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Review of:

Lev Manovich, *The Language of New Media*. Cambridge, MA: MIT Press, 2000.

[1] Most scholars of modern media now agree that the shift of symbolic representation to a global digital information network is as systemic and pervasive a mutation, and as fraught with consequences for culture, as the shift from manuscript to print. Any one who wants to think clearly about the cultural implications of the digital mutation should read Lev Manovich's new book, *The Language of New Media*. This book offers the most rigorous definition to date of new digital media; it places its object of attention within the most suggestive and broad-ranging media history since Marshall McLuhan; finally, by showing how software takes us beyond the constraints of any particular media substrate--paper, screen, tape, film, etc.--this book overcomes the media framework indexed by its own title. *The Language of New Media* leads its reader to confront what is strange yet familiar, that is, *uncanny*, about the computable culture we have begun to inhabit.

[2] Before characterizing Manovich in greater detail, it is helpful to say what this book is *not*. Pragmatically focused upon the present contours of computable media, Lev Manovich is neither a prophet nor doomsayer, peddling neither a utopian manifesto nor dystopian warnings. Manovich also eschews the conceptual purity of those cultural critics who set out to show how new digital media realizes the program of... Gilles Deleuze, Jean Baudrillard, Jacques Derrida (insert your favorite theorist). Like many raised in the former Soviet Union, Manovich seems inoculated against any explicit aesthetic, conceptual or political ideology. Instead, Manovich practices a catholicity founded in negative capability: if an art practice or popular media culture has flourished, it is part of the picture, and the critic and historian of media must find a way to account for it. This helps explain the remarkable scope of Manovich's book as it ranges easily from analysis of the software/hardware/network infrastructure that supports new media practice to the synthetic efforts to explain what new media is; from contemporary artistic practice to aesthetic theory; from popular media culture to advanced media theory; in short, from the Frankfurt School and Dziga Vertov to the GUI (Graphical User Interface) and *Doom*.

Defining New Media

[3] What makes new digital media different from old media? Many early answers--discrete versus continuous information, digital versus analog media--founder upon closer inspection. A host of scholars and critics have approached this question through various vantage points: the history of technical culture (Jay David Bolter), hypertext (George Landow), narrative (Janet Murray), architecture (William J. Mitchell) virtual reality (Michael Heim), theatre (Brenda Laurel), and so on.^1^ From these books there has emerged a series of general traits ascribed to new media. Here are a few: new computer based media is described as procedural, participatory and spatial (Murray); discrete, conventional, finite and isolated (Bolter); liquid (Mitchell), productive of virtuality (N. Katherine Hayles, Heim) or cyberspace (William Gibson). While these traits and terms have cogency within particular analyses, the attempt to generalize their use brings diminishing returns. Thus Manovich argues that a favorite term to characterize new

media--“interactive”--is simply too broad and vague to be critically useful. It not only fails to account for the variety and specificity of new media; the term also tendentiously implies that old media are fundamentally non-interactive. For example, isn't it part of the critical point of various kinds of modernism to make its audience “interact” with the art object (56)?

[4] Trying to isolate the essential traits of new media repeatedly courts two complementary problems: one may overplay the novelty and difference of new media by ascribing to it traits in fact found in old media (so, for example, random access to packets of data is as old as the codex); or, by restricting attention to the aesthetic or phenomenological effects of new media products, for example by comparing “e-literature” and print literature as formal artifacts (cf. J. Hillis Miller on “the Digital Blake”), one may fail to come to terms with the difference made by what lies at the heart of new media--a computer running software. The sheer familiarity of the personal computer may have encouraged cultural critics to treat the cultural products of the computer (word processing documents, cinema with digital special effects, hypertext) as nothing more than old media enhanced by the flexibility and transportability of digital code and a global network. Thus, in *Cybertext*, Espen Aarseth has shown how literary theorists who interpret new media genres like hypertext or computer games have reduced them to conceptual terms--like labyrinth, game and world--that annul the difference for textuality of a computer operating in the background and doing calculations (8, 75). Manovich's first response to this dilemma is to develop an intrinsic list of the five principles of new media, a cluster of terms that specify the techniques and operations of a computer running software and suggest how an old media sphere is being “transcoded.”

[5] Here is a rather bald restatement of Manovich's five intrinsic principles of new media. First, through *numerical representation*, a new object can be described formally (mathematically), and subject to algorithmic manipulation: “in short, media becomes programmable”(27). Second, new media objects have *modularity at the level of representation and at the level of code*. Thus, new media objects such as a digital film or a web page are composed from an assemblage of elements--images, sounds, shapes, or behaviors--that sustain their separate identity and can be operated upon separately, without rendering the rest of the assemblage unusable. In an analogous fashion, modular programming speeds the development and maintenance of large-scale software (31). Thirdly, numerical coding and modularity “allow for the *automation of many operations involved in media creation, manipulation, and access*”(32). From the earliest use of computers to target weapons at high speed, to web pages generated on the fly, to intelligent agents that sift and retrieve information, automation achieves speed that is the fulcrum of computer “power.” Fourthly, while old media depended upon an original construction of an object that could then be exactly reproduced (for example as a printed book or photograph), *new media is characterized by variability*. Thus, browsers and word processors allow users defined parameters; databases allow selective search-sensitive views; web pages can be customized to the user. The variability of new media allows for branching-type interactivity, periodic updates, and scalability as to size or detail (37-38). Finally, new media finds itself at the center of the *“transcoding”* between the layers of the computer and the layers of culture* (46). In new media lingo, to “transcode something is to translate it into another format”(47). Manovich makes the strong claim that the “computerization of culture gradually accomplishes similar transcoding in relation to all cultural categories and subjects”(47). By using the term “transcoding,” Manovich acknowledges the distance between computer and culture, even as that distance is often dissimulated. Thus, as Manovich explains, the “cultural layers” of a new media object (like Microsoft's *Encarta*) might be as familiar as an encyclopedia, but its “computer layers” are process and packet; sorting and matching; function and variable (46).

[6] These admittedly cumbersome five principles don't seek to specify the computer/software in itself, nor do they characterize the specific media forms it makes possible (like hypertext, computer games, jpegs, web pages, etc). Instead, these five principles characterize that zone between and across which the transport between computer and culture is happening. These five principles offer a commonsense way to specify the capacities and tendencies of that new “universal media machine,” the

computer running software: computers use numerical representation and modularity so as to automate functions and offer variability within the media objects that are produced and sustained by them (69). These four tendencies of computer-based media helps to win its broader cultural effect, a “transcoding” between computer and culture, so we begin to inhabit the new forms of a computable culture. These general tendencies of a computer running software are what Manovich explores in the rest of the book, a trajectory of analysis that implicitly offers a second answer to the question “what is new media?”. While several influential books have sought to embed the computer in the history of media (Bolter and Grusin’s *_Remediation_*; Borgmann’s *_Holding on to Reality_*; and Levinson’s *_The Soft Edge_*), Manovich insists that if one is to take account of the full scope of new media, one must take account of its different “levels.” He begins at the most basic level with the “operating system” and the human-computer interface, taking account of the inheritance from print and cinema, the salience of the screen, and the body of the user (Chapter 2); moving up to the level of the software applications, Manovich offers broad cultural interpretations of operations like “selection,” “compositing,” and “teleaction” (Chapter 3); at the level of user experience, Manovich turns to the “illusions” created by computer-based image making: “synthetic realism” or virtual reality (Chapter 4); at the level of new computable media genres, Manovich reads the “database” and “navigable space” as rivals and alternatives to the previously hegemonic cultural form, “narrative” (Chapter 5); and finally, Manovich traces the dislocations worked by new media upon what he calls the dominant medium of the 20th century, cinema (Chapter 6).

[7] Manovich’s multi-layered topology of new media does not really claim conceptual comprehensiveness: surely new “layers” could be discerned between his layers. Nor does he attempt completeness at the level of media types: so hypertext, which plays a large part of the critical survey of new media told by Landow and Aarseth and others writing out of literary studies, plays a rather small role in this book. Manovich’s book of new media draws its methodological rigor from Russian formalism, and the technique of doing a topology. However, that does not mean we have to accept the empiricist anti-idealist assumptions of that approach. One doesn’t have to take this multi-leveled approach to new media literally--as though Manovich has suddenly taken the blindfold from the eyes of critics groping around the elephant of new media--to appreciate the fruitfulness of this approach. Manovich’s topology of new media is based on a self-conscious analogy to the conventional “levels” of the computer hardware and software (from microprocessor through operating system to high-level application). But this analogy works because it allows him to “touch” upon more of the many constituents of computable media, and thus more of the complexity and plurality of new media, than any other critic I have read. Manovich does this by introducing new terms into the analysis of new media. The “language” of his title suggests that the computer, as the new universal media machine, is producing new discourses and new terms, and thus a new “language” in the strong sense of post-structuralism and Russian formalist theory. Lev Manovich’s book issues an implicit invitation to the reader to enter into a language game that will develop a lexicon that can do two things: 1) specify with precision the software technique and underlying technology of new media, and 2) open these techniques and technologies out to the broader cultural practices, and unsuspected historical affiliations, of new media.

[8] This terminological strategy is on display in his development of the term “interface,” the term used in computer science where there is “a point of interaction or communication between a computer and any other entity” (*_American Heritage Dictionary_*). Computer culture has given a rich and diverse elaboration to this term because the interface is habitually the crucial boundary, or zone of articulation and translation whenever a computer would communicate with devices (such as printers, networks, monitors, machines) or the human user. In *_Interface Culture 1997_*, Stephen Johnson demonstrates the unprecedented centrality that computers give to the computer human interface. Manovich takes a different approach: he expands the concept of “interface” backward in time so that it encompasses not just the diverse software interfaces of new media (from the desk-top Windows environment to the conventions of computer game design) but also the formal traits and user practices with salient media like the printed word and cinema. Rather than viewing the persistence of the printed word and cinema as the indebtedness

of new to the old, perhaps by citing Marshall McLuhan's well known dictum that each new medium takes an old medium as its content, Manovich argues that the printed word and cinema should be considered not just as media forms but "cultural interfaces." Here is how he describes the crucial components of each: "the printed word" includes "a rectangular page containing one or more columns of text, illustrations or other graphic framed by the text, pages that follow each other sequentially, a table of contents, and index"; "cinema" "includes the mobile camera, representations of space, editing techniques, narrative conventions, spectator activity"(71). These formal descriptions of "the print word" and "cinema" uncouples them from their original media so Manovich can trace how they migrate into, and become part of, the interfaces of new media. Although the human-computer interface is much newer, Manovich insists it has become "a cultural tradition in its own right" (72) featuring "direct manipulations of objects on the screen, overlapping windows, iconic representation, and dynamic menus" (71) along with operations like copy/past and search/replace. Manovich puts these three cultural interfaces side by side so we can see that they are richly different ways of "organizing information, presenting it to the user, correlating space and time, and structuring human experience in the process of accessing information" (72). The subsistence of these cultural interfaces at the moment when the printed word and cinema are being "liberated from their traditional storage media--paper, film, stone, glass, magnetic tape" means that a "digital designer can freely mix pages and virtual cameras, tables of content and screens, bookmarks and points of view"(73).

[9] The concept of "cultural interface" suggests what distinguishes this book from many discussions of digital media: its resolutely historical consciousness. Many critics have argued that the digital mutation, through a kind of (historical) retroaction, is enabling us to see earlier events like the "print revolution" in new ways. (For an influential example, see Landow, 20-32.) Manovich carries this perspective much further by offering an archeology of earlier cultural forms and practices that are flowing into, and receiving distinctive inflection within, new media. Thus Manovich's discussion of the "screen" of the human computer interface [HCI] distinguishes the static screen of traditional painting from the dynamic screen of the moving image (of cinema and TV), and both of these from the screen of real time (of radar, of video feeds). This comparative perspective allows him to ask questions about how each screen places the user and entails certain costs. He shows, for example, the tension between uses of the computer screen to make it, on the one hand, a real-time control panel, and on the other, the site for an absorptive experience which expands the threshold of the visible but impose stasis on the body of the spectator.

Manovich's Analytical Engine

[10] My discussion of Manovich's redefinition of new media does not come to terms with the critical range of this book. With wit and elegance, he coordinates several different agents: the thoughtful critic of modernism, the accomplished scholar of cinema, the innovative practitioner of new media, and the humanist who wears his vast learning lightly. All are needed to do what this book attempts: to crosscut between the full range of contemporary new media (art and popular culture) and the history of visual and technical culture. The analysis achieves a lot of its rhetorical force from the consistent operation of what I would like to call Manovich's analytical engine. By using the word "engine," I am seeking to isolate the recurrent movements in his analysis. I can demonstrate this analytical engine as it sorts the implications of one of the "operations" discussed on the third chapter: selection. Although selection appears as an apparently simple and modest operation in many a software programs, Manovich insists upon its broader cultural implications. "While operations [like selection] are embedded in software, they are not tied to it. They are employed not only within the computer but also in the social world outside it. They are not only ways of working within the computer but also in the social world outside it. They are...general ways of working, ways of thinking, ways of existing in the computer age"(118).

[11] To suggest the key rhetorical and conceptual moves of Manovich's analytical engine, I have put them in bold type.

Manovich begins his overview by offering several empirical examples of selection: Manovich describes the centrality of selection in programs from Adobe _Photoshop 5_, Macromedia _Director 7_, and Apple's _Quicktime 4_.

These programs suggest a basic logic of new media, which is stated as an *opening generalization, often through provocative overstatement*: "New media objects are rarely created from scratch; usually they are assembled from ready-made parts. Put differently, in computer culture, authentic creation has been replaced by selection from a menu"(124).

Archeological question(s) situate selection within the long history of visual culture: "What are the historical origins of this new cultural logic?"(125). Manovich describes the way E.H. Gombrich and Roland Barthes have critiqued the romantic ideal of artistic creation; and how industrial production prepares for the artistic experiments around 1910 with montage and photomontage, culminating with their use in _Metropolis_ (1923) and other films, and finally, to Pop artists of the 1960s.

Manovich, playing the journalistic cultural critic, makes a *broad and loose cultural connection*: "The process of art has finally caught up... with the rest of modern society, where everything from objects to people's identities is assembled from ready-made parts. Whether assembling an outfit, decorating an apartment, choosing dishes from a restaurant menu, or choosing which interest group to join, the modern subject proceeds through life by selecting from numerous menus and catalogs of items"(126). After a discussion of the branching menu systems of various software program, Manovich refuses to the software user the "author" function of creating something new (128).

How, asks Manovich, can one resist this rhetoric of endless choice through selection, the obligation to choose as a vehicle for expressing your identity? Perhaps by accepting a computer's and software program's bland defaults, one can refuse to choose, and thus wear the software equivalent of jeans and a tee shirt.

Manovich clinches the centrality of selection with a new media example: "The WWW takes this process [of selection as more pervasive than invention] to the next level: it encourages the creation of texts that consist entirely of pointers to other texts that are already on the Web"(127), cf. Yahoo, Voice of the Shuttle.

Manovich makes a *detour into the prehistory of cinema*: the Magic lantern exhibitor was also a selector. Crucial to this practice in film and video has been the modern standardization of formats. These allow the cutting and pasting that enables selection to work.

Manovich makes a *cultural connection to art theory (here postmodernism)*. The technique of pastiche, the quoting of earlier styles, which is widely associated with postmodernism (by Fredric Jameson and others in the early '80s) is seen by Manovich as finding its fullest realization with software: "In my view, this new cultural condition found its perfect reflection in the emerging computer software of the 1980s that privileged selection from ready-made media elements over creating them from scratch" (131).

Manovich makes a *conceptual extension of the concept of selection to that of filtering, in new as well as older electronic media*. It is not just selection that is central to new media, but the fact that we can modify what we select through the use of software programs, for example, through using the filters in _Photoshop_. But this is not a new phenomenon in the history of media. The telephone, the radio and television were already based upon a technology that made selection--through the modification of an existing signal--crucial. "All electronic media technologies of the nineteenth and twentieth centuries are based on modifying a signal by passing it through various filters. These include technologies for real-time communication such as the telephone, broadcasting technologies used for mass distribution of media products such as radio and television..."(132).

This leads to a *retroactive interpretation of older media in light of new media*: "In retrospect, the shift from a material object to a signal accomplished by electronic technologies represents a fundamental conceptual step towards computer media. In contrast to a permanent imprint in some material, a signal can be modified in real time by passing it through a filter or filters... an electronic filter can modify the signal all at once... an electronic signal does not have a singular identity--a particular qualitatively different state from all other possible states" (132). Examples: volume control for radio receiver... brightness control for analog TV set. "In contrast to a material object, the electronic signal is

essentially mutable.” “This mutability of electronic media is just one step away from the ‘variability’ of new media” (132-33).

This allows Manovich to *assess the difference made by digital mutation*: Now we can see that the mutability of signals suggests that radio and TV signals are “already new media.” “Put differently, in the progression from material object to electronic signal to computer media, the first shift is more radical than the second” (133). The increase in range of variation in the digital is accounted for by two factors: “modern digital computers separate hardware and software” (so for example, changing volume will just be a software change) and second, “because an object is now represented by numbers, that is, it has become computer data that can be modified by software. In short, a media object becomes ‘soft’--with all the implications contained in this metaphor”(133). The mutability of TV (with hue, brightness, vertical hold, etc.) becomes the much wider range of variability for display of a page in a browser window.

Manovich closes his analysis through a witty invocation of a new cultural practice: The rise of the DJ is seen as cultural symptom of the centrality of the art of selection. “The essence of the DJ’s art is the ability to mix selected elements in rich and sophisticated ways... [T]he practice of live electronic music demonstrates that true art lies in the “mix” (135).

[12] Manovich’s analytical engine develops an ordinary term--selection--with which to think about what living in a computable culture means. By his account selection does not come from the computer running software. It is something humans--artists, consumers, and users--do and have done in a vast range of contexts, perhaps for as long as human culture. Of course modern industrial production, by expanding the range of selectable commodities, has increased the everyday salience of the act of selection. Modern electronic media, by changing media objects into media signals, expanded the powers of selection through modulation (of, for example, a radio signal, its volume, etc.). Manovich’s discussion effectively puts aesthetic theorists, moralists, and artists in dialogue around the subject of selection. Such a perspective on “selection” embeds an argument about media determinism he never makes explicit: computable media does not determine culture. The pleasures of selection help to drive the harnessing of a technology that extends the powers of selection. In this way, new media are a symptom of culture, rather than something that comes from outside it (cf. Bruno Latour on technology). Of course, it is also easy to see how selection in real time is greatly facilitated by the first four principles of new media: numerical representation, modularity, automation, and variability. Thus, by the way computers expand the pervasiveness and varieties of selection, computable media bears their effects into culture. My favorite popular cultural expression of this trend: Amy Heckerling’s film *Clueless*, where the heroine Cher begins the day by using a computer to preview and select the outfit she will wear to Beverly Hills High.

Software Theory as a Theory of a-Media; or, Surpassing McLuhan

[13] Although Manovich’s book takes “new media” as its object, there is much in his book to suggest that computable culture unsettles the media paradigm introduced by Marshall McLuhan in the early 1960s. In *The Gutenberg Galaxy: The Making of Typographic Man* (1962) and *Understanding Media: the Extensions of Man* (1964), McLuhan introduced a set of terms and concepts that defined media studies. Like any other paradigm shift, McLuhan’s work helped ground scholarly monographs in the humanities and social sciences (e.g. Elizabeth L. Eisenstein’s *The Printing Press as an Agent of Social Change*). But McLuhan’s ideas also become part of the common sense about media that circulates in daily conversation and the Sunday supplements. To understand how the computer running software challenges the grounding premises of media theory and media history, I will suggest, very briefly, what these grounding ideas are. McLuhan’s invention of modern media theory depended upon three related ideas. First, he focuses upon the centrality of the physical medium of communication, and insists upon the profound mutual imbrication of medium (the material substrate of the symbolic expression) and the “message” or meaning (ideas, ideology, plausible genres, etc.) Thus the slogan, “the medium *is* the message.” Second, by emphasizing the way the physical contours of a medium conditions production, use and experience of media, McLuhan shifts attention from meaning to practice, from what media do in the

mind to the way bodies can dispose themselves while communicating. Thus the transformation of the first slogan into its somatic extension in an artist's book he published with the artist Quentin Fiore in 1967 under the title, "the medium is the message." Thirdly, McLuhan's approach to media encourages a broadly comparative study of media: media as different as speech, manuscript, print, radio and television, as well as other "media" of communication such as the automobile, the air plane, the human body, etc., can be compared with each other as to their defining traits and across their long histories. Although McLuhan's approach has been exposed to withering critique--for its central premise that [the] media [environment] determines [human] culture, for its facile anecdotal "probes" of media history, and for its quasi-religious belief that electronic media can restore an earlier time of intuitive, embodied communication. McLuhan's writings offer a particularly ecstatic and credulous version of what Armand Mattelart calls "the ideology of communication" (xi). Nonetheless, any historian of media who accepts the centrality of the category "media" inherits and extends the three basic ideas I have listed above: the centrality of the media substrate, its implications for embodied practice, and the comparability of media. As we have seen, Manovich is a particularly effective practitioner of this sort of media history and analysis.

[14] The Language of New Media, by the way it applies this framework to "new media," also suggests the limits of the media paradigm. For Lev Manovich allows us to grasp this fundamental fact about new media: that while computable cultural forms can be understood, for the sake of historical comparison, and in our study of modern media culture, as successors to earlier media forms, *a computer running software produces digital code which simply is not a medium*. Manovich first broaches this complication in his story when he points to the limitations of the comparative historical approach he uses so well. Understanding new media as old media that is now digitized and thereby changed has fundamental limitations:

[This perspective] cannot address the fundamental quality of new media that has no historical precedent--programmability. Comparing new media to print, photography, or television will never tell us the whole story. For although from one point of view new media is indeed another type of media, from another it is simply a particular type of computer data, something stored in files and databases, retrieved and sorted, run through algorithms and written to the output device. That the data represent pixels and that this device happens to be an output screen is beside the point.... New media may look like media, but this is only the surface. (47-48)

The most casual acquaintance with the history of the computer suggests the relative autonomy of computable information from its media "surface." Over sixty years of development, computers have communicated information to their users first on paper tape, then computer cards, then paper from printer output, then video display screen, and most recently through a simulated voice. Media are not just used for input and output; the information within the computer is stored on computer cards, magnetic tape, floppy disks and hard drive media, and the silicon chip (as RAM, ROM, and bubble memory). Of course, this list of media is far from complete, and in any case, it is subject to ongoing technological extension.

[15] The mobility of information encoded in digital form makes the objects of media study waver. Thus, although some computer code can be expressed as an image that can be printed on glossy paper (and thus resemble a conventional photograph), and other computer code can be expressed as letters on a monitor screen, the physical surface (whether paper or screen) is not the salient aspect of computable information systems. In fact one of new media's crucial traits is the way it eludes bondage to any medium. How is one to conceptualize this different system so that we grasp how it extends the forms and practices of the long history of media, but also grasp the way it simply is not a medium, but (perhaps) a species of a-media*? Soon after the passage quoted above, Manovich seems to realize that his definition of new media challenges the media paradigm he still uses for his analytical framework. He invokes the "revolutionary works" of Harold Innis and Marshall McLuhan, and insists we must turn to computer

science to understand new media. Then, in a gesture of surpassing that echoes the manifestoes of modernism and post-structuralism, Manovich calls for a fundamentally different approach to computable media: “*From media studies, we move to something that can be called ‘software studies’--from media theory to software theory*” (48, emphasis Manovich). That Manovich does not heed his own call to go beyond media study and media theory, that he just begins to explain what “software theory” might look like, does not diminish the importance of his having demonstrated the logic of a movement beyond the media paradigm toward one based on the great underlying fact that software is what is really new about new (a-)media.

[16] A computer and its software are much more intimately and essentially co-implicated with one another than a book and its written content, a television and its program. In fact, a computer scientist would be correct to point out that the phrase I’ve been using--“a computer running software”--is tautological. From the first mathematical theorization of the computer as a “universal machine” by Alan Turing, and Turing’s subsequent realization of an early (base 10) computer, the “Bombe,” built to decipher the code produced by the German Enigma machine in WWII (see Simon Singh’s *Code Book* and Andrew Hodges’s *Alan Turing: the Enigma*), to John Von Neumann’s first designs for the computer after the war, computers receive their essential character from the software they do not just run but which they run on. When compared with the earlier analog computing devices used to point weapons and automate machinery during World War II, the flexibility and power of the computer running software comes from the way data and the program are loaded into memory at the same time (see Bolter, 47-49, and Turing, 436-42), meaning that the computer, unlike the machine, could be reconfigured by the changes introduced at the level of software. Although the phrase “the computer running software” is redundant, it offers a way to emphasize the way a relatively immaterial thing--software--invades and dematerializes its supposedly hard home, what is conventionally called “hardware” but what we sometimes mistakenly identified as “the computer.” This is a mistake, not just because hardware needs software the way, by analogy, we might say that the human body needs the communications media of neurons, enzymes and electric signals as a condition of life. From the beginning of computing, even the hardest components of design--the arrangement of circuits and vacuum tubes, the code embedded on read-only memory, and microprocessors made of silicon--were designed to embed “logic blocks” (like “and,” “or,” invert”) and algorithms first expressed as software (see Daniel Hillis, *The Pattern in the Stone*, 21-38). In other words, there is a very real sense in which the computer is software all the way down.^2^

[17] How can we begin to think the difference for media made by software? Manovich shows how software produces uncanny effects upon the cultural and aesthetic sphere it operates within, for example, by challenging the underlying assumptions of the realist project. The long Western commitment to mimesis as a pathway to truth (see Derrida, *Disseminations*) has gained expression in the development of visual technologies--from the linear perspective of painting to photography to film--that win visual fidelity for the image. It is hardly surprising that the computer running software has been used to develop new and more powerful forms of realism. For example, algorithms embedded in Adobe *Photoshop* allow a photographer to correct and enhance a photograph. However, it also simplifies the production of simulations of what was never photographed, undermining the indexical function of photography and cinema. Manovich’s vivid way of putting this idea: “Cinema is the art of the index; it is an attempt to make art out of the footprint” (295). Digital special effects technologies have enabled Hollywood films to bring a new level of realism to the visually believable representation of the impossible. For example, in *Terminator 2* an ordinary policeman seems to morph into a “metal man.” Manovich notes that digital special effects like “metal man” are made possible by the software algorithms that migrate from computer science journals to software programs. Because images within the computer interface can become bit-mapped control panels, the software at the heart of the digital image disturbs the classical image of the Western aesthetic tradition. There it was assumed that the viewer assumed a detached frontal position before the image so as to compare it with “memories of represented reality to judge its reality effect”

(183). The new media image summons a more active user: “The new media image is something the user actively *goes* into, zooming in or clicking on individual parts with the assumption that they contain hyperlinks (for instance, image-maps in Web sites). Moreover, *new media turn most images into image-interfaces and image-instruments* (183, emphasis Manovich).

[18] Images supported by software turn out to be fundamentally different than the traditional images they can simulate. In order to fake photorealism, computer software does not enrich but instead downgrades the synthetic image so that we experience it as like a photo: it is given the blur, graininess, and texture of the photographic image. We may think of these computer-generated images as inferior to the photographs, but Manovich notes, “in fact, they are *too perfect*. But beyond that we can also say that, paradoxically, they are also *too real*” (202, emphasis Manovich).

The synthetic image is free of the limitations of both human and camera vision. It can have unlimited resolution and an unlimited level of detail. It is free of the depth-of-field effect, this inevitable consequence of the lens, so everything is in focus. It is also free of grain--the layer of noise created by film stock and by human perception. Its colors are more saturated, and its sharp lines follow the economy of geometry. From the point of view of human vision, it is hyperreal. And yet, it is completely realistic. The synthetic is the result of a different, more perfect than human, vision. Whose vision is it? It is the vision of a computer, a cyborg, an automatic missile. ... *Synthetic computer-generated imagery is not an inferior representation of our reality, but a realistic representation of a different reality*. (202)

Manovich here gives a trenchant s/f turn to his argument. If we unmoor what is being done from its arbitrary referent (here photorealism as a functional stand-in for “reality”), we can see the uncanny difference of the new digital image: it can go beyond the constraints of social conventions, aesthetic traditions, and even the human perceptual apparatus. The computer running software can serve the old ideals of visual realism, but it can also overturn that logic of appropriation through visual approximation, and proceed to do very different things. Thus In *_Terminator 2_*, the fact that the metal man comes from the future offers a narrative rationale for his ability to fully benefit from the “reflection mapping algorithm” operating in the software. That algorithm creates the highly unrealistic special effect of a hyper-reflective body. In this way, the “metal man” of *_T2_* provides a visual analog of the uncanny perfection, the infinite plasticity, the soft hardness of the computer-generated image as it seems to leap out of the limitations of the film medium itself.

An Ethos for Software Studies?

[19] Software studies can teach us skepticism of what might be called the covert idealism of media theory’s materialism: the notion that if one knows the medium of an act of semiosis, then one grasps its essence or inner logic. There are obvious reasons to be distrustful of the reductive tendencies of this sort of materialism. Thus, if a molecular biologist tells us that all central constituents of life--DNA, RNA and proteins--are composed of “nothing” but carbon, oxygen, hydrogen and nitrogen, we have not learned very much about what life is. For example, the life functions of these molecules--most crucially the capacity to replicate--depend in part upon the way they are folded into 3-dimensional shapes. Similarly, when a cyber critic claims that what distinguishes the computer running software is its use of digital code (bits of 1’s and 0’s), or that all the algorithms that a computer can perform are combinations of three logical actions: “and”; “or”; and “not” (*_New York Times_*, 08/27/2001), we have not learned much about the underlying logic of computable culture. However, if software studies gets us to travel too far away from the materialism of media studies, toward a celebration of the “magic” (Bill Gates) and “power” of software code, one soon finds oneself implicated in problematic new fantasies of control, and an idealism based on the immateriality of software.

[20] A glance at the early history of computing suggests that a will to control through the powers of the mind may explain the tendency to go beyond material embodiment. Alan Turing and Norbert Wiener conceived the computer as a machine that could simulate and extend human intelligence, so it could, for example, decipher encrypted enemy messages, target weapons in real time, and perhaps someday rival human intelligence (for example, by beating human chess masters). This project--by emphasizing the distance between the human and the computer--helps to seed the s/f narratives about those robots, artificially intelligent computers, and cyborgs that exceed their assigned functions and return to haunt their human creators. This popular interpretation of the computer as a dangerous "other," with the diverse techno-gothic scenarios it invites, may have little of the predictive value science fiction craves. Nonetheless, these narratives carry intimations of the uncanny powers of the computer running software. However, by exaggerating the distance between a software technology and the historical and culture locus of its invention, it also breeds popular new forms of transcendence. For example, in Clarke/Kubrick's *2001, A Space Odyssey* transcendence takes the form of the final ride where the astronaut morphs into a "star child;" at the end of Gibson's *Neuromancer* the mysterious union of the information agents--Wintermute and Neuromancer--leads them to claim that they are now "the matrix" of "the whole show"(269).

[21] Katherine Hayles has developed an analysis that challenges this drift toward transcendence. In her overview of the historical emergence of the concept of information after World War II, she notes that molecular biology helped popularize the notion that what is crucial to the constitution of human bodies are the patterns of information embedded in genetic code. The hierarchies that quickly creep into these terms breed a new form of idealism. "In the contemporary view, the body is said to 'express' information encoded in the genes" (69-70). Hayles show how in this theory "pattern triumphs over the body's materiality--a triumph achieved first by distinguishing between pattern and materiality and then by privileging pattern over materiality" (72). By constructing "information as the site of mastery and control over the material world," this line of thinking suppresses the equally obvious insight that "the efficacy of information depends on a highly articulated material base" (72). In this way Hayles casts suspicion upon the idea that spirit (as code) is superior to matter, an idea she links to Western religious culture, and which returns with the ultimate computer fantasy--Han Moravec's scenario by which humans could achieve immortality by uploading the mind's information from the brain to a computer (Hayles, "The Condition of Virtuality," 72).

[22] How can we grasp the news powers of software without refusing a necessary embodiment and materiality? The temptations of disembodied transcendence, so prevalent in books on "cyberculture," makes this reader appreciate the way Manovich has found, in *The Language of New Media*, to balance the momentum and staying power of traditionally embodied media forms (like the book, cinema, the screen) with a sustained analysis of what enables the production, networked distribution, and use of "new" media: the computer running software.

Notes

¹ The most casual reader of this book will be able to note "where Manovich comes from"--film studies and the history of cinema. But his giving cinema pride of place among 20th-century cultural production is less an unconscious bias than a conscious strategy. It helps this book on a vast topic (new media) to have the discursive coherence necessary to reconceptualize that new media is. Through an irony that obviously pleases Manovich, he is able to show how many of the traits ascribed to new computer-based media can be read off the practice of the Russian 1920s avant-garde filmmaker, Dziga Vertov.

² Andrew Grove, former CEO of Intel, has conceded the impossibility of making a fundamental categorical distinction between the code embedded in Intel chip designs and the software provided by

Microsoft. This became a problem when Intel wanted to embed functions in their chips to prepare them for the use of Java, the open source programming language developed by Microsoft's rival, Sun Microsystems. Manovich notes the tendency, over the development of a computer system, to integrate functions first introduced as software into hardware defaults.

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