

# **State Of The Union: The Synesthetic Experience In Experimental Music And Sound Art**

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While a seamless progression of crystal-clean, high-register glissandi forms the soundtrack, something interesting happens on the video screen: fluid ripples of a phosphorescent blue-ish hue appear in almost perfect lockstep with the sounds, to the point where it is immediately clear what is happening- the sounds themselves are exciting and shaping the visual materials on hand. The shivering blue cloud-forms rise and fall again from a pool of enveloping darkness in patterns that, while never entirely predictable, always seem to be in absolute harmony with the audio streams. The coloration of both the audio and visuals change slowly and surely, as do personal reactions to the presentation, but the feeling of dealing with a unitary sensory phenomenon persists. And, although little else happens on-screen beyond what is mentioned here, the sensory effect is captivating like sitting in front of an open fire- an activity that still provides a primordial inspiration this deep into the 21<sup>st</sup> century.

These sights and sounds, taken from the Line DVD *Camera Lucida* - designed by various sound artists working in collaboration with Evelina Domnitch and Dmitry Gelfand - are the result of an encounter with sonoluminescence, the generation of light patterns in imploding bubbles caused by sound excitation. Developed in the 1930s by University of Cologne researchers Frenzel and Schultes, sonoluminescence is one of a few known types of sonochemical reaction, in which ultrasound initiates acoustic cavitation (the formation, expansion, and collapse of bubbles in a liquid.) It took some 5 decades for sufficiently powerful ultrasound generators to be developed after Frenzel and Schultes' initial work, and up until now Domnitch and Gelfand's project is one of the

only artistic undertakings using sonoluminescence phenomena as a "canvas" for creation. To achieve a result like the one mentioned above, though it may appear easy, is fairly hard work: the DVD's notes mention how the screen visuals called for "the brightest known sonoluminescence" to be attained (using a recipe of 97% sulfuric acid doped with xenon gas), and even then the authors recommend viewing the results in a darkened room.

Experiments such as these are vitally interesting because of the way they deal with the "representational" paradigm of art. That is to say, there is no place here for symbolism or metaphor: the sights produced by the sounds are literally a "mirror" or even a "film" of those sounds. With projects like these, there is a concerted effort to extract an aesthetic value merely from the act of engaging with our senses, rather than using that process as the initial act *en route* to some other social epiphany (although that choice *is* left open to the audience, this kind of artwork rarely makes it an explicit imperative.) On the liner notes of another Line DVD release (*Optofonica*), R. Ganchrow notes how "a new form of art is surfacing that invites audiences to transcend the limits of habitual perception...it seeks to shift the observer's attention from the physical objects that stimulate perception to the act of perception itself." The type of perception we normally have in mind when discussing the mirroring of sensory information is *synesthesia*- from the Greek "syn" [union] and "aesthesia" [sensation]. While being diagnosed with this condition as a permanent state is extremely rare and likely to be inherited (something we'll look into shortly), the number of artistic practices dealing with synesthesia as an adventitious or acquired state are growing steadily. For the latter, maybe the term "cross-modal translation" should be used in the place of "synesthesia" to differentiate adventitious and inherited forms of experience, yet the "sexiness" of the term synesthesia is difficult to shake off: when I refer to *synesthetic effects* later in this piece, this should be understood as the results of both subjectively experienced synesthesia, and the attempts to create an objective simulation thereof.

## Computerized Correspondence

Advancements in computer processing power, and other technological progressions, have made it possible for total novices to approximate some kind of cross-modal translation in their own home- a fact that is appreciated by those music lovers who, though desiring to make music, remain uncomfortable with the syntax of traditional music notation and prefer a different set of cues. Many computer applications, some available as freeware or shareware, contain some set of algorithms that will produce graphic output from sonic waveforms and vice-versa. Some of the results are disappointingly predictable, e.g. when painting a screen area completely white in early programs of this type (see Metasynth, Coagula, etc.) leads to a blast of white noise, yet the results at their best can provide ineffable moments of wonderment and serendipity- an open architecture program like Max / MSP's "Jitter" is one example of the sophistication that can be achieved here. Other programs such as AudioSculpt, developed at the IRCAM labs, allow for multiple sound signal processes to be modified once a visual readout of a waveform has been created by the program- typically these include time compression and cross-synthesis of multiple sounds.

Many of the current programs in this vein have their genesis in the UPIC<sup>1</sup> music composition tool designed by Iannis Xenakis in the late 1970s, essentially a drawing tablet linked to a synthesizer boasting an impressive 64 oscillators (UPIC itself is doubtlessly inspired by Xenakis' architectural training, particularly his comfort with using an architect's table for writing music compositions.) The x-axis of the drawing tablet represented time, while the y-axis represented pitch- a convention that has been imitated by numerous electronic music tools. It has since been criticized as being

primarily a "sound design" tool, thanks to the characteristic timbres created by the computer's translation of the drawings, but not an effective "compositional" tool. All the same, the built-in limitations of the system have not been a total deterrent to electronic music composers, especially ones curious about cross-modal translations.

The UPIC system was never offered on the consumer electronics market, although there was the Fairlight CMI [computer music instrument], introduced in 1979, a similar innovation involving real-time manipulation of waveforms by moving a light pen across a monitor screen, which could be modified in turn with a piano keyboard. Unfortunately, the asking price for all Fairlight models, including the "20<sup>th</sup> anniversary" re-release, was about as much as a new automobile. In the intervening years between then and now, the "graphic user interface," as a means of computerized musical composition and real-time control, has become *de rigeur* in electronic music circles. Newer instruments such as the JazzMutant Lemur - a touch-screen controlled tablet - offer a wide array of graphic user interfaces to fit the exact mood of a particular music performance, in fact the sales pitch for the Lemur recommends that players use it to enhance the look of a performance environment (presumably through projection of whatever is happening on the Lemur's screen): users should "...not only use the Lemur for functionality, [but] actually [as] a part of the look and feel of their stage theme [...]. The brilliant colorful interface fits in with any stage lighting and adds to the 'cool factor' of the audience experience."<sup>2</sup>

Documentation continues to surface about more obscure attempts at synesthetic instrument building: for example, the computer-controlled DIMI-O organ which was controlled by co-designed by composer Erkki Kurenniemi and electrical engineer Hannu Viitasalo (prototype completed in 1971.) In addition to a 4-octave keyboard, the instrument also included a 32-step sequencer. While this is fairly conventional for

experimental electronics of the period, the DIMI-O became truly radical when a videocamera was introduced as an input source for the attached video monitor. Once transferred to black and white, the picture could be used as a "control signal" (this is demonstrated in the documentary film *The Future Is Not What It Used To Be*, where we see an ebullient Viitasalo at the keyboard and "playing" a captured image of his own face.) Setting brightness and contrast controls on the monitor would also directly impact musical output: for example, at peak brightness, the instrument emits a diatonic cluster across all 4 octaves, and fewer notes are included as the brightness decreases. The image capture feature of the DIMI-O led to one proposed experimental use of the device, where it would capture images of live dancers or performers, and then use these images as the basis for musical output. Although a suitable manufacturer was not found for the DIMI-O, it remains a highlight in a career that exceeded even beyond synesthetic experimentation: Kurenniemi is also one of the few artists to conceive of using brain waves themselves as audio controllers (using a cross between EEG and sonar technology.)

## **Historical Perspectives**

Having said all this, the desire to find convergences between different types of sensory data is not an exclusively 20<sup>th</sup>-21<sup>st</sup> century phenomenon, nor was anything like a computer required to begin the intellectual inquiry into this subject: Sir Isaac Newton, on papers presented before the Royal Society and published in his *Opticks* in 1704, noted a correspondence between the width of the seven prismatic rays and the string lengths needed to produce the D,E,F,G,A,B,C musical scale. Though this was indeed criticized by contemporaries as an over-simplified analogy, discussion did persist based on the similar physical properties of light and sound. Contemporaries such as John Locke stirred up much debate when observing how a blind man heard the sound of a trumpet

as having a "scarlet" tone. The concept of luminous ether (discredited after the 1887 Michelson-Morley experiment, that also paved the way for the theory of special relativity) also proposed that light and sound were the result of vibrations in a common medium: it was only the rate of vibration that determined whether light or sound would be perceived. Interest in this theory developed when it was observed how mathematical similarities in ratios of vibration could be viewed from one end of the visible light spectrum to another, and then compared to the vibrational frequencies within a musical octave. Despite attempts by Paul Dirac to resurrect the concept of an ether in 1951, the scientific community has largely abandoned further research in this area.

Scientific consensus has never been necessary for the production of art, though, which is what we're concerned with after all. The attraction to "colored" music was renewed at various points throughout the Romanticist artistic movements 19<sup>th</sup> century, in composers as diverse as Aleksandr Scriabin and Nikolai Rimsky-Korsakov. The former, directly influenced by Newton's theories, also upped the ante by ascribing spiritual qualities to each of the colored tones: blue and violet lent themselves better to spiritual transcendence, while reddish tones were more earthy or associated with the material realm. By this logic, one might instinctively expect a higher frequency to correspond to the higher end of the spectrum of visual light, when mapped onto a keyboard. This is not the case with Scriabin's system, though, where F-sharp is the "blue" note and the lower D-flat is violet. It was Rimsky-Korsakov who attempted to convince the wary Sergei Rachmaninoff about the colored music theory, using one scene in Rachmaninoff's opera *The Miserly Knight* as an illustrative example that Rachmaninoff was unconsciously promoting a synesthetic compositional method (the scene involved the opening of some gold-filled treasure chests and was scored in D-major, the key that Scriabin associated with yellow or 'gold.'). In a much more general sense, European 19<sup>th</sup> century music - particularly through the proselytizing of Richard Wagner - saw increasing interest in the "total artwork" (*Gesamtkunstwerk*); which in itself was one of the major

precursors of "multi-media." The publication of Wagner's polemical pamphlet *Artwork Of The Future* did much to divide music audiences: there were those who favored "absolute" music free of interruption by lyrical content (let alone any kind of staged elements), and those who viewed music as one component in a fully-integrated artistic program, where each element commented upon the other. Already in Wagner's time, the opposition was evident via critics like Eduard Hanslick, whose defense of *absolute Tonkunst* remains relevant today.

Long before Wagner's intervention, though, work had begun on devices that - had their construction succeeded - would not require a bombastic *Gesamtkunstwerk* stage show in order to be enjoyed by players and listeners alike. The 18<sup>th</sup> century mathematician Louis Bertrand Castel is another name often associated with the development of "colored sound" keyboards, a labor he took upon himself in addition to building automata for replicating the human voice (his contemporary Jacques de Vaucanson was more successful at the latter, having built a flute-playing automaton with a repertoire of 12 songs, and, more amusingly, a "digesting duck.") The design of the *clavelin oculaire* of Castel dissented from the theories laid out by Newton: Castel believed the color blue corresponded to a 'C', while Newton believed this note to be red in tone (because the fundamental order of the spectrum, from red through violet, was in agreement with the note range from C to B.) His dissent from Newton's color theory, regardless of its applications to music, was eventually taken up by Goethe for his own theory of colors, which was more physiologically oriented than Newton's. At any rate, the composer Telemann was so taken with Castel's invention, that he agreed to score some pieces for it. In the end there is, however, no evidence that a workable copy of Castel's design was ever made: Albert Wellek has concluded after his research that "...there can be no doubt that Castel's construction was begun, but by no means did this lead to a fortunate termination."<sup>3</sup> His influence lingered long enough, though, for the American science fiction enthusiast and inventor Hugo Gernsback to propose the

building of a "smell organ" in 1922: this in itself is unique in a world where the olfactory sense is almost completely ignored as a stimulus to creation, but Gernsback's article goes into very insufficient detail about the functionality of this hypothetical device (for example, we're unsure whether, say, a louder sound output will produce a stronger odor, or what will be done to prevent a confusing blurring of smells, since each individual note played on the keyboard is supposed to activate a different perfume spray bottle.)

In the early 19<sup>th</sup> century, Ernst Florens Friedrich Chladni experimented with spreading sand across glass plates of varying sizes. As he ran a violin bow along the edges of these plates, differing patterns in the sand would form depending on the placement of the bow or the shape of the plate- a consistent enough bowing would cause the "nodal points" within a pattern to become more clear. One result of this experiment into the emergent field of acoustics was that it saw sound "...as a species of vibration,"<sup>4</sup> leading in turn to a condition where studying soundwaves meant studying the way in which all organic matter was shaped. Chladni's experiment was given new life in the 20<sup>th</sup> century as physicist Hans Jenny, who coined the term *cymatics* (from the Greek "kyma," and meaning study of waves) used electronic tone generators as the means of exciting the plates, which were covered with all sorts of materials from sand to gelatin. Modern proteges of Jenny, such as Carsten Nicolai, embrace his cymatic theory and marry it to a musical style that consists of a spherical, tactile electronic pulse. In both the experiments of Chladni and Jenny, low frequency sound waves led to the formation of rudimentary shapes and patterns of the medium being manipulated, while high frequencies led to much more complex designs (which, it has been noted, share much of the symmetry and concentricity of such ancient designs as Indian *mandalas* or *yantras*.) Chladni's discovery was also, it would seem, a confirmation of period theories such as that of Arthur Schopenhauer's, i.e. that lower-frequency sounds corresponded to "the lowest grades of the Will's objectification" and higher frequency tones (presumably vocal solos at this time) were equivalent to "man's conscious life and

endeavor." If nothing else, the scientific and philosophical work of Chladni and Schopenhauer, respectively, showed how far appreciation of sound had come since Kant had all but dismissed music's relevance in his *Critique Of Judgement*.

The dilemma we have face is that the more truthfully a device manages to translate sensory information, the less "musical" it seems to be. The vibrating plates of Chladni and Jenny offer more to the experimenter or audience in terms of visual stimulation than they do auditory stimulation, although the visual forms created during these experiments may be fairly true to a 1:1 correspondence between audio and image. Even the intriguing sonoluminescence experiment initiated by Domnitch and Gelfand requires definite constraints to be placed upon the kind of audio content that will make it work: in order to produce the desired visual results, the artists had to record material at an inaudible frequency range of 22-140 kHz before it could be translated into the audible sound spectrum with the aid of a hydrophone. Those who are seeking out sonoluminescence experiments set to, say, classical chamber music will have to wait. On the opposite end of the spectrum, the *clavecin oculaire* of Castel and the light organ of Aleksandr Scriabin, while intriguing and inspiring in their own right, still operated on metaphorical principles.

Faced with this dilemma, it's easier to understand why films illustrating pre-recorded music have become most art followers' primary contact with synesthetic experimentation. The history of theatrical vignettes set to music has long become commonplace through the music video (and the earlier, if forgotten, 'scopitone'), but the avant-garde flirtation with translation of sound into sight predates either of these by several decades. The best-known short works of filmmakers like Viking Eggeling, Len Lye (e.g. *Free Radicals*) and Harry Smith were not only innovative for attempting to present a synesthetic experience with various forms of geometric abstraction, but for the

painstaking methods used to create them: Smith painted directly onto film stock in the mid-1940s, while Lye employed a more spartan scratching-on-film method. It is somewhat uncanny how these works, using now-"primitive" animation techniques, can still hold their own against 21<sup>st</sup> century representatives of the genre (such as the numerous works by Finnish video art group The Pink Twins, or the visualizations of granular synthesis sounds included on Curtis Roads' CD/DVD package, *Point Line Cloud*.) At any rate, a Smith painting used for his film *With The Greats*, inspired by the Dizzy Gillespie tune "Manteca," is described as follows:

Each line in that painting represents a certain note of the record. Like, if I had the record, you could project the painting as a slide and I could point to a certain thing [...] the main theme in there, which is [sings theme], are those curved lines up there, [sings theme again], and so forth. [...] The most complex of this [series of paintings] is one by Charlie Parker, that's a really complex painting, that took years [to make.] There's a dot for each note and the phrases that the notes consist of are colored in a certain way, or made in a certain path, or that kind of thing.<sup>5</sup>

Musical composers as radical as Erik Satie could be found admitting, at times, that "musical evolution is always a hundred years behind pictorial evolution"<sup>6</sup> - an admission that undoubtedly saw him experimenting with the "graphic score" decades before its heyday (the scores for his humoristic piano suites eschewed bar lines and time signatures in order for the notation to take on a more decidedly "calligraphic" appearance.) Such quotations, even if we interpret them as the defeatist eulogies of artists who wish they had mastered a different craft, often carry with them a tacit acknowledgement that - since one art form needs to come "up to speed" with another - a more fertile art world would involve sonic, visual and other sensory information all

progressing at the same pace with each other. Considering Xenakis' intense labor on the development of the UPIC system, it is interesting to note how he contradicts Satie and others inclined towards his point of view:

When you compose or listen to music, you manipulate more abstract notions than that of the visual world [...] the dimensions of what we hear - pitch, frequency, intensity - are closer to us in their structures. There are no photons, only *phonons* - phonons can be perceived, touched...photons only leave a global imprint. So, maybe when you manipulate sound, you reach something closer to Man, and therefore much more perceptible, where the function (the discovery of ideas) is also closer, more accessible.<sup>7</sup>

For Xenakis, at least, there was no contradiction in manipulating the way that we "see" music in order for it to achieve these musical functions. The logical predecessor to Xenakis' UPIC tool was his work with graphic notation: more now than ever, the graphic score is an important feature in the occasionally perplexing "multi-media" arts milieux we now inhabit, because the use of computers and electronics as compositional tools forces players to think in terms other than the ones conveyed through stave notation (for example, thinking of musical pitch in terms of hertz values rather than as 'notes'.) Of course, epic-length graphic scores like Cornelius Cardew's *Treatise* do exist, which have little to do with computerization, and elsewhere the graphic notation of Anthony Braxton is meant to alter the attitude of his ensembles towards the otherwise imposing, rudder-less activity of collective improvisation (Braxton counsels his players to "have fun" with his work.)

However, the same graphic score that liberates one performer's expressive ability may also frustrate another's. Christoph Cox elaborates on this, saying that "the latitude given to performers means that no two realizations of the same composition are ever likely to sound the same...moreover, these pieces are often 'scored' for 'unspecified instruments' and few give any indication of how long it should take to play them."<sup>8</sup> Indeed, the lack of clearly discernible time axis information may be one of the main things separating these types of scores from the classical five-line stave notation developed by Guido d'Arezzo in the Middle Ages, though the latter type of score is essentially "graphic" information as well. It may be time to invent a more accurate term to designate scores that give performance cues with heterogeneous, multi-colored objects and patterns rather than with notation that, although monochromatic and "fixed," is "graphic" all the same.

There have been notable instances in music composition where the subjugation of sonic information to graphic information has led to awkward or unsatisfying results, and, in extreme cases, has called into question the entire practice of performing music from visual cues. The tone row compositions of Arnold Schoenberg, for example, are often derided for the fact that one can "hear" the theoretical rigor animating the music but not any music in itself (a complaint that comes from musical conservatives and radicals alike.) One of the more acute denunciations of this style comes from critic Andy Hamilton, who notes:

Schoenbergian serialism, especially in its extreme post-Second World War manifestation of total or integral serialism, is the paradigm of 'eye music.' The tone row and its manipulation, and in total serialism the rows governing other parameters such as rhythm and timbre, is legible in the score but not audible in performance. To refer to a piece as 'eye music' is

rightly taken to be a damaging artistic criticism, and it is a consequence of privileging the score above performance.<sup>9</sup>

Notable students of serialist technique such as "Theater Of Eternal Music" founder LaMonte Young, while not delivering critiques as withering as Hamilton's, already began to look beyond Schoenberg as a driving influence- for Young, Schoenberg protégé Anton Webern was preferable because "...in Webern row technique is very strictly coordinated with thematic and motivic materials."<sup>10</sup> As a relevant aside, Young later moved on to host installations billed as "continuous frequency environments in sound and light," where oscillators produced steady sine waves and combined with Marian Zazeela's light projections, achieving "...a fluid, variable environment which appears to contain self-luminous colored bodies freely suspended in an atmosphere of continuously moving calligraphic strokes."<sup>11</sup> The two forms of sensory information were to be harmonized since "the slow shifting movements of the forms and their multiple shadows in space recall the slow phase drift of two sine waves in rational relationship, as displayed in lissajous figures or an oscilloscope."<sup>12</sup>

Young's devotion to "Dream Music" led him towards an embrace of music created purely with harmonics, and as such the harmonizing of light and sound seemed to be on his mind as well. Fluxus artist Yasunao Tone joins the chorus of twelve-tone skeptics as well, claiming that "the situation of 20<sup>th</sup> century music was brought to a deadlock by dodecaphony and serial music, which had destroyed otherness, [and the] spontaneity of performers with excessive control and homogeneity of sounds."<sup>13</sup> Interestingly, Tone has previously utilized the Sound Designer software in a UPIC-like manner, drawing the characters of traditional Japanese *man'yo* poetry on screen and letting the software interpret them as audio output.

## A Truce In The Sensory War?

Casey O'Callaghan, in his phenomenological treatise *Sounds*, stands firm against visuocentrism or "the tyranny of the visual," lamenting the way in which, "from the perspective of a philosophical account of perception, understanding auditory, tactile, or olfactory perception involves little more than extrapolating or transposing from an account of vision."<sup>14</sup> He argues that a full understanding of perception involves knowing how sounds differ from other perceptual stimuli, or how they present "...both novel philosophical problems and telling new instances of old ones."<sup>15</sup> This has occurred in spite of the best efforts of Enlightenment and Romantic thinkers to give aesthetic precedence to organized sound: they could be found saluting architecture as "frozen music" (Goethe) or positing that music was "...the *copy of the will itself*, whose objectivity the Ideas are."<sup>16</sup>

O'Callaghan's claims of visual predominance far from being ungrounded; as the most cursory look at modern pop-culture products will make clear: by the mid 1980s, MTV had arguably supplanted commercial radio to become the main conveyor of pop music, and popular songs were irrevocably linked in the minds of listeners to the imagery of their corresponding promo video clips. Yet, while MTV is a fashionable 'soft target' for alienated kids and postmodern critics alike, its infiltration of households across the globe was hardly the breach birth of O'Callaghan's "visual tyranny": long before, synecdochic expressions such as "*visualize, if you will...*" or "*try to see things my way*" have been used to motivate people to fully comprehend some scene that would, ideally, include stimuli from the whole human sensorium. It begs the question, when seeing someone wearing a "*visualize world peace*" t-shirt, should we just imagine that this peaceful condition would be a succession of silent filmic images, in which our taste,

touch and smell receptors would be totally numbed? At the very least, cliches of this sort make visualizing seem like an activity whose transformative power will far exceed that of hearing. Even as I compose this essay, I find myself fighting back a deeply ingrained urge to use "view," "see," "look" and other optical vocabulary to stand in for a state of multi-sensory awareness.

On the other hand, sound is not without those who criticize its tyrannizing potential: theorists Gilles Deleuze and Felix Guattari showed some concern over a "fascism of sound" in which sound, as the potential sum or totality of all experience, had the same false synecdochic qualities as the ones O'Callaghan has associated with "visual tyranny." Critics arguing along these lines will point to the role that the unassisted, broadcast human voice played in subjugating entire populations and warping public opinion: the maddening frequency of radio announcements from cult leader Jim Jones, prior to the mass suicide of his followers, is mentioned by survivors of Jones' Guyana experiment as one of the most insidious features of life in the "Jonestown" complex. Meanwhile, despite the careful stage management and visually arresting nature of propaganda in the Third Reich, the intimacy provided by hearing Hitler's oration over one's *volksempfänger* radio set was a necessary ingredient in conferring an illusion of omnipotence upon the Nazi regime (the receiver originally went into production on the order of propaganda minister Joseph Goebbels, and the sales pitch for its 1936 advertising poster was that "all of Germany can hear *der Führer*.") This fact has become so widely acknowledged that the 1975 album *RadioActivity*, by seminal German electro-pop group Kraftwerk, was denounced in some musical circles for its usage of a *volksempfänger* speaker as the central image on the album sleeve.

And yet, there are those who believe in the primacy of sound over other sensory stimuli, are well aware of these cautionary examples, and have no qualms about

unleashing its power to the most overwhelming degree that their playback equipment (and their own bodies) will allow. There exist auditory events as diverse in nature and intent as dub reggae "sound system" parties and scourging, sado-masochistic exhibitions of "power electronics," all of which aim to (borrowing sound artist Ruben Garcia's term) "turn the whole body into an ear."<sup>17</sup> Skillful volume dealers such as Masami Akita, Daniel Menche and Zbigniew Karkowski all speak of the totalizing and potentially fascist aspect of sound in their work, yet they largely neglect to use a crucial sub-category of sound (human speech) that would give it any kind of didactic sensibility. More likely, their militant embrace of sound as a weapon is inspired by a hope that new, different forms will arise in the wake of their sonic demolition program, rather than more of the same. It is unsurprising, then, that this newer breed of high-powered psychonauts show great respect for a composer such as Xenakis (who claimed that "music, by its very abstract nature, is the first of the arts to have attempted the conciliation of artistic creation with scientific thought"<sup>18</sup>): he implies that the mutual arising of technological advances and sonic advances will likely always be with us, but that the former will never be able to domesticate or extinguish the latter.

With so many claims being made from either side of the audio-visual "divide" relating to each side's purported omnipotence, one can be forgiven for imagining some kind of ongoing, low-intensity "war of the sensory modes" taking place every day. Numerous critics, aware of this schism, have attempted to draw up lists of ways in which sound and vision "confront" each other, or are irreconcilable in some way. All of those that have been encountered by this author personally have had some problematic degree of contestability to them, and one of these in particular (the so-called "audiovisual litany" of Jonathan Sterne) provides a fairly exhaustive overview of how these different modes of perception end up clashing. As per Sterne, "hearing is spherical / vision is directional," "hearing is about affect, vision is about intellect," "hearing immerses its subject, vision offers a perspective," "hearing tends towards subjectivity,

vision tends towards objectivity," and most curiously, "hearing brings us into the living world, sight brings us closer to atrophy and death."<sup>19</sup> Sterne attributes this list (which is only excerpted here) to a "salvationist" current in Western intellectual thinking that "idealizes hearing (and by extension, speech) as manifesting a kind of pure interiority" while "alternately denigrat[ing] and elevat[ing] vision...as a fallen sense, vision takes us out of this world."<sup>20</sup> From the language he uses, it would seem Sterne has an ax to grind with Western Christian tradition in particular (he admits the word 'litany' is used here in a kind of sardonic way), yet there are those - like the "Afro-Futurist" author Kodwo Eshun, who stand outside of that tradition and yet also see hearing as a kind of transcendent liberator: "...sound comes to the rescue of thought rather than the inverse, forcing it to vibrate, loosening up its organized or petrified body."<sup>21</sup>

As the techniques continue to increase for creating artworks that "speak to" individual sensory modes, the debate will only intensify over which mode is the most direct conduit to our spirits, or which reveals the most about our relationship to the organic whole of life. The modernist writer Hermann Broch once claimed that his particular expressive mode, the novel, was chosen because it communicated things that "only the novel could communicate," and this defense will have staying power in the future for artists who prefer to work in a single medium. As long as this debate continues to stimulate more powerful and memorable works from both sides of the audial / visual divide, and does not just degenerate into petty bickering, perhaps the continued friction will be a good thing. Still, *contra* O'Callaghan's statements above, we should consider what happens when one sense "translates" the information received by another. Though we have already discussed electronic simulations of this phenomenon, which are meant to externalize this condition, it is well past time that we begin looking at synesthesia as it is internalized within the minds of people who live with it daily.

## Living With Synesthesia

Synesthetes are a fascinating topic of research for the creatively minded, since so much of the creative activity we undergo involves making metaphorical connections between seemingly disparate objects, people and so on- this is something that synesthetes do almost effortlessly, and some of the most famous examples (e.g. the girl whose kisses "tasted like orange sherbert foam," the "man who tasted shapes" and so on) provide limitless inspiration for people who use counter-intuitive ideas to inspire them. At least one of the great composers of the 20<sup>th</sup> century, Olivier Messiaen, was a legitimate synesthete who saw distinct colors both upon hearing music or reading scores, and was actually a "bi-directional" synesthete owing to his ability to view landscapes and effortlessly map musical themes onto them. Since he tended to see colors in the vertical spacing of notes on paper, this led to his highly idiosyncratic compositional style, namely his "modes of limited transposition" (some scores that survive Messiaen have color notation still intact.) Casey O'Callaghan maintains of synesthesia that "synesthetes do not *literally* [italics mine] perceive through audition the color of a sounding object, or through gustation the shape of tasted food...the experience always involves an illusion."<sup>22</sup> This is all fine and good, but the illusory nature of synesthesia does not disqualify it from being a powerful creative or communicative tool. To do so would be akin to saying other states not fully rooted in objective reality (dreaming, etc.) are illegitimate sources of inspiration. Warning someone that an act is irrational has never been a great obstacle to the creative process- if anything, it is an incitement to that process.

Here are some of the most widely accepted features of clinically designated synesthesia. It is largely inborn and heritable, with an unusually high number of synesthetes being female, left-handed, or both. There is also a high instance of this condition in, suitably enough, fine arts students- one report (Domino, 1989) claims that 23% of a sampling of arts students reported experiencing synesthesia. Synesthetes' visualizations of sounds and textual data have a spatial character to them (for example, someone who hears the days of the week have a complex "spatial schedule" in which they interpret Monday as being "behind" themselves in space, Tuesday as being slightly to the rear right side and so on). Synesthetes report enhanced emotional responses to the multi-sensory stimuli they experience, while the opposite situation may occur as well (a visible "aura" will be produced in some subjects after a flash of inspiration, a fit of anger, various forms of intimate human contact etc.) There is a strong argument for synesthesia as being anatomically localized within a particular area of the brain- hypothetically the "source" is within the limbic system and temporal lobe; and favors limbic activity over neo-cortical activity. The angular gyrus, given its location between the temporal, parietal and occipital lobes, is also a prime candidate for helping to initiate synesthetic cross-wirings.

As reported in the classic autobiography of author Vladimir Nabokov (*Invitation of a Memory*), the most commonly reported form of synesthesia is "grapheme / color" synesthesia, or the belief that numbers and letters must have fixed corresponding colors regardless of how they appear on a printed page (again, emotions or feelings about a particular letter or word can affect how it appears in the mind's eye.) About 2/3rds of all reported cases deal with this particular combination. Other varieties like colored musical sounds and colored general sounds account for some 12-14% of the overall synesthetic "pie," though they are the types considered the most relevant for students of the arts. The experiences of colored odors or colored touch are even further down the scale,

while reports of pairings such as touch/smell synesthesia or smell/sound synesthesia typically account for less than a single percentage point.

The way that grapheme / color synesthesia relates to eidetic memory is also intriguing: synesthetes, when claiming to imagine these colored letters, pictographs etc., will regularly have a stronger impression of the attached color than of the grapheme that carries that color. So, sometimes the 'photographic' recall that this type of synesthesia offers will fail- names, addresses and so on will be completely forgotten, but synesthetes will still remember the impression that such-and-such name had a "green tone" to it.

The "serious" study of synesthesia is (within scientific discourse, at least) so new that only a handful of researchers are likely to be mentioned when citing papers on the subject (to wit: Simon Baron-Cohen, Richard Cytowic, V.S. Ramachandran, E.M. Hubbard and Hinderk Emrich, with authors like Cretien van Campen offering slightly less academic accounts of the phenomenon.) Many researchers still skirt around the subject warily for fear of being tagged as frivolous "new age" or metaphysical dabblers, despite the fact that this intrepid handful of explorers are following in the footsteps of such deathless intellectual titans as Goethe and Newton (the uniform laws of motion proposed by the latter did much to stimulate debate about a possible algorithm for translating sound vibrations into wavelengths of light.) The objection to the subjectivity of synesthetes' reports clearly contributes to the skepticism, but Cytowic capably throws down a gauntlet for such skeptics: "...many established medical conditions are entirely subjective, such as headache and all pain syndromes, dizzy spells, and TLE [temporal lobe epilepsy]...TLE patients [...] have all sorts of peculiar *subjective experiences*, such as disordered time sense, a sense of leaving one's body (autoscopy) and other dissociative states [...] they occasionally experience *synesthesia*.." <sup>23</sup> In the end, it is not just

synesthesia's "cutting edge" exotic nature, and the potential for new ways of thinking, perceiving, and creating that makes it a compelling subject of study. Rather, it is this combined with synesthesia's potential for illuminating ways in which the mind has always worked.

Synesthesia, as a neurological condition, is so highly idiosyncratic in nature that, even if a Newtonian theory of color / sound correspondences were to be perfected, it would mean little or nothing to those affected with it. The highly personal or subjective nature of synesthesia makes it such that even a cross-modal exercise like *Camera Lucida* would feel "wrong" to those who heard different colors or tasted different textures that were at odds with the visual content. For a vast number of synesthetes that have been test subjects, their cross-modal associations do not change over their lifetime, and as such they have a great level of conviction in their "correctness." These associations are so unique from one synesthete to the next; it would immediately become a topic of heated debate if two were asked to compare their perceptions. This is the great irony of the condition; that individual synesthetes have already stumbled upon a perfectly harmonious set of correspondences, yet are unable to fully share them with the general population. Their harmonizing effects are the result of individual quirks in neurological circuitry, and not of external forces - for this reason it has been easy to dismiss that synesthesia really exists. However, citing the theory of *color constancy* (which is, sadly, too much of a diversion to properly tackle here), Cytowic notes that non-synesthetes are just as susceptible to subjective illusions (e.g., claiming an apple is the same tone of green regardless of the strength of illumination that strikes it.)

Synesthesia is also marked by a striking automaticity, i.e. an inability to "shut it off" without at least performing some form of complex mental aerobics. Cytowic claims that, for those who have fully internalized this condition, a sudden loss of synesthetic ability

would be "an odious state akin to going blind or not being alive at all."<sup>24</sup> One subject of Cytowic' notes how

...somebody says to me, "how is your dog?" First I see the word DOG in color, then I think of the dog. That's how it goes. The color always comes first before I can think of the thing.<sup>25</sup>

While speaking about the involuntarism of synesthesia, it's also worth mentioning that unpleasant experiences receive their own forms of synesthetic enhancement in addition to the expected positive experiences (listening to music, and so on.) Where image intensity begins to match sound intensity, for example, some synesthetes have reported that loud, high-register tones or a babble of voices will make it difficult to see what is going on around them, easily impairing activities like driving or machinery operation. Pain is also given an added measure of intensity when the triggering stimuli become rendered as visible forms or spatial perceptions.

### **Who Wants To Be A Synesthete?**

So, what can be said about attempts to "will" a state of synesthesia upon oneself? Certainly, much more grandiose tasks have been attempted by alchemists and esoteric researchers throughout history. Many practitioners of esoteric or magical arts have insisted that a synesthetic faculty lies dormant within us all; the artist Austin Osman Spare suggests as much when he states

...within the sensorium is a transcriber, or a synthesizing faculty, using synonymous intangibles where association and experience fail: as the capacity of certain sounds to induce color images, certain arabesque forms may find aesthetic truth.<sup>26</sup>

The predominant synesthesia researchers, while cautious about convincing non-synesthetes that they can "train" themselves to acquire this condition, are not beyond claiming that some esoteric practices do lead to a synesthetic awareness. Cytowic quotes Zen monks in his clinical guide to synesthesia, and concurs that "meditators may be an untapped subject pool for studying synesthesia and cross-modal metaphors."<sup>27</sup> The question needs to be asked- what would lead one to covet this condition in the first place? For many synesthetes, the condition is a ticket to social ostracization as well as a means of confounding the simplest transactions (e.g. wondering why a paint would have a whitish tone when it "smelled blue.") In spite of this, the increasing number of interviews with synesthetes suggest a world where cross-modal sensory awareness can not only be applied to advancing music, visual art and so on, but can also be highly therapeutic and can act as a major boost to faculties like attention span and memory. The famous account of "Patient S" by A.R. Luria, *The Mind Of A Mnemonist*, exhibits a remarkable individual whose lifelong synesthesia is the key to a photographic memory (first discovered during his stint as a newspaper reporter, when it was found that "S" could repeat an assignment verbatim without having taken any notes.)

"S" is often portrayed in Luria's account as a somewhat tragic man-child who becomes overwhelmed by his impressions, remains fairly passive, and "had no clear idea what he wanted out of life."<sup>28</sup> His synesthetic experiences are seen by Luria as both giving and taking away, leaving us doubtful as to whether this ability constitutes a net gain for him: "the rich synesthesia of his memory images, their very completeness,

prevents his fusing the simultaneous with time-contextualized planning...as if one system won out over the other, or a hypertrophy of one prevented the other from developing."<sup>29</sup> All the same, who wouldn't be tempted to use synesthesia as a means for dealing with pain effects, as "S" claims he can do:

Let's say I'm going to the dentist. You know how pleasant it is to sit there and let him drill your teeth. I used to be afraid to go. But now it's all so simple. I sit there and when the pain starts I feel it...it's a tiny, orange red thread...I'm upset because I know if this keeps up, the thread will widen until it turns into a dense mass...so I cut the thread, make it smaller and smaller, until it's just a tiny point. And the pain disappears.<sup>30</sup>

All things considered, it is the brilliance of "S" in some areas, and his failure in other areas that calls into question the status of synesthetes as an elite "mutant" group both intellectually and perceptually. One hypothesis, by Daphne Maurer, posits that *all* newborn infants have a synesthetic awareness (and consequently "grow out of it" in 6 months' time.) This leads us to believe that eventual splitting of the sense modalities is one necessary step on the road to maturation- and thusly, those who sidestep this process are "vestigial remnants." It is also suggested that synesthetic experience is older, in evolutionary terms, than the individual perceptions that are associated with the cortical areas. So, synesthesia may be a more common occurrence in so-called "lower" animals than in humans (see Paul Schiller's experiments with fish, in which his fish, "having learned to discriminate between a bright and a dark chamber, synesthetically related brightness with a 'bright' odour and darkness with a 'dark' odour.")<sup>31</sup> When all this is taken into consideration, we are left with a situation whereby synesthesia actually pre-dates human language, and as such it can be further argued

that synesthesia played a role in shaping language (both as a general precept) and regional variants on it.

Though "true" synesthesia largely remains an inherited phenomenon, there are instances in which trans-sensory stimuli can be experienced by individuals not clinically designated as synesthetes. Meditative practices have already been suggested as one potential gateway, while the number of anecdotes dealing with synesthetic experiences initiated by psychedelic drugs are manifold (to the point where legitimate synesthetes are often stigmatized as drug-loving miscreants.) However, pharmaceutical consumption is hardly the only method of bringing this state about in people who spend the majority of their lives as non-synesthetes. Not every "trip" launched by LSD or some other anti-serotonergic chemical will bring about a state of synesthetic awareness, and, curiously, actual synesthetes given the drug have shown remarkably little intensification of their condition (some with no reaction whatsoever.) Pharmaceutically induced synesthesia is, per Ramachandran and Hubbard, "not based on the same neural mechanisms as the congenital, lifelong experiences of *true* synesthetes, in spite of the superficial similarities."<sup>32</sup>

Hypnagogia, defined as "hallucinatory and quasi-hallucinatory events taking place in the intermediate state between wakefulness and sleep"<sup>33</sup> and taking its name from the Greek *hypnos* [sleep] and *agogeus* [leader, conductor], is a conscious state in which one can temporarily experience sensory 'translations' ranging from sublime to startling. For example, H. Hollingworth claims of one patient that

...as he became drowsy while attending a concert, the three finishing blasts of the musical piece turned into "the movements of some huge

bug which came sailing from behind the wings, suddenly alighting on the stage, first on the two hind feet, then bringing down the middle pair, and finally the two front feet with the final blast."<sup>34</sup>

As this example may hint at, synesthesia coming about during a hypnagogic state may often have more of a 'narrative' element than the experiences encountered by grapheme / color synesthetes or sound / color synesthetes, along with a tendency to anthropomorphize sensory stimuli- that is to say, a sound stimulus may result in the hallucination of some corporeal form (animal, human, or otherwise), which in turn appears in the hypnagogue's optical field rather than in the "mind's eye." In Luria's "Patient S," this involuntary reaction was present as well. With the intensity of the visions ratcheted up as such, the emotional responses to hypnagogic visions can range from detachment to enchantment to full-on terror (as to the latter, many 'UFO abductee' reports, out-of-body experiences and otherworldly 'visitations' have been later attributed to hypnagogic shock.) When hypnagogic experiences are extreme enough, they also bear striking similarities to the mental phenomena encountered in the daily lives of schizophrenics (e.g. an identification with the universe, or dissolution of boundaries between internal and external reality, and impaired volitional action.) Curiously, reports of these types of visions usually involve the subject being aware of the hypnagogic vision first, and only later becoming aware of the triggering stimulus from another sensory mode.

Entopic phenomena (the seeing of visual effects that have the eye itself as their source) are another way in which a simple "cross-modal" effect can be achieved. One variety of such, phosphenes, are most commonly brought about by simple forms of pressure (rubbing the eyelids, or suffering sharp blows to the head.) Hermann von Helmholtz, among his many other contributions to acoustics and the physics of

perception, published sketches of his phosphene visuals. If we keep in mind pressure as a catalyst, phosphenes can be triggered by an intense sound output under conditions of low or negligible lighting. Ramachandran and Hubbard have noted how "visual deprivation causes tactile input to start activating visual areas; either the back-projections linking these areas become hyperactive, or new pathways emerge."<sup>35</sup> This was also the impetus for percussion-based musician Z'ev performing concerts in complete darkness in the mid-1980s. He has claimed that, that during these concerts "people have a variety of experiences ranging from abstract imagery, to geometric imagery, to cartoony type things, to visuals which are as very representational, as if it were a dream...the acoustic phenomenae which I am generating is being translated by their sensory apparatus, and creating a pretty unique experience."<sup>36</sup> Numerous artists within the psycho-acoustic music realm have followed suit since then, although it is unclear whether the stimulation of this phosphene activity is their direct intent. Concerts such as these can, naturally, be as much of a statement against the "tyranny of the visual" and the potential for the performer's stage presence to detract from the music on hand.

One notable experiment, the "Kiki and Bouba" experiment initiated in 1929 by Wolfgang Köhler, should also not go unmentioned in this list of ways that non-synesthetes can occasionally unify their senses. This experiment, first conducted on the island of Tenerife, required test subjects to simply look at a pair of line drawings - one prickly / sharp in nature and one round / amorphous - and determine which shape should be given the name "takete" or "baluba." Data showed that an overwhelming number of test subjects associated "takete" with the sharp object and "baluba" with the rounded one. Not content to leave it at that, Ramachandran and Hubbard repeated this experiment in 2001, but this time re-named the prickly object "kiki" and the smoother one "bouba," while also seeing what the results would be if spread across multiple languages (test subjects were either American college students, or speakers of Tamil.)

Still, only about 2% of the test subjects deviated from the previous result. The implications of the result of this experiment - that synesthetic mappings can be fairly universal - has led to further discussion over the role they play in developing our linguistic capabilities, and gives added weight to the "synesthesia antedating language" hypothesis mentioned above. As Ramachandran and Hubbard insist, language is "rich with synesthetic metaphors ('loud shirt' or 'hot babe'),"<sup>37</sup> and with phrases that use the sensory data from one modality to describe sensations received in another (cheese that tastes "sharp" even though it is soft to the touch.)

### **Sensory Fusion: Coming "To The Rescue" Of Experimentation?**

At this point, it has to be noted that cataloging the history of sensory translations in avant-garde music means little if we don't know why these translations have been deemed necessary in the first place. The motivations for this kind of activity are as wide-ranging as those animating experimental music practice itself, and are especially interesting to note when we place them on a spectrum with selfishness and altruism at its opposite ends. As for the former, there are musicians who, cowed by the hostility that can often greet live performances or recordings of their work, use some sort of visual correspondence as a bargaining tool to keep audiences from tuning out, walking out, or (in extreme cases) rioting. On the other end of the spectrum are artist-researchers who view the sensory translation process as providing valid insight into non-musical fields of study such as linguistics, affect theory, and even inter-species relations (refer to the claims made above about synesthesia in animals.) Of course, the former type mentioned can always disguise themselves as the latter if need be (audiences will not likely tolerate an artist who frankly admits that his work is too un-engaging to be presented "on its own"), but it is not essential for the purposes of our discussion to identify these disingenuous individuals. Let's just say that some fakes can be found

draped in the mantle of synesthetic research, just as surely as artists in any field can adopt causes *du jour* as a means of drawing critical fire away from their mediocre output. Elsewhere, there are genuinely talented artists and composers (Aleksandr Scriabin, Wassily Kandinsky, Georgia O'Keefe and numerous others) who, for all their exceptional skill, were crafting their "synesthetic" works more from inspiration than from first-hand experience with an involuntary condition.

The world of artistic experimentation is one place where O'Callaghan's "tyranny of the visual" seems to be very authoritative indeed. The same audience that would flee from a *musique concrete* performance consisting of bracing explosions and grinding industrial noises would, in all likelihood, enjoy a fireworks spectacular in which sounds of a similar intensity are complemented by bursts of light (Richard Cytowic acknowledges that "no other form of abstract expression is so popular"<sup>38</sup> as a fireworks show.) Why is this, exactly? Donal McGraith has one suggestion regarding this dilemma:

Unlike visual art - for the most part - music takes time. Duration requires endurance and patience. Even if the non-musician is tempted by avant-garde music, he or she will need to take the time to sit through it, and that's where most people become annoyed. [...] There is no subtle introduction to this music.<sup>39</sup>

This sentiment is echoed time and time again in the avant music world. If we return to LaMonte Young, for example, we find him noticing that "a much greater part of the world is visually oriented and more capable of concentrating on visual stimuli than aural...only a small percentage have learned how to concentrate on sound."<sup>40</sup>

What McGraith says is particularly true of the public venues where avant-garde sound works and visual works are presented. Since sound is "...more intimate, more threatening [...] more dominating, and more inscrutable" than visual art, it's understandable where some intitates will feel a sensation of being under attack when experiencing it in an enclosed space. While visual art galleries and museums offer relative freedom of movement to their patrons, and the promise that the next wing in the museum may offer a return to the familiar, many of the spaces that host the more radical forms of new sound experimentation demand that their patrons not wander off to listen to something else in an adjacent space (with multi-stage electronic music festivals being a notable exception to this.) Couple the fear of the unfamiliar with another common fear - that of being mocked by one's peers for displaying discomfort or an inability to handle the rush of new information - and it is easy to see why large numbers of people just choose not to attend any performance labeled as "experimental" or even "new." McGraith attributes avant-garde visual art's success to its ability to retain both a "casual audience" and an audience of "cognoscenti," while the audience for the sonic arts increasingly becomes whittled down to the latter alone. So, seen in the context of live / public auditioning of this work, the presence of the cognoscenti acts as an extra deterrent to the casual audience- already enclosed in an arena where anything may happen, casual audiences fear a secondary interrogation of their interpretive abilities by a dour retinue of hardcore fans that will shout down any admissions of bewilderment, or perhaps even try to bar the exits.

The writer's own encounters with avant-music audiences have, thankfully, not been as unpleasant as this; where imperious know-it-alls attempted to browbeat the less-informed, they were usually ignored or loudly taken to task for their pomposity. As unscientific as my invocation of subjective experience is, it has shown me that a third type of audience exists apart from either the casual (read: entertainment-oriented) audience,

or the status-oriented cognoscenti. There seems to be a growing, adventurous, and trans-national audience that does not care for either the social status conferred by being "in the know," and will not spend a great amount of time or money on public activities that do not offer some sort of transformative experience. This audience is non-specialist in that it does not view any one creative medium (film, music, etc.) as being the centerpiece of a social "scene," and generally does not view the forms as being in competition with one another (although, on some level, competition may exist when it comes to securing arts grants and institutional funding.) This non-specialist attitude contributes towards a greater curiosity about what kind of information is exclusive to what form, and what information can be replicated across the board. I submit that the growth of this type of audience is as much of a spur towards the creation of synesthetic art as is the sheer desperation that, again, no one is going to understand new sonic forms un-aided by other sensory stimuli. I also expect that, given the current state of Internet communication, this audience will continue to grow.

What does it tell us about the state of creative life in general, that more people are gaining curiosity about an art that "shifts the observer's attention towards the act of perception itself?" Has the vast majority of topical artwork, i.e. artwork "about" something, finally become so bankrupt as to increase the interest in synesthetic experiments, investigations of proprioception and so on? More and more, critical artwork in the post-modern vein is treading water by resorting to increasingly baroque or cryptic collocations; using an arsenal of hyper-complex cues to convey information that is otherwise easily intuited. At its worst, it is merely developing a new vocabulary with which to preach to the already converted. This is the precise inverse of what I feel important artwork should accomplish. With this in mind, I would wager that synesthetic or cross-modal works are popular for much the same reason that a steady accretion of individuals starts to take an interest in the aesthetic qualities of "pure" noise or silence: in their apparent lack of message lies an ability for new messages to be formed, and for

the listener to transcend listenership and join the ranks of creators (without, of course, assuming that the act of listening without a subsequent desire to create anew is something bad.) The same has also been said for writing poetry, a concept whose German translation - *dichten*, to condense - is of particular interest in our discussion about the fusion of sense data. The five criteria of creativity proposed by educational philosopher Ralph J. Hallman (connectivity, originality, auto-realization, irrationality, and openness) all lend themselves to an artistic practice based around exploring "perception itself".

Both the scientific study of cross-modal similarities, and the subjective interpretation of "colored sounds" and the like, have their place in the furthering of creative life and in the search for more nuanced, sublime forms of communication. In an era where we are constantly reminded of the more banal forms of technological "convergence" (e.g. the increasing ability of hand-held electronic devices to act as Swiss Army knives of telecommunication and entertainment), it is truly exciting to see a two-fold convergence taking place. It is a convergence of disciplines both artistic and scientific, with the purpose of exploring the convergence of different types of sensory information. This convergence of disciplines is motivated, it would seem, by the fact that the discovery of hidden potentials can increase our understanding of mental life *and* lead to works of great aesthetic value. I do not propose that cross-modal synthesis become the dominant mode of artwork; indeed I do still agree that "mono-modal" forms have much to do before their own potential is exhausted- in this respect, I agree that each individual creative medium has its own unique problems to confront with its own distinctive techniques. However, by this same logic, the art of cross-modal synthesis has its own unique set of techniques with which to tackle ages-old questions of perception and communication. Unlike these other creative forms, though, the real work of synesthetic art is just now getting under way.

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- <sup>1</sup> UPIC is an acronym for Unité Polygogique de CeMaMu (the latter is itself an acronym for Centre d'Etudes de Mathématique et Automatique Musicales.)
- <sup>2</sup> Available online at [http://www.jazzmutant.com/lemur\\_innovation.php](http://www.jazzmutant.com/lemur_innovation.php). Retrieved July 22, 2011.
- <sup>3</sup> Albert Wellek quoted in "Famous Color Organs" by Kenneth Peacock. *Experimental Music Instruments* Vol 7 # 2 (September 1991) p. 17. EMI, Nicasio CA.
- <sup>4</sup> Jonathan Sterne, *The Audible Past: Cultural Origins Of Sound Production*, p. 44. Duke University Press, Durham / London, 2003.
- <sup>5</sup> Harry Smith interviewed by P. Adams Sitney, 1965. Available online at [http://www.ubu.com/sound/smith\\_h.html](http://www.ubu.com/sound/smith_h.html). Retrieved June 15, 2011.
- <sup>6</sup> Erik Satie quoted in *Critical Lives: Erik Satie* by Mary E. Davis, p. 83. Reaktion Books, London, 2007.
- <sup>7</sup> Iannis Xenakis quoted in *The Owl's Legacy* episode #8 ("Music"), dir. Chris Marker, 1989.
- <sup>8</sup> Christoph Cox, "Visual Sounds: On Graphic Scores". *Audio Culture: Readings In Modern Music*, ed. Christoph Cox and Daniel Warner, p. 188. Continuum Books, London / New York, 2004.
- <sup>9</sup> Andy Hamilton, *The Aesthetics Of Music*, p. 113-114. Continuum Books, London / New York, 2007.
- <sup>10</sup> LaMonte Young quoted in *Selected Writings* by LaMonte Young and Marian Zazeela, p. 23. Ubu Classics, New York, 2004.
- <sup>11</sup> *Ibid.*, p. 13.
- <sup>12</sup> *Ibid.*
- <sup>13</sup> Yasunao Tone quoted in liner notes for self-titled CD, Asphodel, San Francisco, 2003.
- <sup>14</sup> Casey O'Callaghan, *Sounds: A Philosophical Theory*, p. 3. Oxford University Press, Oxford / New York, 2007.
- <sup>15</sup> *Ibid.*
- <sup>16</sup> Arthur Schopenhauer, *The World As Will And Idea*, p. 164. Trans. Jill Berman. Orion Books, London / North Clarendon, VT, 1995.
- <sup>17</sup> personal conversation with the author, July 16 2011.
- <sup>18</sup> Iannis Xenakis, *Formalized Music: Thought And Mathematics In Composition*, p. 133. Trans. Christopher A. Butchers. Indiana University Press, Bloomington IN / London, 2001.
- <sup>19</sup> Refer to note 4 above (p. 15.)
- <sup>20</sup> *Ibid.*
- <sup>21</sup> Kodwo Eshun quoted in *Sonic Warfare: Sound, Affect, And The Ecology Of Fear* by Steve Goodman, p. 82. MIT Press, Cambridge, 2009.
- <sup>22</sup> refer to note 14 above (p. 174.)
- <sup>23</sup> Richard E. Cytowic, M.D., *Synesthesia: A Union Of The Senses*, p. 63. MIT Press, Cambridge / London, 2002.
- <sup>24</sup> *Ibid.*, p. 46
- <sup>25</sup> "Subject JM" quoted in *Ibid.*, p. 35.
- <sup>26</sup> Austin Osman Spare, *The Logomachy Of Zos*, p. 5. Freely distributed / public domain reprint.
- <sup>27</sup> Refer to note 23 above (p. 122.)
- <sup>28</sup> A.R. Luria, *The Mind Of A Mnemonist*, p. 9. Trans. Lynn Solotaroff. Harvard University Press, Cambridge / London, 1987.
- <sup>29</sup> *Ibid.*, p. xvii.

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<sup>30</sup> "Patient S" quoted in *Ibid.*, p. 141.

<sup>31</sup> Andreas Mavromantis, *Hypnagogia: The Unique State Of Consciousness Between Wakefulness And Sleep*, p. 243. Thyros Press, London, 2010.

<sup>32</sup> V.S. Ramachandran and E.M. Hubbard, "Synesthesia: A Window Into Perception, Thought, And Language." *Journal Of Consciousness Studies* Vol. 8, No. 12 (2001), p. 5.

<sup>33</sup> Refer to note 31 above (p. 3.)

<sup>34</sup> H. Hollingworth quoted in *Ibid.*, p. 31.

<sup>35</sup> Refer to note 32 above (p. 12.)

<sup>36</sup> Z'ev quoted in *Acoustic Phenomenae* by Dmitry Koselnick. *The Egg and We #1*, March-June 1999 (unedited MS Word manuscript.)

<sup>37</sup> Refer to note 32 above.

<sup>38</sup> Refer to note 23 above (p. 177.)

<sup>39</sup> Donal McGraith, "Music Without An Audience, Part 2: The Visual And The Aural, Popular And Unpopular." *Music Works* #96 (Fall 2006), p. 15. MusicWorks Society Of Ontario, Toronto.

<sup>40</sup> Refer to 10 above (p. 30.)