

Pd & Synaesthesia

Human evolution has created 5 prominent senses, but it seems they are not enough to satisfy the mind's desire to understand its environment.

Introduction

What is synaesthesia ?

Synaesthesia has long been a popular concept in the arts, but actually derives from a neurological condition where various sensory inputs are perceived as some other modality; well known examples include "hearing" color or "seeing" sounds. While potentially debilitating in the medical condition, a blending or cross-pollination of the senses is seductive to the artist in pursuit of different perspectives (and interpretations) of reality. However, as desirable as a blending of sensations may seem, historically it has been difficult to achieve in the fine arts.

History of synaesthesia

Comprehensive historical accounts of the artistic realization of synaesthesia are widely [available](#) , but a short introduction is possible. It must be recognized that the realization of a merging of the senses has long suffered technological obstacles. One of the earliest examples of an attempt to physically enact sound and vision in one device is Louis-Bertrand Castel's *Ocular Harpsichord*(1735). This device consisted of a normal harpsichord mechanically extended by a frame with colored tape, which allowed candlelight to stream through in conjunction with keypresses.

It wasn't until the widespread availability of electric light and other electromechanical devices that much further advances could occur. Early 20th century experimental filmmaker's Viking Eggeling, Hans Richter, and Walter Ruttmann were among the first to extend static canvas-based painting to film, and immediately attempted to join the new "moving" paintings to sound. The same time saw the development of several specialized mechanical devices, such as Tomas Wilfred's series of *Clavilux*'s or Oskar Fischinger's *Lumigraph*.

Film, lights and magic

The 1950's and 60's saw a second generation continue the earlier efforts in filmmaking, with a meticulous attention to detail exhibited by inscribing individual frames of film with sound induction patterns, such as seen in the work of Ernst Schmidt Junior [tonfilm](#) , Norman McLaren, and John and James Whitney. James Whitney is also noted as one of the earliest adopters and proponents of the computer in the arts, and devoted much of his work to the pursuit of a union of sound and visuals he termed "Digital Harmony."

How does Pd relate to synaesthesia ?

Pd is a graphical computer-music language. Small graphical elements are combined into bigger functional units by wiring them together. While pd-programs (commonly referred to as "patches") are often used to produce sound, writing such a program

actually entails working within a graphical tool: in essence, the act of creating music is an act of creating an image.

Since a major hallmark of synaesthesia is a crossing of borders between different senses, the problem becomes one of quantification within different domains, and the borders of these domains are generally difficult, if possible at all, to cross. For instance, a somewhat simplistic example of a synaesthetic phenomenon consist of the literal "stars" you see when experiencing a collision of a hard object with your eye: even though both the perception of pain and vision are transmitted via the same means (electric charge carriers) in parallel nerve pathways, it takes a considerable amount of energy for the effect to take place. Fortunately, computers can ease this task.

Pd stands for *pure-data*. As the name indicates, it attempts to treat *data* - which is everything a computer can think of - exactly as what it is: data. Pd does not make any assumptions on what this data might eventually represent. Whether it is sound or an image, a letter or the position in space, everything is expressed by numbers. And numbers can be added, subtracted and manipulated easily in any (mathematical) way. While these data are available as plain numbers in every computer software, high-level user applications usually do not allow one to access the data as such, but encapsulate it within artificial layers of abstraction, which encumbers the process of synaesthetic creation in an unnecessary way. Pd, on the other hand, does not differentiate between the various types of data presented, and thus allows one to more easily cross the borders between different perceptions.

Pd stands for *public-domain*. Being available as a Free Software / Open Source project, Pd is easily extensible with plugins written in other programming languages. While most of the interaction and modification of data can be done in "plain pd", extensions allow one to access low-level hardware interfaces from within the environment, thus making new sources of sensor data accessible. Through its technical and political openness, Pd has aggregated a large number of software developers with both artistic and technical background, many of them adding, as they see the need, new possibilities of interaction between various types of data.

Examples with pd

Many Pd projects have encapsulated synaesthetic ideas (intentionally or not!), certainly more than can be mentioned here; but a few merit current note. Since Pd is primarily considered an audio manipulation program, many pieces tend to use sound to generate video, but perhaps more interesting are the projects that convert video to sound. Erich Berger's "Tempest" uses the Pd extension GEM to produce 2D & 3D abstract animated shapes, which then control a sound generated from the electromagnetic radiation of the display monitor as received by AM radio. In a performance at the first International Pd Convention entitled "The Purple Haired Kitchen Experiment", Tom Schouten used his own library PDP and a video camera trained on the screen. This confrontation of the computer with it's "self" produces self-referential/fractal visual feedback patterns which in turn are used as the waveform of the sound. In both of these projects there is inherently produced a symbolic visual grammar and tight synchrony with sound not often found in synaesthetic pursuits.

The piece "Ectodermal Ways" by Nicole Pruckermayr uses stress to generate sound, video and atmosphere. Encased in a full body latex-suit, she isolates herself from the environment. Suspended from an elastic umbilical cord, she floats through space without any direct contact to the outside world. Since the latex-suit seals her skin, she produces an enormous amount of sweat, which is measured by a number of medical

sensors. The distribution of her sweat, determines the structure of an environmental soundscape as well as the floating movement of a virtual camera through the 3D computer model of the artist's brain.

Finally, in Pd Workshops Ben Bogart pays special attention to what he terms "Metaphorical Networks." Metaphorical Networks are defined as a mapping of one domain to another, such as the relation of a "sun rising" to an "eye opening". This conceptual framework is designed to establish an artistic ground within which further meaningful art is created.

Conclusion

Proposed "taxonomy"

- metaphor
- transform
- implicity

While preparing this short review of synaesthetic art we noticed that while the term can be broadly applied, perhaps some organization is needed to spur further exploration. To this end we developed an embryonic "taxonomy" of artistic synaesthesia consisting of three basic types: transforms, metaphor, and implicity.

"Transforms" are the most basic of the three and are the easiest to implement in Pd; indeed, any patch created delivers some form of data transformation. This most basic level could represent projects that arbitrarily map data from differing domains without regard for retaining an united meaning to the dual domains. In other words, the parameter space of the input and output domains are related only at the whim of the artist, and likely will produce wildly varying or unexpected results that evade control.

"Metaphors", then, would add an extra dimension of meaning to the work, such that one conceptual domain produces analogical information in a second domain. These metaphors or analogies aren't arbitrary but give a deeper understanding of the two domains that isn't readily apparent when the two domains are singly inspected. Obviously Ben Bogart's work mines this seam, and perhaps we can place pieces such as "Ectodermal Ways" into such a category.

"Implicity" points toward a deeper level of meaning. One domain cannot be separated from the other without losing the process as a whole. The parameter space of each domain is specifically mapped to the other in a naturally emergent manner. Both Erich Berger's and Tom Schouten's work falls into this category: the visual images or the soundforms considered alone have considerably less identity and emotive power than their actualization together.

We offer these categorizations not to impose stifling limitations on artistic expression, but more in the hope that they will identify rich areas of inquiry, waiting for further exploration. The historical record is rich with attempts at artistic synaesthesia, mostly considered from our vantage point half-realized: with tools such as Pd in our hands, one can hope for fuller works in the future.

Images

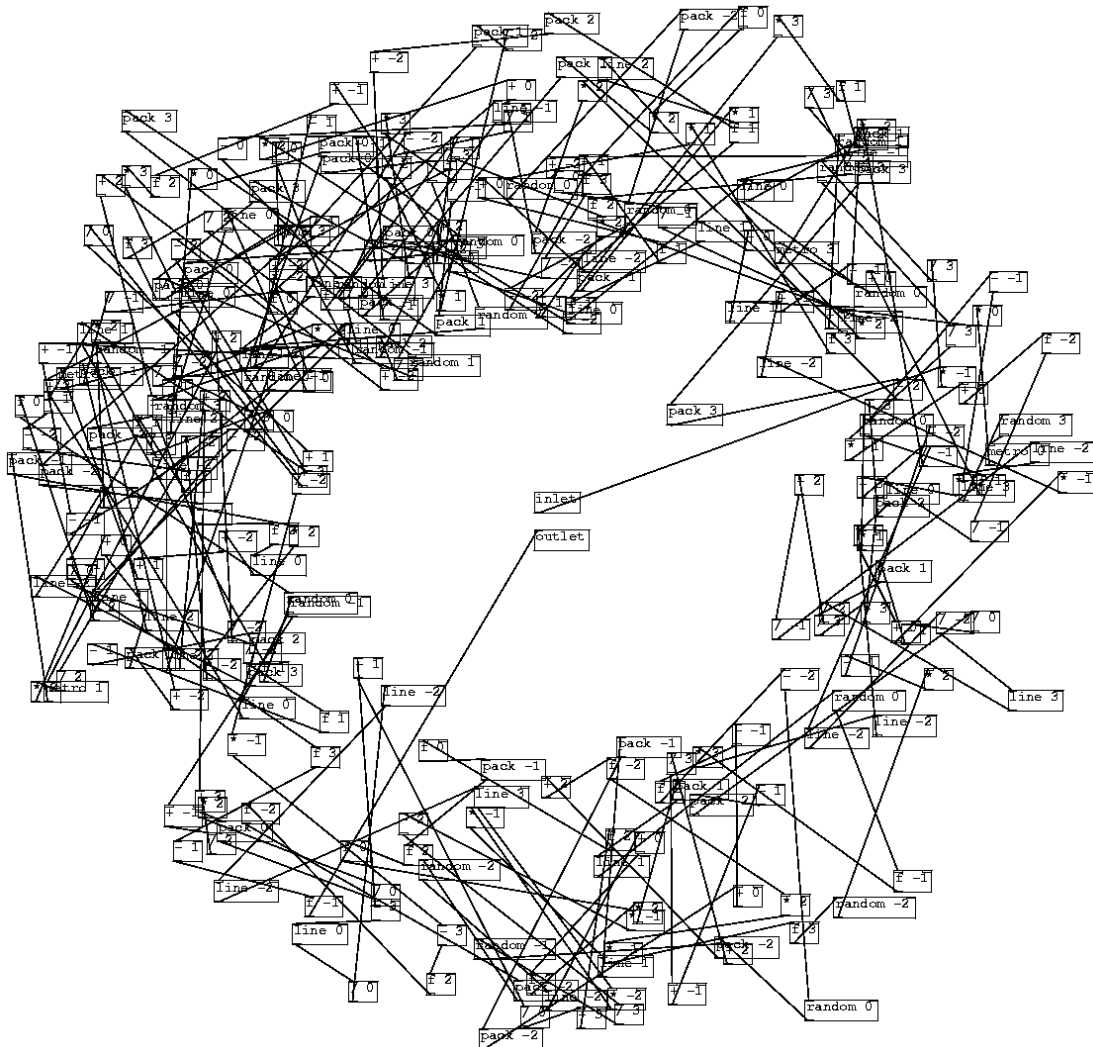


Illustration 1 graphical pd patch



Illustration 2 Whitney's idea of "Digital Harmony"



Illustration 3 Pruckermayr performing "Ectodermal ways"

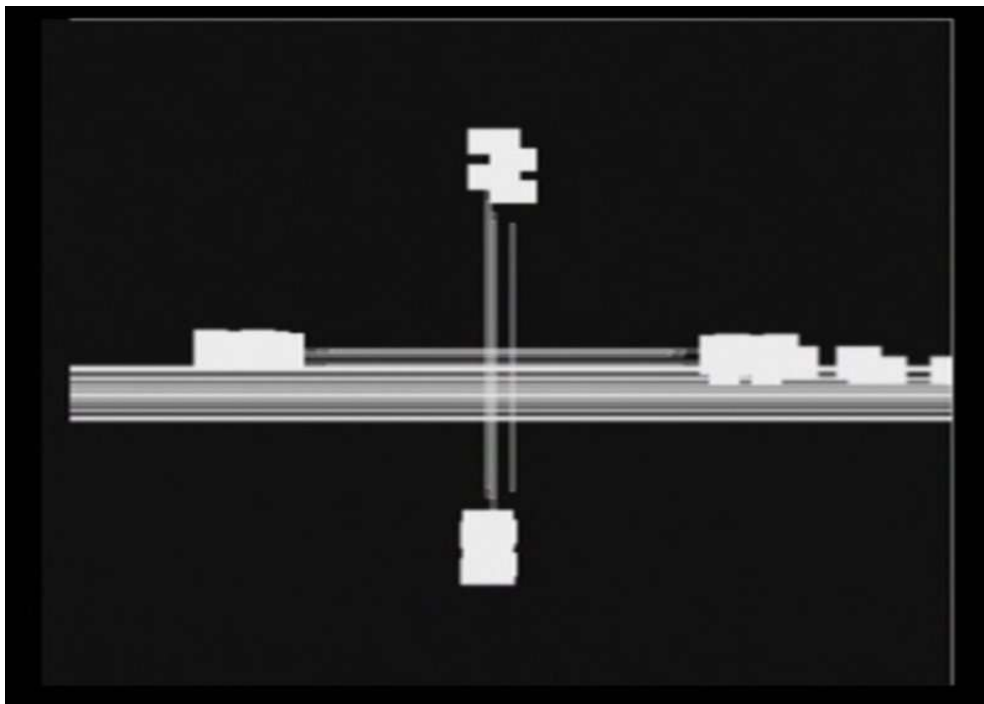


Illustration 4 Erich Berger's "Tempest"

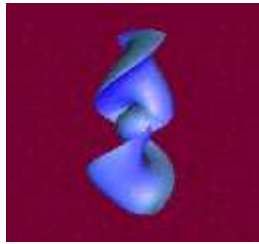
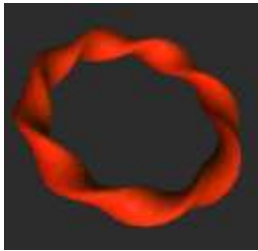


Illustration 5 Andrew Glassner's idea of a Shape Synthesizer

Further reading

Bibliography on Synaesthesia : <http://www.flong.com/synaesthesia/index.html>

pure-data : <http://www.puredata.info/>

tonfilm (ernst schmid jr) : <http://www.sixpackfilm.com/catalogue.php?oid=192>

tempest (erich berger) : <http://randomseed.org/tempest/>

Shape Synthesis (andrew glassner) :

<http://www.glassner.com/andrew/cg/research/shapesynth/shapesynth.htm>

A Shape Synthesizer (james tittle) :

<http://puredata.info/community/projects/convention04/lectures/tk-tittle/>