The Plastic Brain

Najmeh Khalili Mahani

Cinema is a lot of things to a lot of people, but it is most certainly not contained solely within the physical (celluloid), or even the easily quantifiable (1s and 0s). The same can be said of our body. What are we, if not sensing, feeling, meaning making participants in the world? In her article, Najmeh Khalili Mahani explores the qualities of perception, rooted in the physiology of the brain, that break down the relationship between subject and object. This topic is of much significance for the more recently established discipline of Film Studies, which has not yet come to terms with its relationship with science.

A novel, poem, picture, or musical work are individuals, that is, beings in which the expression is indistinguishable from the thing expressed, their meaning accessible only through direct contact, being radiated with no change of their temporal or spatial situation. It is in this sense that our body is comparable to a work of art. (Maurice Merleau-Ponty, Phenomenology of Perception, p.15 .)

I turn the TV on. Somewhere behind the glass, beams of concentrated electrons surge forth from a Cathode Ray Tube, striking rows upon rows of phosphors that coat the back of the screen, triggering emissions of light. Tiny concentrations of red, green, and blue beams fly across the room and find their way into the back of my retina, accompanied by vibrations produced by speakers. After a long day at school, the sounds and images emanating from the television extend my nervous system—a sensor for perceiving a complex, ever -changing world—far from the sensory cells that constitute my body, my physical person. An ad for a sports TV channel announces, "What is the power in scoring a goal that brings thousands to their feet?" This casual question posed by the sports channel announcer may seem innocuous, but it is fundamental to research that seeks an answer for the intricate mechanisms of pleasure, identification and intersubjectivity.

I have just returned from a lecture about the role of mirror neurons in sensory-motor activations of the cortex associated with observations of hand actions, speech related lip movement and gaze shift. I wonder if science has begun to muse over the neuronal mechanisms of identification—self-self, self-other identification—and emotions. Such inquiries begin from the brain; the body connects to the world via receptors on its surface; receptors connect to the brain through a complex network that links billions of neurons across the body. The information on this enormous network is transferred at the speed of 200 miles per hour, stirring up energies that return to the world in the form of movement, representation, thought, speech, music, reaction, action, affect. Perception is rooted in the synaptic fields. On the dendritic trees grow the forbidden fruits of my humanity: the 'knowing': the knowing 'how' to speak, the knowing 'how' to create, the knowing how to 'will to power.' The thorns are the unknowns, uncertainties, and doubts, the interoceptive reflexes that bypass the cerebral intellect and produce deep effects, from deeper layers of the body: effects such as fear, anger, love, impulse and insanity. The forest of my brain is the Eden of my humanity to which I was destined when the ape in me was exiled from the heaven of 'not-knowing- how'.

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Until we succeed in simulating this magnificent system—the body in which we reside, the brain that senses, represents and communicates the world, the world that this body occupies, that occupies this body—until we dissect it to the last atom and plot all the maps of imminence and planes of consistency of this great organization, it will remain in misty planes of transcendence. Theoretically, simulation is possible. Modeling a physical system with mathematical descriptions is an engineering task; reverse engineering is a (comparatively) trivial chore. We have already reverse-engineered the visual and sensory-motor system of humans into these clumsy compu-robots which we have called Rover and have sent to the outer space. Of course, the feeling, singing, cunning robot HAL has not yet transcended the fictitious world of Stanley Kubrick's *2001: A Space Oddyssey* (1968) and human-like artificially intelligent machines still live in a Hollywoodian world of imaginations (or hallucinations). We have also engineered life: cloned a sheep and named it Dolly. True, our designs were not entirely optimized, Dolly died prematurely, and we did not have a chance to demystify the magic of life and mind of the sheep; but the prototype was complete.

Today, there are scientists who are struggling to bypass the ethical politics or detour the political ethics that prevent engineering humans. Others strive for refined models of the input and the output mechanisms, the feedback loops, the amplification and modulation and filtering at each node of this magnificent molecular system constituting our body. As I am writing, somewhere in the world, a special electronic eye is observing every molecular growth of an axon as it journeys to its genetically predetermined synaptic residence. A magnetic detector is peeping through the brain of someone who feels, someone who remembers, someone who hears. Someday, we will have a grand model that incorporates the emotional states with the molecular composites of cellular organizations, be it matter or ether—the two sides of the same coin, transformable modes of the same existence. "What for?" asks my alter ego, the one who loves the mystery of art, the subtlety of compassion and altruism, the magical world that creates love. As I try to come up with an answer, my email pops with the subject line: Brain Imaging Center Seminar – *How Can We Study Emotion With fMri*? Speaker: Dr. Jorge Armony, Douglas Hospital Research Centre, Montreal, Canada. Neuroscience is rubbing shoulders with philosophy. Whether or not we love our magical, mystical world of spirits, science is attempting to debunk our metaphysical notions of soul. To conserve the beauty which makes art, to not trivialize love, to not reduce humanity to *planes of consistency and organization*, I want to be aware, I want to be able to follow the trajectory of the *lines of flight*, even when they are materialized by the laws of physics, by the logic of math.

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A few days ago, I presented the introduction of Brian Massumi's "The Parables for the Virtual: Movement, Affect, Sensation" (Duke University Press, 2002) in a course entitled *Flesh and Film*. Massumi's plea for bringing the *corporeality* into the domain of cultural theory and wedding the sciences and humanities astonished me. The surprise did not arise from the novelty of the ideas that Massumi prophesized; rather from learning that the neuro-scientific leaps in understanding the nature of human's *in*corporeality (perception, memory, cognition, emotion, to name a few) have been either neglected entirely or snubbed by the humanities as empiricistic reductionism. Of course, reducing the problematic of human society and human behavior to a physical model is neither an attractive nor a pragmatically sensible endeavor. It was science that claimed authority in the biological categorization of the human race and helped the Nazis to create a myth to justify their catastrophic conquest of the world. How can we trust the narrow view of science to do justice to the formidable structures that form the human body and human society? The answer is that we cannot. However, the role of science in creation of myths that form, inform or deform social structures cannot be overlooked. The scientific hypotheses painstakingly examined within the controlled environment of a laboratory make it to the sphere of public interest and cult aspirations long before concrete results do. Furthermore, shedding scientific light on the nature of human emotion, consciousness, cognition—the building blocks of abstract thought, culture and ideology—illuminates a discursive path in an era when the forces of culture and economy march toward a ubiquitous globalization. Uniting mind—that envisions ideology—with body—which sustains in its corporeal substance the abstract value system of ideology—brings cultures and communities to a level field of communication where dialogue can happen. This is precisely why the legions of science and humanities need to re-legion.

Perception and representation are the core paradigms of cultural studies that can assess the potential for social or ideological change, hidden in the dynamics of identification with a represented image or concept. With a flair for the same subject, neuroscience has progressed to a point where it can productively theorize about the basic principles of brain function and, hence, it can address questions concerning learning, representing, cognition and behavior. Thus, science can join the communications specialist to speculate (empirically) about "the power of scoring a goal that brings thousands to their feet." If you ask a scientist "How do we perceive?" he is likely to answer that our body is a mega-receptor for external stimuli, a mega-modulator for convolving external pulses and oscillations with internal filters and rhythms, a mega-machine that outlets the product of stimulation and modulation of the inner and the outer signals in the form of vision, sensation, movement, memory, perception, affect. The body, for the scientist, consists of an assemblage of cells, destined to perform a specialized function by a primordial desire for survival—the deriving force of evolution. What constitutes life to a body is the cell-cell interaction via mechanisms of molecular communication, which occurs across complex pathways that have evolved to ensure the proliferation of the organism. The soul of the organism is thus understood as the journey completed by the electrochemical particles that traffic life across the cellular infrastructure of the body. The soul for a scientist is the output of the constant interaction of an internal mega-system that embodies a person with an external mega-system that tirelessly stimulates. The more complex the interconnectivity of the organism, the more complex the output from its interactions with the external world, the more evolved the affect, the more notable the effect will be. The scientist, therefore, shares in the philosophy of Maurice Merleau-Ponty that the world has certain ways of invading humans and that humans have certain ways of meeting this invasion; they interplay with a "certain kind of symbiosis." [1] I refer to the neuroscientist's view of this symbiosis as *neurophenomenology*. The body is shared by the world that reflects it, in a "relation of transgression or overlapping." [2] The reflection of the world and of the self occurs in the mirror of the brain, upon where it converges with the surface of the body, and from which the image of the world projects back onto the surface of the body, and thus back to the world. A new discursive paradigm, neurophenomenology aims to explain neuronal mechanisms that guide perception, pleasure and intersubjectivity.

What constitutes identity? How does ideology affect humans? Is desire innate? Is pleasure physiological? What derives empathy? Modern neuroscience is exploring these questions with new tools and on a comfortable bed of over 200 years of empirical evidence that the brain and the mind are interrelated with electrochemical agents and not metaphysical divinities. [3] However, in this electronic age that, as Marshall McLuhan prophesized, "we carry the whole of humanity as our skin;" an age that "we have extended our central nervous system in a global embrace, abolishing both space and time as far as our planet is concerned," [4] these questions are of particular —and immediate—importance to communication theorists. They are also important to ethnographers and anthropologists because in the era of *simulacra*—to borrow from Jean Baudrillard—intersubjectivity works within a paradoxical system which, on the one hand, opens infinite windows for encounters with the *other*, but simultaneously conceals the corporeality of the subject and object relationship behind an electronic wall. It is the collapse of a bi-directional experience of flesh that alarms Paul Virilio, who threatens a "loss of orientation" in the speeding "stereoreality" of the electronic age. [5] At the cyberjuncture of hypercommunication, apparatus theory calls for revision. To be in step with the advances of cumulative human knowledge, the revisionist needs to pay attention to the advances in neuroscience and its relation (not always amicable) with established schools of psychoanalysis. Obviously, neurophenomenology embarks on the premise of a unified theory of brain and mind, but I stand on the scientist's side of the divide between philosopher and neuroscientist. If there is a chance of philosophical skepticism, I let the eloquent work of philosopher Patricia S. Churchland speak in neurophilosophy's defense. [6]

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In challenging the dualism of object and subject, in marrying the seer and the seen, the touching and the touched, in bringing the dimension of flesh to the invisible processes that precede symbols and ideas, Merleau-Ponty— like Gilles Deleuze, Michel Foucault and Jacques Derrida—paves the non-binary course of postmodern philosophy. At the conjuncture of cultural diversity, brought together in the conciliatory mantra of postmodern-isms, flashes in bold the problem of intersubjectivity. However, as a phoenix that has arisen from the ashes of a 'dead god'—that in turn inspired 'the death of the author'—postmodernism

flies perilously in an all-image, disorientingly rapid and superficially diverse cultural cyberscape, where the trend of 'deconstruction' threatens to consume it in fire yet again. Martin C. Dillon calls postmodernism "a transcendental system of the signifier" in which the meaning of the world is that projected by signifiers and our knowledge of it is mediated by the vehicle of language, which drives culture and history. Deconstruction helps us understand how the system of signifiers works through and upon us; however, to influence the genesis of these systems, Dillon argues in favor of Merleau-Ponty's phenomenology to 'accommodate empirical truths' in postmodern systems of thought:

Truth requires a ground: if one seeks an ultimate ground, … one must fetch up with an ultimate, an absolute. And there are good reasons (grounds) for rejecting absolutes. But the argument that proceeds from the rejection of all absolutes to the rejection of all grounds (and hence all truths) is specious. There are finite grounds, finite truths. It is on the finite ground on which we stand that we must base the truth … [7]

In its liberal disavowal of 'subject position', postmodernism assumes a strict regime of relativism where semantics are replaced with symbols; symbols are extracted from intersubjective—but not necessarily objective —cultural agreements; meaning is individuated and thus devoid of global appeal; and thus subject matter is flattened as a deconstructable text, devoid of a 'grand' value. In legitimizing infinite states of subjectivity, postmodernism runs the peril of losing objectivity and an ideologized disconnection from reality: a model closely resembling schizophrenia. Ironically, science has joined philosophy in a discourse of subjectivity and intersubjectivity in search of the origins and mechanism of schizophrenia. Strikingly, the leading evidence has originated from the discovery of mirror neurons. [8]

Fifteen years ago, Giacomo Rizzolatti and colleagues discovered a subset of neurons in a focal area of the brain associated with motor activity. The functional characteristic of these neurons was that they were activated both when the primate performed a task and when it observed or anticipated the same task being performed. [9] The discovery of mirror neurons along with non-invasive *invivo* techniques of observing the human brain in action gave science a giant leap forward in understanding the mechanisms of language, behavior and intersubjectivity. [10] Recently, Vittorio Gallese, one of the leading scientists in studying mirror neurons, proposed that, "… our capacity to understand others as intentional agents, far from being *exclusively* dependent upon mentalistic/linguistic abilities," is "deeply grounded in the *relational* nature of our interactions with the world." According to his hypothesis, "… an implicit, pre-reflexive form of understanding of other individuals is based on a strong sense of identity binding us to them. We share with our conspecifics [members of the same species] a multiplicity of states that include actions, sensations and emotions." To capture the richness of experience shared with others, Gallese has conceived the shared *manifold* of intersubjectivity, a multi-dimensional 'we-centric' shared space, characterized at the phenomenological and functional level. He then argues, "…the same neural structures that are involved in processing and controlling executed actions, felt sensations and emotions are also active when the same actions, sensations and emotions are to be detected in others." [11] The complexity of selfother identity and the affective dimension of interindividual relations are common interests of today's neuroscience and yesterday's philosophy. Merleau-Ponty and Gallese meet at the juncture where the self and the other correlate and represent a reciprocal system governed by—what Gallese calls—*reversibility rules*.

The reversible system ruling intersubjectivity is founded upon blocks of perception. "The last frontier of biological science" notes Eric Kandal, "is to understand the biological basis of consciousness and the mental processes by which we perceive, act, learn, and remember." [12] Today's scientist joins the voice of the critics of empiricism that the human mind is *not* just a *tabula rasa*, a blank slate upon which all knowledge is marked by way of experience. Although more sympathetic to Kant's view that the brain is not just a passive receiver of sense impressions, and that it is rather confined to certain pre-existing conditions and brain properties that organize sensory experience, today's scientist is vigilant about the evidence of brain plasticity—the changes in structure and function in accordance with environmental factors. [13] One might wonder: if the brain is plastic, then how could it help in grounding the plastic culture of postmodernism? Whether or not the plasticity of the brain perpetuates reversibility rules of social and perceptual intersubjectivity, it provides the philosopher, the cultural theorist, and the political activist with an earthly-grounded premise for investigation of the ways in which the nature-culture dichotomy exerts influence on individuals, on society and on the interaction between the two.

Almost seventy years ago, Walter Benjamin drew attention to the process of mechanical reproduction of the work of art and the power of symbolic and representative images in connecting the public and mobilizing the wheels of social change. [14] Forty years later, Jean-Louis Baudry planted the seeds of Apparatus Theory in the terrain of Lacanian psychoanalysis and brought attention to the technical nature of the optical instrument in cinema and the ideological mechanisms that it evoked. [15] The apparatuses of communication—be it print, press, telephone, cinema, television, internet or wireless technology—have undeniably transformed our cultural anatomy and displaced localization of many social functions (across gender and ethnicities). Many a philosopher, feminist, cultural theorist, and politician have vexed about the ways in which this transmogrification has taken place; nevertheless, few have addressed the primordial laws of flesh as the mediator in negotiating a relationship between the corporeal site of the individual's reception and the physical reality of the apparatus's stimuli. Furthermore, although the empirical reality is that the biological course of human (d)evolution lags behind persistent social ®evolutions; neurophenomenological discourse posits that the flesh that touches is also touched; the brain that enacts a behavioral response is also encroached upon, marked, touched by patterns of electrophysiological response that the environment, the subject, the *other* elicit. Thus, in light of scientific findings about the nature of neuroplasticity, it is possible to begin inquiry into the ways our perceptual activities may affect our fleshly existence.

In 1975, Laura Mulvey used psychoanalysis "to discover where and how the fascination of film is reinforced by pre-existing patterns of fascination already at work within the individual subject and the social formations that have moulded him." [16] Whether modern neuroscience or postmodern critics refute Freud's theories or sneer at Lacan's psychoanalysis, Mulvey's political analysis of the machinery of narrative cinema and visual pleasure remains plausible. Similarly to cultural studies, science—whether at the service of plastic surgeons, esthetic clinics, labor markets and ad agencies, or in search of evolutionary effectors of mate-selection, psychological and social behavior—has been witnessing an upsurge of interest in 'pre-existing' or intrinsic patterns of fascination by visually pleasant stimuli and universal metrics of beauty and attractiveness. Science has comfortably postulated that perception of beauty is innate [17] and although modulated by hormonal status and psychological factors—that determine short-term and long-term preference for attractiveness—it is universal across race and cultures. [18] These findings shed a neurophenomenological light on Mulvey's psychoanalytical speculations about cinema's role in catering to *scopophilia*, a primordial 'voyeuristic' wish for pleasurable viewing. But if science is correct that the perception of beauty—like fear, hunger and sexual desire—is an innate and universal feature ingrained in the genetic mesh of human existence in such a way that it attracts the gaze and activates a visceral reward system, then how far can the physiological threshold of desire be extended? I find this question particularly pertinent in relation to the indefinite virtual possibilities that our digital and satellite technologies currently provide us. I return to Mulvey, who writes (reinforced now by scientific evidence) that an active/passive heterosexual division of labor controls narrative cinema in such a way that a woman on screen is the bearer of the look and signifies male desire, while the male star controls the film phantasy by representing a perfect, powerful and ideal ego, mirroring the spectator's alienated and internalized imaginary identity. In Mulvey's assessment of Lacan's description of the mirror phase, *image*—before language—is what "constitutes the matrix of imaginary, of recognition/misrecognition and identification, and hence the first articulation of the 'I', of subjectivity." (Mulvey, 1975) If we accept Gallese's shared manifold of intersubjectivity, which roots empathy in mirror neurons—that mimic the activation pattern of actions observed or anticipated—then we are also in accord with Lacan that the mirror phase—when a child *sees* and recognizes his image in a mirror—is crucial to the generation of ego and identification with the other. Again, this raises a similar question: if vision provides the primary input to the system of recognition of self and other, and if the neuronal processes of identification occur prior to processing of other experiential cues by the brain, then what is the threshold of recognition of 'real' from the fantastic phantasm?

Imagine a naïve scenario: a *scopophilic* generation has accomplished perfection in the creation of virtual realities to such an extent that anyone can create a *narcissistic* version of world, ego and identity, and accelerate in pleasure and desire in ways that are unimaginable or impossible in the real world. This world is also "hermetically sealed": it unwinds magically; but instead of being in a passive relationship with cinema, the spectator of the virtual reality world is himself a part of this circular voyeuristic fantasy, creator and cyborg at the same time. The identity in this world will be totally dissolved along the lines of imagination, indulgence of visual illusions and egotistic unification

with a technologically (digitally) enhanced illusion of perfection. The global village of image in which we live electronically is a hologram of cinema perpetuated in many dimensions of culture and technology, postmodern and multiplanar. The digital image, whether projected in a movie theater, interacted with on a computer, or communicated on wireless cameras, modulates the fundamental processes of our pleasure and identification in the same way that phantasmagoria of the eighteenth century did. But the intensity of experience is different, as is the nature of the illusion of freedom, albeit at the expense of a greater disconnect from reality. How would this affect the course of our biological (d)evolution? Science has yet to fully investigate. But science has already determined that a lack of resonance with the real, and segregation of the self from the tangible 'other' constitutes psychopathological evidences of *schizophrenia*. Unless it finds a 'ground' to establish a reality, postmodernism runs the risk of psychosis. Can the clinic of neurophenomenology suggest a preventative course that outweighs the side-effects of reductionistic medications?

This is Najmeh's first contribution to Synoptique.

NOTES

1 Merleau-Ponty, Maurice. *Phenomenology of Perception*. London: Routledge & K. Paul, 1962. p. 317

2 *ibid*, p. 248

3 The credit for demystification of concept of soul often goes to Hermann von Helmholtz (1821-1894) who showed evidence of chemical and metabolic reactions involved in electrical stimulation of nerves. Julian Offray de la Mettrie, author of *L'Homme Machine* in 1748, was the first to note that behavior in human, both reflex and intellectual, results from 'irritation' of nerves. For a historical sketch of the science of nervouse system, see Churchland, P. S.. *Neurophilosophy: Towards a Unified Science of the Mind-Brain*. Cambridge, London: The MIT Press, 1996.

4 McLuhan, Marshal. Understanding Media. New York, Mentor, 1964.

5 Paul Virilio, "Speed and Information: Cyberspace Alarm!" *Le Monde Diplomatique* (Aug 1995).

6 In her pioneering work, *Neurophilosophy: Towards a Unified Science of the Mind-Brain*. (Cambridge, London: The MIT Press, 1996),Churchland has married contemporary research in the empirical neuroscience with recent research in philosophy of science and philosophy of mind and explores prospects for a unified cognitive and philosophical neurobiology.

7 Dillon, M. C. *Merleau-Ponty's Ontology*. Evanston, Northwestern University Press, 1988.

8 For more information on the role of mirror neurons in development of language and social behavior see Stamenov, M. I. and V. Gallese, Eds. *Mirror Neurons and the Evolution of Brain and Language*. Advances in Consciousness Research. Amsterdam, Philadelphia, John Benjamines Publishing Company, 2002.

9 Rizzolatti, G., R. Camarda, et al. "Functional organization of inferior area 6 in the macaque monkey. II. Area F5 and the control of distal movements." *Exp Brain Res* 71(3) (1988): p. 491-507; Fogassi, L. and V. Gallese. T*he Neural Correlates of Action Understanding in Non-Human Primates. Mirror Neurons and the Evolution of Brain Language*. M. I. Stamenov and V. Gallese. Amsterdam/Philadelphia, John Benjamines Publishing company, 2002. p. 14-32.

10 It has been long discovered that major functional systems of the brain are governed by five principles: 1) each functional system involves several brain regions that carry out different types of information processing, 2) the functional systems are connected by identifiable pathways, 3) functional systems are hierarchically organized, 4) functional systems control action contralaterally, and—most interestingly 5) brain is organized topographically, i. e. the peripheral receptive surface—the retina or the eye, the cochlea of the ear, the surface of skin—is represented throughout successive stages of processing in such a way that neighboring sensory receptors project to neighboring regions of the cerebrum associated with that particular sensory system. (I can't help thinking about flesh, touch, Merleau-ponty.) In the past decade, non-invasive functional brain imaging techniques (PET, fMRI, EEG) have provided behavior and cognitive neuroscientists with an exciting outlook into the topography of the human brain in action. For details see Kandel, Eric R. and James H. Schwartz eds. *Principles of Neural Science*. New York : Elsevier North Holland, 1981.

11 Gallese, V. "The roots of empathy: the shared manifold hypothesis and the neural basis of intersubjectivity." *Psychopathology* 36 (4) (2003): p. 171-

80.

12 Kandel, E.. *The Brain and Behavior. Principles of Neural Science*. E. R. Kandel, J. H. Schwarts and T. M. Jessell, McGraw-Hill, 2000. p. 5-18. Eric Kandel is professor in Colombia University whose laboratory has focused on developing reductionist approaches to learning designed to explore the molecular mechanisms of memory storage and to uncover new aspects of neuronal signaling. He shared the 2000 Nobel Prize for Physiology or Medicine with Arvid Carlsson and Paul Greengard for their discoveries in signal transduction in the nervous system.

13 It is long known that cortical plasticity is associated with functional rather than anatomical changes. In a recent article "Neuroplasticity: Changes in Gray Matter Induced by Training", (Bogdan Draganski, Christian Gaser, Volker Busch, Gerhard Schuierer, Ulrich Bogdahn and Arne May. *Nature* 427 (22 January 2004), p. 311 – 312,) it is shown that the structure of an adult human brain alter in response to environmental demands. The researchers used whole-brain magnetic-resonance imaging to visualize learning-induced plasticity in the brains of volunteers who have learned to juggle. They found that these individuals showed a transient and selective structural change in brain areas that are associated with the processing and storage of complex visual motion. Furthermore, there is new evidence that, neither anatomically nor physiologically, neocortical neurons of a given class are not restricted to specific areas or layers of the cortex, and electrochemical manipulations at the cellular level can affect the electrophysiological properties of single neurons. (Mircea Steriade, "Neocortical Cell Classes Are Flexible Entities." *Nature Reviews Neuroscience* 5, (2004) p. 121 -134)

14 Benjamin, Walter. "The Work of Art in the Age of Mechanical Reproduction." *Art and the Interpretation*. E. Dayton. Peterborough: Broadview, 1935. In "The Work of Cinema in the Age of Digital (Re)production", (*Offscreen*, Oct 31, 2003. http://www.horschamp.qc.ca/new_offscreen/new_media.html), I have discussed the cultural implications of new interactive media technologies in formation of new political and social practices.

15 Baudry, J. L. "Ideological Effects of the Basic Cinematographic Apparatus." *Narrative, Apparatus,* Ideology. P. Rosen. New York, Colombia University Press, 1986.

16 Mulvey, Laura. "Visual Pleasure and Narrative Cinema." *Screen* 16 (3) (1975): 6-18.

17 Several studies have reported visual preferences—in terms of gaze duration—of human infants for faces that varied in their attractiveness. (For details see Geldart, S., D. Maurer, et al. "Effects of eye size on adults' aesthetic ratings of faces and 5-month-olds' looking times." Perception 28 (3) (1999): 361-74; Geldart, S., D. Maurer, et al. "Effects of the Height of the Internal Features of Faces on Adults' Aesthetic Ratings and 5-montholds' Looking Times." *Perception* 28 (7) (1999): 839-50, Rubenstein, A. J., L. Kalakanis, et al. "Infant Preferences for Attractive Faces: a Cognitive Explanation." *Dev Psycho*l 35 (3) 1999: 848-55; Rhodes, G., K. Geddes, et al. "Are Average and Symmetric Faces Attractive to Infants? Discrimination and Looking Preferences." *Perception* 31 (3) (2002): 315-21.) Infants, as young as 4 months, have shown similarity with adults in the 'aesthetic perception' of attractiveness. (Samuels, C. A., G. Butterworth, et al. "Facial aesthetics: babies prefer attractiveness to symmetry." *Perception* 23 (1994) (7): 823-31.) A recent study on 'saccade effects', it was shown that gaze is actively involved in preference formation and that saccade effects are present when participants compare abstract, unfamiliar shapes for attractiveness, suggesting that orienting and preference for objects in general are intrinsically linked in a positive feedback loop leading to the conscious choice. (Shimojo, S., C. Simion, et al. "Gaze Bias Both Reflects and Influences Preference." *Nat Neurosci* 6 (12) (2003): 1317-22.) An inquiry into neurophysiological evidence of preference for attractiveness has revealed that passive viewing of female faces stimulates regions of brain that are associated with the reward circuitary. (see Aharon, I., N. Etcoff, et al.. "Beautiful Faces Have Variable Reward Value: fMRI and Behavioral Evidence." *Neuron* 32 (3) (2001): 537- 51.)

18 For more details see Perrett, D. I., K. A. May, et al. "Facial Shape and Judgements of Female Attractiveness." *Nature* 368 (6468) (1994): 239-42; Cellerino, A. "Psychobiology of Facial Attractiveness." J *Endocrinol Invest* 26 (3 Suppl) (2003): 45-8, Johnston, V. S., C. J. Solomon, et al. "Human Facial Beauty: Current Theories and Methodologies." *Arch Facial Plast Surg* 5 (5) (2003): 371-7.

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