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From the Gun Controller to the Mandala: The Cybernetic Cinema of John and James Whitney//2009

In Los Angeles in the late 1950s, John Whitney started purchasing junk: 'mechanical junk excreted from army depots across the country ... Junk such as brand new thirty-thousand dollar anti-aircraft specialized analogue ballistic problem-solver computers dating back to World War II'.[1] He transformed this military-spec surplus into a machine for creating experimental animation – literally and metaphorically retooling a device that had itself served to remake human vision for modern war. A twin of this machine would enable John's brother James to create the 1966 film *Lapis*, a work P. Adams Sitney would describe as 'the most elaborate example of a mandala in cinema'.[2] [...]

The work began with hand-painted plates. These were used as input for a system that utilized the junked 'hardware from war surplus: selsyn motors to interlock camera functions with artwork motions; ball integrators to preset rate programming of some motions; and differential assemblies to control the incremental advance of the motions as each frame advanced'.[3] As John Whitney later stated, 'it was astonishing to discover the variety of orderly patterns generated by as random a source as these dot patterns. The original artwork contains no hint of the patterns that were produced'.[4] The formal properties of this mandala emerge in dialogue with the apparatus used to create it – the gun controller, a mechanical analogue computer that was a precursor to contemporary computational technology. In this dialogue is crystallized an entire subterranean history of vision and computation that reverberates into the present.

William Moritz situated *Lapis* in an artisanal tradition of experimental film animation that moved from Hans Richter and Viking Eggeling in the 1920s through Len Lye and Oskar Fischinger to the West Coast school with which the Whitneys were involved.[5] Gene Youngblood – writing at much the same time as Moritz – chose to situate *Lapis* in a different trajectory, placing it under the auspices of the human-machine feedback loop. Youngblood's rhetoric is precise; he does not call these works computer films or graphic animations but situates them as 'cybernetic cinema'.[6] In using this terminology Youngblood himself was riding a wave of pop media criticism that began when Buckminster Fuller and Marshall McLuhan a few years prior latched onto cybernetic as a descriptive catchphrase for a diverse range of phenomena from visual media to child psychology. The term's origin, however, can be more precisely located as a theory of messages and information control developed through military research in anti-aircraft technology during and after World War II. During the 1960s, cybernetics had eclipsed these early beginnings to become a more general means of considering and analogizing the organization of bodies – both human and machinic. As such, cybernetics became part of the foundation for an emerging discourse of both human-machine interaction and computational representation. Youngblood's rhetoric situated the Whitneys' films not simply as works made with a computer but as works engaged with this larger field. Youngblood also understood the Whitneys as engaged with the questions the computational turn raised for concepts of representation and visuality and the disciplining of perception in the postwar era. [...]

In the late 1950s, John Whitney continued his experiments in machine-realized art, constructing a machine that he had first imagined during his wartime work at Lockheed. A duplicate of this machine sat in James Whitney's studio.[7] [...] Here, James practised yoga, filmmaking, computer animation, Japanese brush painting and raku pottery, and also studied Taoism and nuclear physics. Here, in the centre, or perhaps off to the side, was the bulky metal apparatus geared with a plethora of moving parts. James Whitney had constructed this machine with his brother John, and he would use it to make a single film – *Lapis*. This large, complex machine with all its gears and selsyn motors, situated at the heart of his studio space, is the pivot around which this story turns; it was a mechanical analogue computer.

[...] Analogue computation implies a representation in which an abstract physical quantity – electric current, light flux – is signified by a concrete physical quantity; for example, length or shape. In this representational practice, an inherent resemblance to the world is maintained. By contrast, digital computing is based upon a rigorous quantization in a practice of unit operations. At the beginning of World War II, a substantial amount of money was spent creating mechanical analogue computers – machines that made their calculations using selsyn gears and wheels and cams. Then, in 1943, the military abruptly replaced these machines with electronic analogue computers. Extraordinarily expensive equipment was dismissed to junk yards by the ton – and John Whitney bought one. The machine he purchased was an M5 anti-aircraft gun director – a special-purpose mechanical analogue computer developed for the guidance and control of anti-aircraft weaponry.[8] These mechanical computers were intricate and elegant integrated systems, each weighing in at approximately 850 pounds and comprising approximately 11,000 moving parts.[9] They were created to solve a particular set of equations for an unchanging number of variables. Specifically, they performed the delicate task of calculating the lead necessary to fire and hit a moving target from a particular distance.[10] [...]

The gun controller is a technology of vision that directly responds to a similar technology of vision. Both are specifically dedicated to augmenting, informing

and enframing the soldier's process of seeing – and both directly shape the actions of which he is capable. This is a process in which the human body is re-educated by the machine to act according to a new paradigm of visuality.

At this early stage in the development of computers, the computer was already being developed as a technology that promotes specific habits of visuality. The gun controller trains its users to look at the world in highly specific ways, beginning with glancing – shifting focus back and forth across a visual field. As Jonathan Crary points out, 'one learns nothing new that way; it yields a world already known through habit and familiarity'.[11] One sees an object quickly; then focus, lock, fire. To look at a particular object is to target it. The machine translates the object into data – height, speed, direction – for the singular purpose of burning that object out of the world. To see is to model is to comprehend is to destroy. This would become, in subsequent years, the model for a new kind of visual experience. [...]

This model of vision can be understood more easily in dialogue with the camera obscura than the film camera—and the similarities and differences are instructive. First is a similarity of separation. The individual is held at a certain distance from the world – [...] the operator is enclosed in a sheath of metal and Plexiglas. Like that of the camera obscura, the viewpoint of the turret is a dream of objectivity and transparency, remove and control. But the gun controller operator does not look at a representation of the world held on a separate wall to trace or examine. The eye looks directly on the world, through a framing device. The space of the eye – the space of looking – is shown to be particularly disciplined. Bodily reach is augmented by ballistics. Vision is enframed with lenses. Unlike the camera obscura, where the subject could be said to control or master a world by himself, the subject is himself constrained and enclosed – locked into a circuit of machines. This mode of looking dreams of efficiency and instantaneity; it is a mode appropriate to a space of visual bombardment and a world that valorizes speed.[12] [...]

While contemporary digital computers may seem impossibly distant from these early analogue computers – distinct in size and shape, interface and use – the early computers offer an important reference point for understanding how contemporary computer visuality functions; for example, the tracking of the mouse, and the habits of pointing and clicking. As Crary points out, 'in most cases, using a computer produces a psychic field of expectant attentiveness, within which one inevitably trains oneself to maximize the speed of response to specific commands and functions and in fact to derive at least some satisfaction from these habitual operations of mechanical facility'.[13]

The work of the Whitneys offers us an alternative way of seeing with the computer – but one that responds to, and participates in, the paradigm of vision

enacted by the gun controller. As stated earlier, the Whitney brothers both literally and metaphorically retooled the military gun controllers, thereby engaging with a technology that was simultaneously material and social. This technology irrevocably shaped their production – pointing us toward asking how particular computational technologies instantiate particular habits of vision, shaping ideas of subject and object. John Whitney tells us that James Whitney began with random dots. Computer processing repeated, rearranged and recombined these figures, generating precise, strobing patterns. Beginning to watch *Lapis*, the viewer may have an experience like that of the operator of the M5 – an experience that itself worked to develop the habits of vision that Crary attributes to users of modern computers. The eyes seem to defocus. The viewer deliberately relaxes the gaze to take in the whole field at once. The experience is of awaiting motion, then attempting to focus in on its particularity – an attempted targeting, as it were. *Lapis* begins with a glowing sheet of white, a space to project or fall into. Slowly, arrays of tiny particles edge themselves into a ring. The particles swarm and cluster, eventually flaring into complex geometric patterns. Unlike with the M5, this targeting cannot be completed. The image cannot be resolved into a stable emplacement. The viewer is presented with a representation in which there is nothing to lock on to. [...]

Abstract art based on permutation and seriality, as developed in the 1960s, has often been understood as a triumphant celebration of Enlightenment-style reason. As Rosalind Krauss points out, serial geometric abstractions were understood, at this point in time, as 'the demonstration of rationalism itself', the apex of a 'triumphant Cartesianism' that reinscribed the transcendental subject.[14]

This particular debate on abstraction was taking place only shortly after Whitney's initial films were produced – and seems particularly instructive in light of the 'triumph of reason' that the digital computer might seem to represent. Fitting the Whitneys into this debate is fairly straightforward, on one level: the Whitney films are a clear example of algorithmically generated, deterministic abstract art. Further, James Whitney states clearly on a number of occasions that in *Lapis* he wanted to depict 'mind forms'.[15] Yet in spite of the seemingly inherent rationality of these films – they were, after all, systematically worked out by computer – their formal permutations do not emerge as particularly rational. Experientially, these patterns are not easily graspable; nor do they deify the human mind as the site of mathematical prowess. To move inside the systems of the Whitneys' work, including *Permutations* and *Lapis*, is 'precisely to enter a world without a centre, a world of substitutions and transpositions nowhere legitimated by the revelations of a transcendental subject'.[16] [...]

In the years after *Permutations*, John Whitney maintained a belief that the capabilities of computational media would transform art as well as the wider

field of human experience. Throughout his lifetime, he continued to dream of the utopian possibilities that computation carried for disrupting traditional modes of representation. James Whitney was less optimistic. Curiously, both brothers' feelings stemmed from a particular aspect of computer technology: its peculiarly dictatorial quality. The M5 was capable of establishing a unique bodily discipline. In a related fashion, *Lapis* produces certain undeniable physical effects (as does *Permutations*). [...]

These effects are not in the film per se but rather in the spectator's perceptual system – 'the electrical-chemical functioning of [the viewer's] own nervous system'.[17] The 'flickering' of film frames can produce strong physiological and psychological effects – including, but not limited to, migraine headaches, nausea, epileptic seizures, anxiety, exhilaration and euphoria. The forceful effect of these films derives from their deft mixing of the purely visual, or optical, with the corporeal, a field that has been described by its phenomenological dimension as 'the haptic'. This mixing took on a particular resonance within the postwar culture of the televisual – as well as within an emerging culture of the computational. [...]

Unlike the distanced reflection of the camera obscura, these new technologies provide no room for distance or judgement – or escape. John Whitney found in this the possibility of a new vision and an accompanying transformation of the human subject. James found disruption, which comes through clearly in the ending to his film *Lapis*. [...]

For James, the computer provoked the sort of physical nausea that can stem only from the furious rejection of a bodily disturbance. Crary has written compellingly of the perceptual retraining that occurred with the advent of capitalism as a dissociation of vision from the body. By contrast, the Whitneys reveal a vision wrought haptic – a reattachment of the body that was understood to hold both revolutionary possibility as well as the danger of a totalizing cybernetic control.

1 John Whitney, *Digital Harmony: On the Complementarity of Music and Visual Art* (Kingsport, Tennessee: Kingsport Press, 1980) 184.

2 P. Adams Sitney, *Visionary Film: The American Avant-Garde, 1943–1978* (Oxford: Oxford University Press, 1974) 264.

3 [footnote 4 in source] Whitney, *Digital Harmony*, op. cit., 184.

4 [5] Ibid., 186.

5 [6] William Moritz, 'Non-Objective Film: The Second Generation', in *Film as Film: Formal Experiment in Film, 1910–1975*, ed. Philip Drummond (London: Hayward Gallery/ Arts Council of Great Britain, 1979) 59–71.

6 [7] Gene Youngblood, *Expanded Cinema* (New York: E.P. Dutton & Co., 1970) 194.

7 [17] John never made a complete work with it, just a catalogue of effects that he would use as a demo reel. [...] John Whitney's catalogue of effects is now in the collection of the Museum of Modern Art, New York.

8 [19] The M5 anti-aircraft gun director [...] went into mass production in 1940.

9 [20] David Mindell, 'Anti-Aircraft Fire Control and the Development of Integrated Systems at Sperry, 1925–1940', *IEEE Control Systems Magazine*, vol. 15, no. 2 (April 1995) 108–13.

10 [21] The gun director that became known as the M2 director, a predecessor to the M5 and M7, was a complicated mechanical analogue computer that integrated four anti-aircraft guns and an altitude finder into a single, coherent system – albeit one that was dependent on human input.

11 [25] Jonathan Crary, *Suspensions of Perception: Attention, Spectacle and Modern Culture* (Cambridge, Massachusetts: The MIT Press, 1999) 298.

12 [31] See Paul Virilio, *The Vision Machine* (Bloomington: Indiana University Press, 1994) and *War and Cinema: The Logistics of Perception* (London and New York: Verso, 1989).

13 [36] Crary, *Suspensions of Perception*, op. cit., 309.

14 [40] Rosalind Krauss, *The Originality of the Avant-Garde and Other Modernist Myths* (Cambridge, Massachusetts: The MIT Press, 1986) 246.

15 [41] Youngblood, *Expanded Cinema*, op. cit., 222.

16 [42] Krauss, *The Originality of the Avant-Garde*, op. cit., 258.

17 [52] Paul Sharits, 'Notes on Films, 1966–1968', *Film Culture*, no. 47 (1969) 14.

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Roy Ascott
Art and Telematics: Towards a Network Consciousness//1983

In Mill Valley, California, in the Spring of 1978 I got high on networking. I had anticipated the condition some 17 years earlier in my rather wintry studio in London where I was visited with a cybernetic vision of art, after reading the works of Norbert Wiener and Ross Ashby, formulating a prospectus for creative work which could, as I saw it, raise consciousness to a higher level.

My work, on gallery walls and in colleges of art both in England and abroad (especially at Ealing, London and at the Ontario College of Art [OCA], Toronto) attempted to create analogues of the cybernetic vision which I had committed to publication, but one crucial element was missing. It was not simply that computer access was difficult to arrange, although that certainly was the case at that time,