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Cross-talk between the Senses

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The Handbook of Multisensory Processes, edited by Gemma Calvert, Charles Spence and Barry E. Stein, Cambridge, MA: The MIT Press, 2004, 915 pages. HB 0-262-03321-6. $125.00.

Visual Music: Synaesthesia in Art and Music Since 1900, with contributions by Kerry Brougher, Olivia Mattis, Jeremy Strick, Ari Wiseman and Judith Zilzcer, London: Thames & Hudson, 2005, 272 pages, with 376 illustrations, 344 in color. HB 0-500-51217-5. £32.00.

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It is commonly assumed that each sense has its proper sphere (e.g. sight is concerned with color, hearing with sound and taste with flavor). This modular conception of the sensorium is reflected in the analytic orientation of most current research in the psychology of perception with its "sense-by-sense" – or, one sensory modality at a time – approach to the study of perceptual processes. In recent years, however, a more

interactive, relational approach to the understanding of how the senses function has begun to take shape as a result of the growing body of evidence that points to the "multisensory organization" or "integration" of the brain. As Calvert, Spence and Stein write in their introduction to *The Handbook of Multisensory Processes*,

> even those experiences that at first may appear to be modality-specific are most likely to have been influenced by activity in other sensory modalities, despite our lack of awareness of such interactions … [To] fully appreciate the processes underlying much of sensory perception, we must understand not only how information from each sensory modality is transduced and decoded along the pathways primarily devoted to that sense, but also how this information is modulated by what is going on in the other sensory pathways. (2004: xi-xii)

Examples of such modulation include the well-documented fact that, in noisy surroundings, speakers can be understood more easily if they can be seen as well as heard. This finding is readily explicable in terms of the redundancy hypothesis of classic information theory. However, the new multisensory psychology of perception probes deeper to explore the *relationships* among the component parts of a multisensory signal. For example, in the case of animal and human communication, redundant multisensory signals can be subclassified into those that produce responses in the receiver equivalent to the response to each unisensory component (*equivalence*) and those for which the response is superadditive – that is, which exceeds the response to the unisensory components (*enhancement*). Multisensory signals may also be made up of stimuli which convey different (i.e. nonredundant) information, as in the case of the McGurk effect, where seen lip-movements can alter which phoneme is heard for a particular sound (e.g., a sound of /ba/ tends to be perceived as /da/ when it is coupled with a visual lip movement associated with /ga/). In this instance, the response to the multisensory signal is new, qualitatively different from the response to either of the unisensory components, and thus demonstrates *emergence*. The relationship between the components of a multisensory signal may otherwise be one of *dominance* as in the ventriloquism effect (where the seen lip-movements of the dummy alter or "capture" the apparent location of the speech sounds) or *concatenation* (my term) as in the case of the reproductive behavior of male oriental fruit moths: such moths "need the visual presence of the female in combination with her pheromones before they will perform their most intricate courtship displays, and they need an additional tactile stimulus of a touch on the abdomen before they will copulate" (p. 235).

Many of the chapters in the *Handbook* use modern neuroimaging techniques to reveal the multiple sites of multisensory processing in the brain, including many regions long thought to be modality-specific

or "primary sensory" areas (as distinct from the so-called higher order "associative areas" traditionally assumed to be responsible for the formation of unified percepts out of the diversity of inputs). In addition to demonstrating the functional interdependence of the modalities, a number of chapters point to their functional equivalence. For example, it is now clear that sensory-specific areas can be "recruited" or "remapped" by other sensory-specific areas in situations of sensory deprivation or intensive perceptual training. Thus, the visual cortex in blind individuals has been found to show activation in auditory tasks while the auditory cortex in deaf individuals can be activated by visual tasks.

> Of note, the quality of sensation associated with activating the visual cortex in congenitally blind individuals, or the auditory cortex in congenitally deaf individuals, appears to derive from the nature of inputs. That is, visual inputs are perceived as visual even when auditory cortex is activated [in the case of the blind, while the reverse holds true in the case of the deaf]… Furthermore, even in normal, nondeprived humans, there is evidence for extensive multisensory interactions whereby primary sensory areas of the cortex can be activated in a task-specific manner by stimuli of other modalities… Common to these findings is the principle that inputs recruit pathways, cortical areas, and networks within and between areas that process the information, and the sensoriperceptual modality associated with the input is driven by the nature of the input rather than by the cortical area activated per se. (p. 690)

Such evidence of adaptive processing, or "cross-modal plasticity," underscores the importance of adopting a relational approach to the study of the sensorium in place of assuming that the senses are structurally and functionally distinct.

Other chapters explore such issues as whether the sensory integration involved in speech perception is fundamentally the same or different from other kinds of multisensory integration (the same); whether the senses are differentiated at birth and become coordinated through experience – the developmental integration hypothesis – or are relatively unified at birth and become differentiated through development – the developmental differentiation hypothesis (neither – the formation of percepts in early development involves the "joint action of developmental integration and differentiation processes" (p. 658)); and whether the phenomenon of synesthesia (i.e. the union or crossing of the senses, e.g. hearing colors, tasting shapes) might not provide a better model for conceptualizing perceptual processes than the conventional sense-by-sense approach that has dominated research on the senses and sensations to date.

The condition of synesthesia is typically understood to be quite rare. The most commonly documented form, color-grapheme

synesthesia (in which written words or letters are perceived as having particular colors) occurs in one in 2,000 people. To limit synesthesia to a congenital condition, however, would be myopic.[1] Synesthetic connections can be learned. Take the case of odor-taste synesthesia which, perhaps because it is such a common effect, has failed to attract much popular attention or scientific documentation. Yet the evidence is clear:

> the majority of people appear to experience odor-taste synaesthesia. First, *sweet* is one of the most common descriptors applied to odors… [Furthermore,] when smelling an odor, most people can more easily recognize a taste-like quality such as sweetness than more specific qualities such as strawberry- or banana-likeness. (p. 69)

When we speak of the odor of vanilla or strawberry as sweet are we speaking in metaphor rather than reporting an actual olfactory sensation? Not according to Stevenson and Oakes:

> The central argument of [their] chapter is that, as a result of eating and drinking, patterns of retronasal odor stimulation co-occur with oral stimulation, notably of the taste receptors, so that a unitary percept is produced by a process of either within-event associative learning or by a simple encoding as one event. Eating sweet vanilla-flavor ice cream will ensure that the retronasal odor of vanilla becomes associated with sweetness; on some later occasion the smell of vanilla will seem sweet, even if no conscious recollecton of eating ice cream comes to mind. (p.81)

In the concluding chapter of the *Handbook*, V.S. Ramachandran et al. also reject what they call the "metaphor explanation" of synesthetic perception, and proffer a physiological explanation having to do with the "cross-activation of brain maps" in its place. Such cross-activation may come about by two different mechanisms:

> (1) cross-wiring between adjacent [brain] areas, either through an excess of anatomical connections or defective pruning, or (2) excess activity in back-projections between successive stages in the hierarchy (caused by defective pruning or by disinhibition). (p. 872)

In the case of color-grapheme synesthesia – their chosen example – the brain areas corresponding to graphemes and colors are right next to each other in the fusiform gyrus, and the potential for excess cross-activation or "hyperconnectivity" as a result of some genetic mutation in those individuals who naturally experience this effect is therefore strongly indicated. Ramachandran et al. conclude that

> far from being a mere curiousity, synaesthesia deserves to be brought into mainstream neuroscience and cognitive psychology. Indeed, [precisely because the neural basis of synaesthesia is beginning to be understood – unlike in the case of metaphor] it may provide a crucial insight into some of the most elusive questions about the mind, such as the neural substrate (and evolution) of metaphor, language and thought itself. (p. 881)

There is much to be said for Ramachandran et al.'s "bottom-up" approach to the study of synesthesia, but I do not think the "top-down" approach, which would descend from the cultural (via the metaphorical) to the psychological to the physiological level of brain organization, should be dismissed out of hand. (In point of fact, owing to the selective focus of their academic discipline, neuropsychology, Ramachandran et al. never ascend through what they call "the hierarchy" as far as the cultural level.)[2] If we are to comprehend fully all this evidence of cross-talk between the senses, there needs to be more cross-talk between the disciplines, by which I mean the insights of anthropology and history into the *cultural* mediation of sensation must also form part of the conversation. As cultural psychiatrist Laurence Kirmayer observes concerning the hierarchical systems view of neural organization,

> contemporary cognitive neuroscience understands mind and experience as phenomena that emerge from neural networks at a certain level of complexity and organization. There is increasing recognition that this organization is not confined to the brain but also includes loops through the body and the environment, most crucially, through a social world that is culturally constructed. On this view, "mind" is located not in the brain but in the relationship of brain and body to the world (Kirmayer, forthcoming).

Ideally, Kirmayer goes on to state, "we want to be able to trace the causal links up and down this hierarchy in a seamless way," but for this to come about neuropsychologists, historians and anthropologists will first have to overcome the selective focus of their respective disciplines and engage in more "joint action" research, as it were.

Imagine what a "Cross-Cultural Handbook of Multisensory Processes" would look like. Instead of presuming sensory processes to be confined to the brain, it would start with the investigation of the culturally patterned "loops" through the environment – that is, with the *cultural modulation of perception*. A "top-down" or culturally sensitive approach to, say, synesthetic perception would begin by providing an inventory of the cultural practices and technologies that

generate different sense ratios across different cultures and historical periods. For example, whether the incidence of color-grapheme synesthesia would be as high in an aural-oral society as it is in a visual-literate one, such as contemporary Western society is a good empirical question.[3] In the latter, words and letters are experienced as quiescent marks on paper or a computer screen, which renders them available for color-coding, whereas in the former words (being experienced aurally) might not tend to be seen so readily as they would be felt or smelled as well as heard. In my own ethnographic research in Papua New Guinea, I found evidence of audio-olfactory synesthesia. In many Melanesian languages one speaks of "hearing an aroma" (and this association is carried over in Pidgin English: "mi harim smel"). The reason for this could be that most communication takes place face-to-face (i.e. within olfactory range of the other) and odoriferous substances (e.g. the oil with which the body is anointed or chewed ginger) are used to augment the power of a person's presence and words. This finding counters Stevenson and Boakes' claim that "odors display taste properties but do not elicit auditory or visual sensations" (p. 73). This claim is also countered by the evidence for a form of color-odor synesthesia reported by Diana Young among the Anangu of Australia's Western Desert (see Young 2005).

Starting with examples such as these, which, I would note, are *practical* (i.e. supported by cultural practices that form part of the "loop" through which all sensations must pass) as well as metaphorical, neuropsychologists could well be inspired to discover all sorts of heretofore unsuspected cross-linkages between the senses wherever they may be localized in the brain.[4] This is a heady prospect, but it can only come about as a result of more cross-talk between the disciplines leading to the establishment of *cultural* neuropsychology as a recognized field of study. It bears noting that the same shift from a unisensory to a multisensory approach to the study of perception that pervades the *Handbook* has been sweeping the humanities and social sciences in recent years (as observed in "Introducing Sensory Studies" – the lead essay in the inaugural issue of *The Senses and Society*). This convergence or fusion of horizons gives me great hopes for the conversation envisioned here. Furthermore, while I must confess to often feeling out of my depth reading *The Handbook of Multisensory Processes*, I never ceased to marvel at the ingenuity of the experiments, or to admire the meticulousness of the reasoning involved in the interpretation of results in any of its fifty-four chapters. I would therefore recommend the *Handbook* as essential reading for any scholar interested in exploring the varieties of sensory experience in history and across cultures on account of the multiple models and questions it suggests for further archival or ethnographic research.[5]

Visual Music: Synaesthesia in Art and Music Since 1900 is a beautifully illustrated catalog that accompanied the exhibition by the same name at The Museum of Contemporary Art, Los Angeles and the Hirshorn Museum and Sculpture Garden of the Smithsonian Institution in Washington in 2005. This groundbreaking study begins by presenting an "alternative history" of the abstract art of the past century by disclosing its debt to music. Because of the selective (visual) focus of conventional art history, the development of abstraction is commonly told in terms of avant-garde artists seeking to produce a non-representational – or "pure" – art that would be "freed from imitative constraints," without it being appreciated how much that movement was inspired and dependent in its formative stages on emulating the formal abstract structures of musical composition. Music had long been considered the most spiritually exalting and purest form of art on account of its ethereality, nonobjectivity and emotivity (or direct appeal to the affects), and it was the idea of visual art aspiring to "the condition of music" – that is, of creating "music for the eyes" – that inspired many of the pioneers of abstraction on both sides of the Atlantic, from Wassily Kandinsky and Paul Klee in Europe to Arthur Dove and Georgia O'Keefe in America. The rhythmic interplay of geometry and color in Kandinsky's later paintings (e.g. *Fuga* (*Fugue*), 1914), and the synesthetic theory of painting he elaborated in *On the Spiritual in Art*, led one fellow artist to write "Kandinsky is attempting to paint the color of sound" (p. 35). Klee, for his part, transformed polyphony into abstract pictorial form (e.g. *Static-Dynamic Gradation*, 1923), while O'Keefe records that the impetus behind her organic abstractions (e.g. *Blue and Green Music*, 1921) came from attending an art class where students were required to draw while listening to music: "This gave me an idea that I was very interested to follow later – the idea that music could be translated into something for the eye" (p. 59).

The dream of the "unification of the arts" through "sensual compounding" which inspired these experiments in abstraction simultaneously exposed a major shortcoming intrinsic to the medium of painting: its immobility or static character. Musical compositions, of course, unfold through time. "Abstract film developed as if in direct response to this shortcoming," the authors claim (p. 19). The originators of abstract cinema, working in black and white, "elaborated sequences of geometric forms that moved across the screen and through time, as would a sequence of sounds," and then, as technologies of color film and soundtracks developed, their successors, such as Oskar Fischinger, were able to bring

> color, form, and sound together to create extended compositions that bore occasional resemblance to the work of the earlier generations of abstract painters while taking full advantage of the crucial element of time and incorporating sound and music to create a fully synaesthetic experience. (p. 19)

The most famous example of this genre is, of course, the Disney Studio animated motion picture *Fantasia* (1940), in which Fischinger had a hand. In addition to propelling the synchronization of the senses to new heights, *Fantasia* signaled a fundamental change in the direction of visual music: the change "from an avant-garde practice toward a modern mass-cultural phenomenon" (p. 111).

The changeover in visual music from avant-garde practice to pop culture continued apace in the 1950s and 1960s with the phenomenon of the light show (e.g. the Vortex concerts), which drew together a wide variety of practices – from performance art to scientific experiments, from coffeehouse jazz concerts to psychedelic drugs – to create

> an immersive visual and sound experience. The light show offered a neutral place in which high art and popular culture, abstraction and representation, the scientific and the spiritual, the electronic and natural, and the visual and aural could all be collaged together in a vast swirling eddy of overlapping sensations. It was the ultimate synaesthetic experience, one that attempted through the hallucinogenic to blur the distinction between sound and image, interior and exterior. (p. 159)

In their effort to trace the "successive unfolding" of the idea of visual music – from abstraction, to abstraction in motion, to total immersion – the contributors to the catalog also canvas many other artistic expressions and inventions besides those surveyed above, such as the color organ, optical printer, contemporary installation art and digital media, as well as diverse controversies (e.g. over the validity of the analogy between specific colors and specific musical notes or keys in the first place). The catalog is also crowned with a brilliant chapter on color music from a musical perspective, which reverses the drift of all the other chapters, and a very informative "Chronology" that, by documenting the successive engagements with and elaborations of the notion of visual music on both sides of the Atlantic (and from coast to coast in the United States), gives substance to the claim that this stylistic strain, while

> not the single mode through which music and the visual arts have interacted over the past century … is certainly the most consistent … continuing to find new arenas for aesthetic exploration even as other, more famous movements and styles [e.g. Cubism through Abstract Expressionism] eventually faltered. Its longevity can be explained above all by the fact that it required technology for its fulfillment. (p. 18)

While I am in deep sympathy with the first branch of this argument, I must register my dissent from the progressivist conclusion in the second branch to the effect that the promise of synesthesia

– the compounding of the senses leading to spiritual awakening as imagined by Kandinsky – was "fulfilled" by technology – that is, by the synchronization of the senses in film and other so-called multi-media. For such media foregrounded certain sensory ratios – most notably the audio-visual – while screening out others and thus limited "mind" or consciousness in the very act of extending or projecting it outwards. The tradition of visual music could equally well be interpreted as involving a contraction of the synesthetic paradigm.[6] There exist other sensory ratios than those hypostasized in the technological dynamo of our audio-visual civilization. At the same time, *Visual Music* does prove that the history of art (or of music) is best practiced with two senses, rather than one – and thus agrees with the central theoretical and methodological claims of *The Handbook of Multisensory Processes*.

Notes

1. The ethnomusicologist Steve Feld once remarked to me that limiting synesthesia to those who are congenitally susceptible to this effect would be like restricting music to those with perfect pitch. It cannot be so confined. But to qualify this assertion, and anticipate my discussion of Ramachandran's position in what follows, let me note that I concur with Ramachandran's view that synesthesia is sensory or perceptual, not conceptual or metaphorical. It is not just another trope. However, by ignoring the *practical* (i.e. culturally patterned and learned) dimensions of synesthesia, it seems to me that Ramachandran forecloses an important avenue of inquiry into the genesis of this effect at the level of the individual and its shaping or expression at the cultural level.
2. Ramachandran et al. are not alone. There is but one reference in the whole *Handbook* to cross-cultural variation in the modulation of perception: apparently, the McGurk effect is significantly weaker in Japanese than in American perceivers (p. 207).
3. Or even earlier periods of Western culture. For example, a form of audio-grapheme synesthesia has been described for the Renaissance: "In a person's handwriting, Erasmus claimed, he could hear that person's very voice" (Smith 2004: 21–41 at 28).
4. That is, proximity of brain areas would no longer be the determinative criterion (*pace* Ramachandran et al.) -- as indeed it is not, given all the evidence of cross-modal activation, feed forward and back-projection processes that has begun to emerge.
5. A number of sensorially-minded anthropologists have already opened this conversation with neuropsychology and made significant headway exploring "the question of how far back into the genesis of bodily experience [or activation of brain areas] cultural worlds can reach" (Kirmayer, forthcoming): most notably, Hinton and Hinton (2002), Young (2005), and Downey (2005).

6. Imagine how different the history of abstraction in art would have been had it started with Des Esseintes' "mouth organ" (a collection of liqueurs each analogous to a musical note, which the protagonist of Huysmans' *À rebours* played upon his palette) in place of the color organ. This example is cited in *Visual Music* but dismissed as too "literal" (p. 16). That audio-gustatory synesthesia can, in fact, form the basis of a highly abstract art is evidenced by the case of Indian aesthetics and cosmology (see Pinard 1991; Schechner 2001). For a good overview of the full range of sensory combinations explored by Western artists prior to the cinematic turn see *The Color of Angels* (Classen 1998).

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