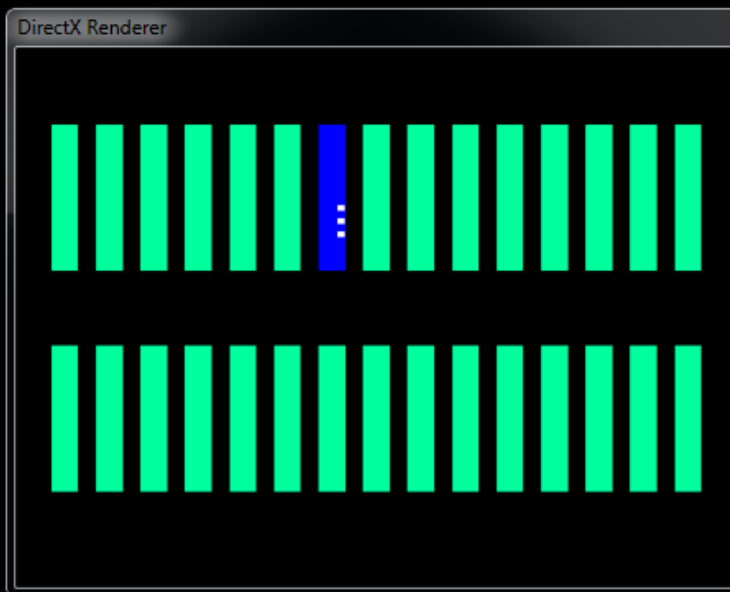
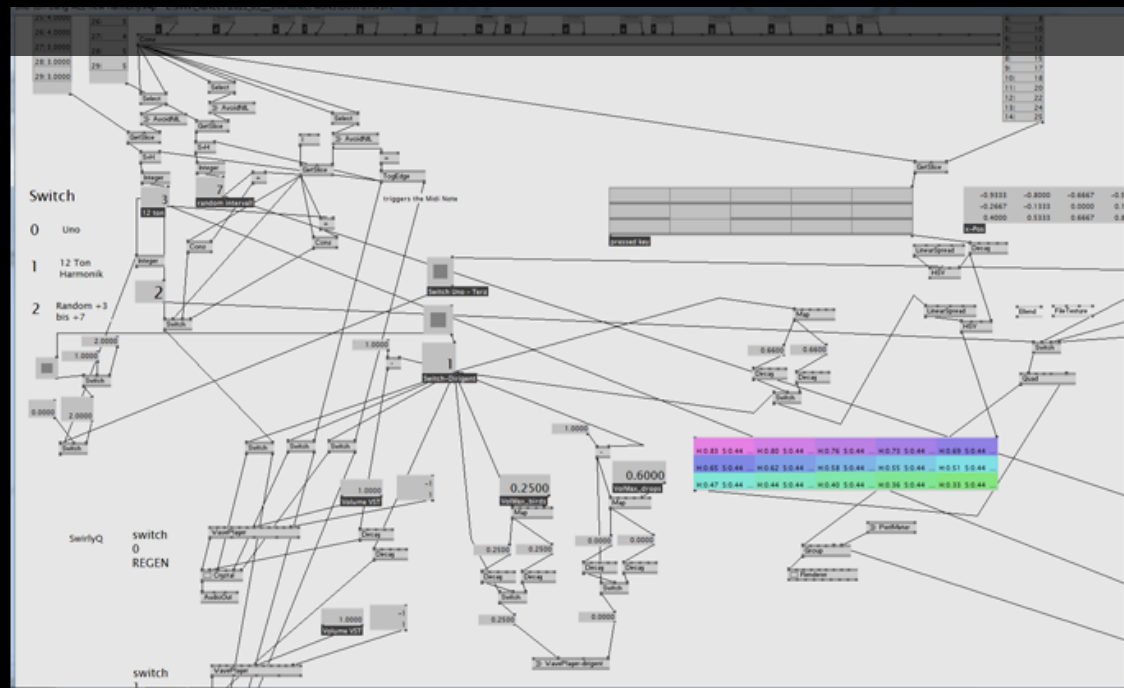


Tempo Akkordanschlag

selecting another audiovisual atmosphere



Behind the scenes ..

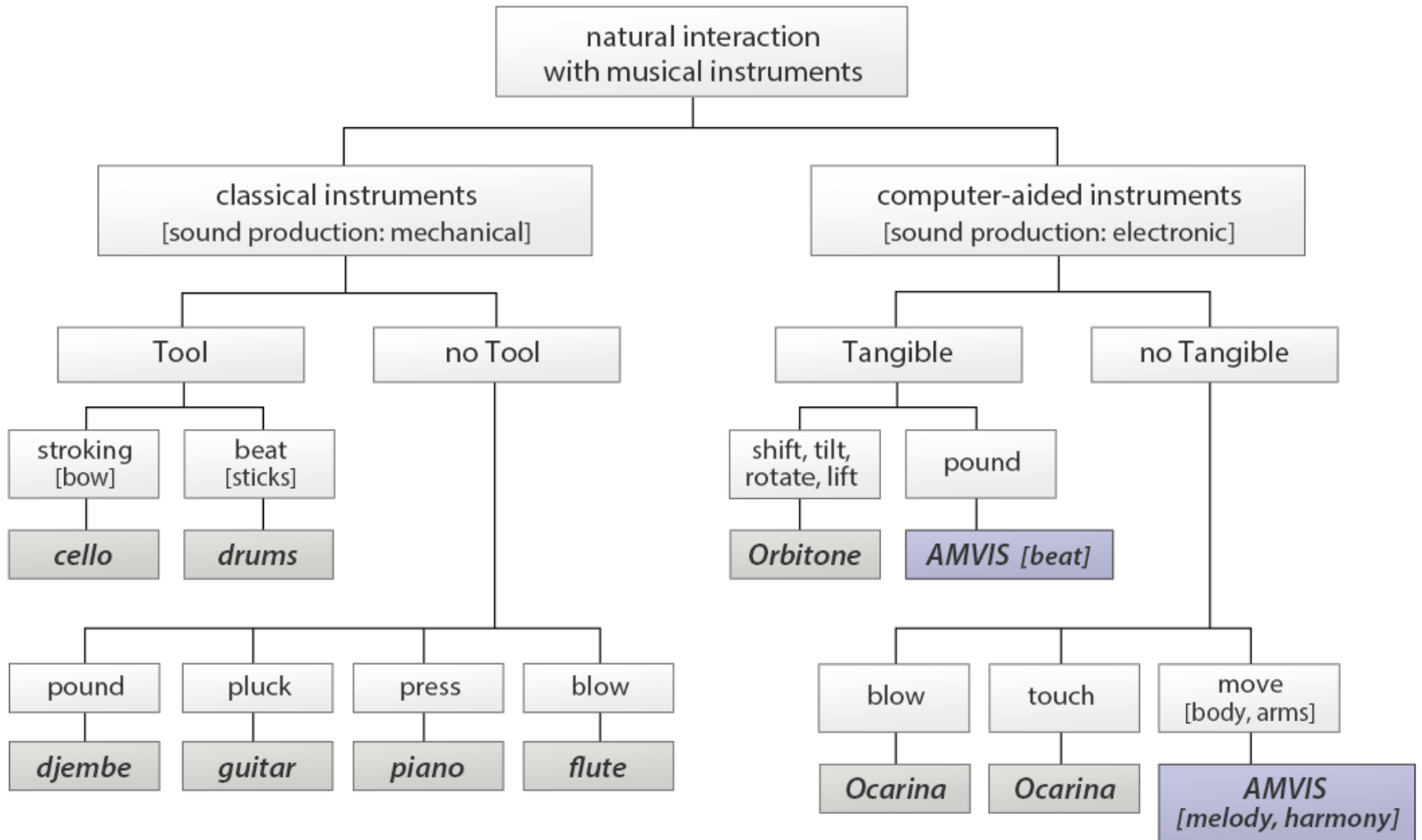


critical reflection

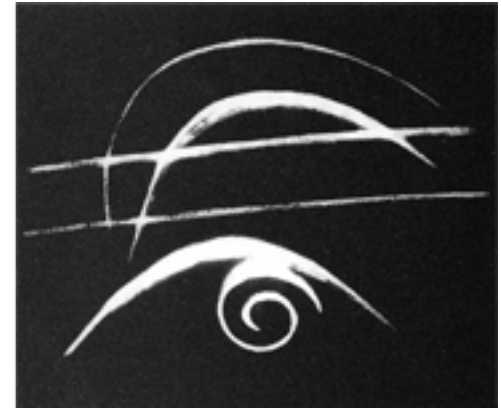
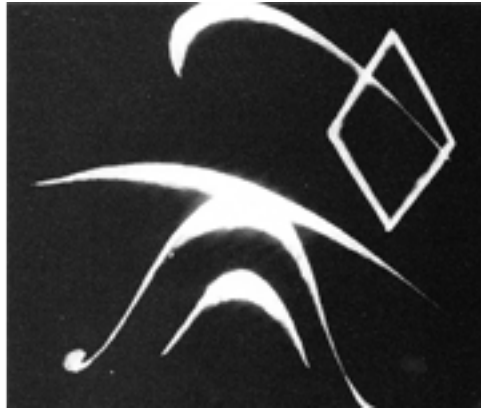
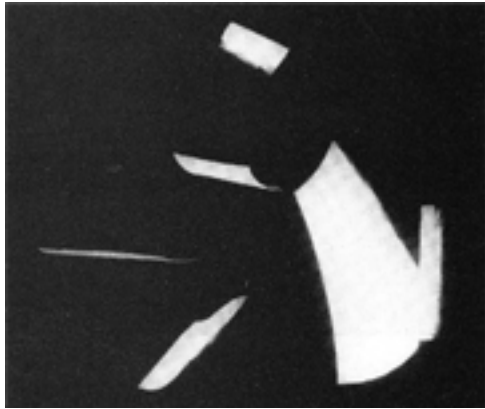
- Kinect + vvvv quite unstable back in winter 2011 // technical issue
 - SDK only allowed for one gesture-based role
 - z-coordinate mapping wasn't reliable
- Usine SDK blocks audio processing in vvvv // technical issue
 - Missing sound analysis in vvvv for audio-reactive images
 - solution: Usine on 2nd computer
- lack of interaction technique variance // design issue
 - waving in a 3d room to hit the projection of tones on a 2d wall might be far away from real direct, emotional interaction
- head-driven design process // design issue

future opportunities

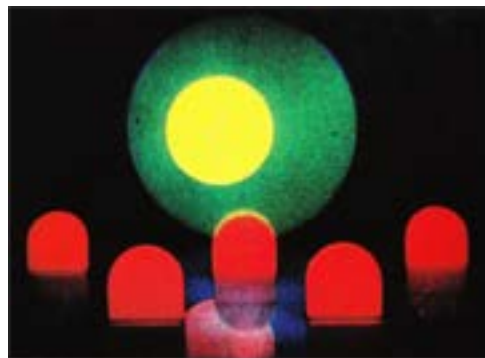
- AMVIS is a modular system that offers different musical roles
 - adding further freely playable, physical melody instruments would be quite easy
 - data exchange via MIDI / OSC
 - visual and audible parameters are manipulatable
- interweave the visible with the audible
 - usage of colored spotlights, that can be adjusted by users
 - visual impact on the entire environment
 - audible impact on the sound output via added filters, that correspond to the tracked colors
- musicians perform expressive whole-body engagement
 - e.g. bending forward with the upper body indicates a music-dynamical change
 - one could translate that behavior to allow loudness variations through bending
- for to create multi-facetted interaction techniques with digital musical instruments, one could get inspired by playing classical instruments
 - but be careful with not just mimicking the analog instrument
 - only look at the technique, and get inspired



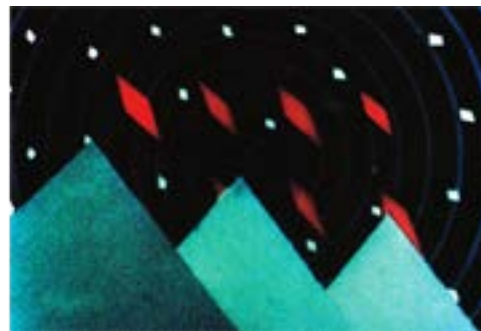
Thank you.



FISCHINGER, Studie No. 7, 1931



FISCHINGER, Komposition in Blau, 1935



FISCHINGER, Allegretto, 1936

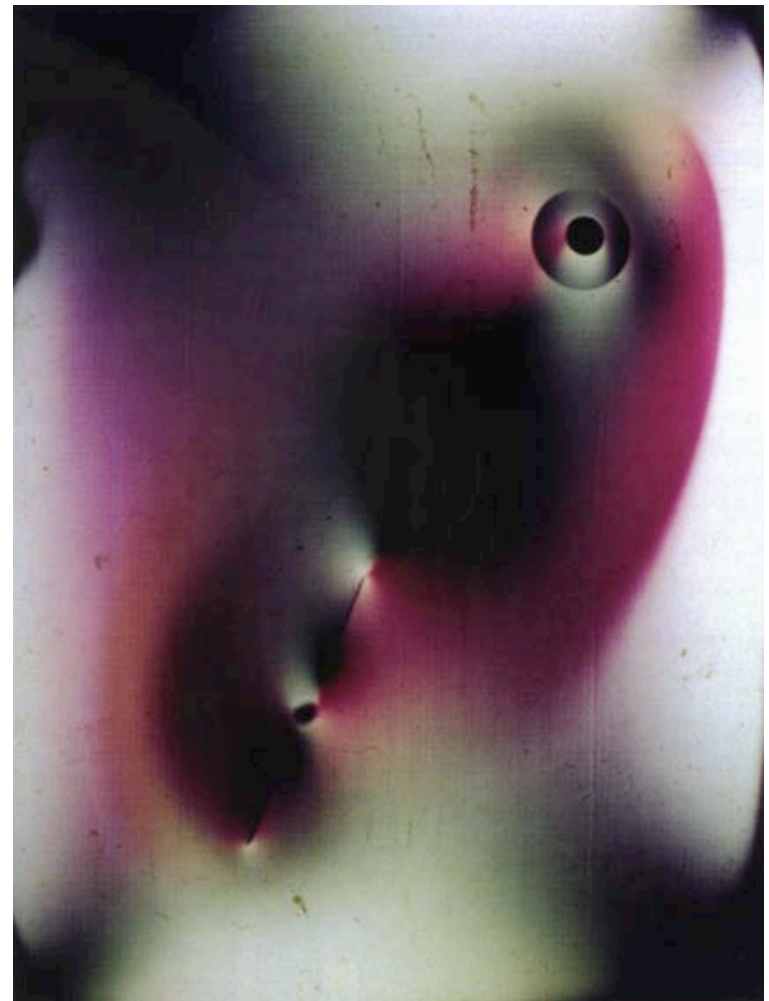
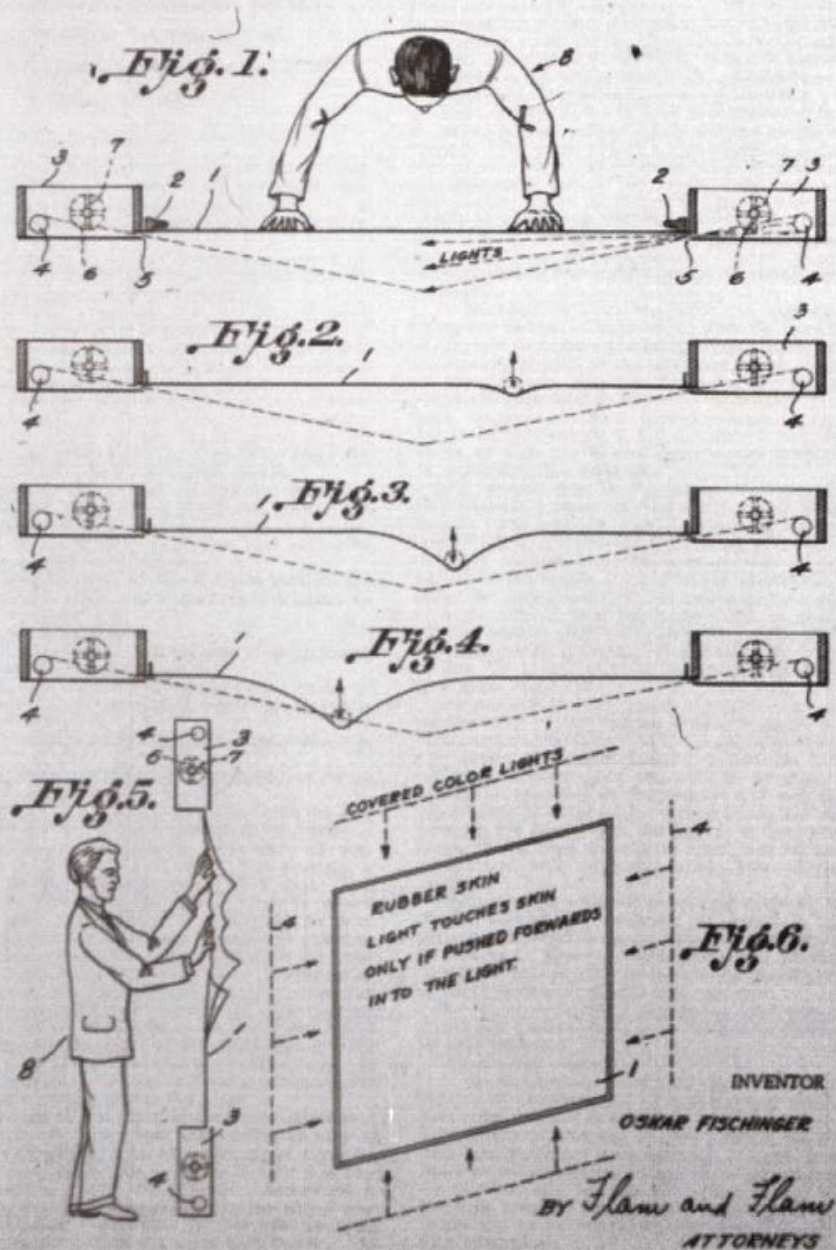
April 26, 1955

O. FISCHINGER

2,707,103

DEVICE FOR PRODUCING LIGHT EFFECTS

Filed Sept. 1, 1950



FISCHINGER,
Lumigraph: instrument for producing light-images,

patent extract;
graphical representation of the functional principle, 1955