



Trusting Aesthetics to Prosthetics

Author(s): Jon Ippolito

Reviewed work(s):

Source: *Art Journal*, Vol. 56, No. 3, Digital Reflections: The Dialogue of Art and Technology (Autumn, 1997), pp. 68-74

Published by: [College Art Association](#)

Stable URL: <http://www.jstor.org/stable/777839>

Accessed: 10/09/2012 13:42

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



College Art Association is collaborating with JSTOR to digitize, preserve and extend access to *Art Journal*.

<http://www.jstor.org>

Trusting Aesthetics to Prosthetics

Jon Ippolito

De gustibus non est disputandum.
(There is no accounting for tastes.)

Criticism as Container: A Leaky Proposition

68

Chris takes the cup of coffee from Sandy as the ArtSite homepage downloads on her computer screen. A banner at the top of the page reads, "ArtSite: The Best of the Web." Arrayed underneath are buttons labeled Artist Projects, Exhibition Reviews, Critics' Forum, and Art Buzz "I think this is one of the best-curated sites on the Web," Chris says between sips of coffee. "They weed through the garbage and pick out the good stuff—so you don't have to." Sandy nods her head. "Sounds like one-stop shopping for art criticism," she says.

This scenario describes the typical World Wide Web site devoted to art criticism today. Modeled on the table of contents of a magazine or the brochure for a curated exhibition, such a site contains an exclusive selection of artworks that one or more experts have deemed to be instructive to the general public. This approach is familiar. It's convenient. And it's completely at odds with the social and technological underpinnings of the Internet.

To come to terms with a digital culture, an interface to art on the Web cannot merely ape museum brochures and magazines, which rely for their power on self-containment, exclusivity, and instruction by experts. Engaging the Internet on its own terms will require an approach that is radically distributed—one that may threaten to spill beyond the appointed containers of traditional criticism. Crude versions of this distributed criticism are already starting to crop up on the Web, and the future they foretell presents a serious challenge to conventional aesthetic theory.

To begin with, the Web is not about containment. It is easier and faster to jump from a server in Paris to one in Tokyo than it is to download a digitized Poussin at one's present location. For this reason, a typical user is unlikely to spend an afternoon on-line browsing links confined to the Louvre's website, an experience better suited to CD-ROM.

Instead, that user will follow a link from the Louvre's lists of other art sites to the Dia Foundation, from Dia to Ping Chong's Web page, from there to La Mama and the Robots Bar and Lounge, then on to the NYC Marathon homepage. The quintessential Web surf does not confine itself to institutional boundaries; it punctures them. This fact robs conventional aesthetic criticism, when applied to the Web, of one of its most valuable tools: artistic intent. Roland Barthes's "death of the author" notwithstanding, most of the vocabulary of critical analysis—plot, closure, tone, point of view, composition—presumes that some author has intentionally crafted the aesthetic experience in question. Even if a novelist's intent is unknown to the reader—which is true in most cases, actually—the reader will try to imagine it in order to understand the work: "Well, I guess Dickens let Little Joe die to underscore the tragic living conditions of the underclass." So what does a critic do when the order of pages is determined not by an author's careful structuring, but by a reader's arbitrary meanderings? On the Web, the user wanders freely out of one artist's intent and into another's.¹ Hence any criticism consistent with a user's experience of the Web must abandon the goal of corraling all the good work into one patch of cyberspace.

From Instruction to Extraction

As the focus of each web surf centers more on the user's intent than on a single author's, so each user is responsible for following the links she or he thinks are most worthwhile. Likewise, most electronic bulletin boards will publish anyone who is diligent enough to post to them. Although there is a high price of admission—buying a computer and modem, investing the hours necessary to learn to ftp files or write html code—by and large the Internet is a nonexclusive arena for discourse, in which everyone who can pay the price of admission can have a voice.

Another arena for discourse—albeit one with a higher price of admission—is the university. The academic equivalent of the website delivering "expert" advice is the tweed-jacketed professor dispensing knowledge to the students:

The professor chalks two words on the blackboard. "Mimesis and rhythm," he says, turning to face the class, "according to Aristotle, are the two properties to which all arts aspire." Definitely a fill-in-the-blank question for the exam, Sandy thinks, as she jots the two words into her notebook.

Fortunately there are other models of teaching besides instruction, the one-way flow of information from professor to student. Instruction is only useful where information is scarce. This is certainly not the case for today's digitally literate aesthetes, who will be rewarded with a daunting 6,000 sites if they perform a Lycos search on the keyword *aesthetics*. What Internauts need now are not instructors, but listeners who will work with them individually to help them choose what to pay attention to, based on correlations among information with different origins. And there's nothing to say those listeners have to be human;² some claim that intelligent software agents will be better suited to the herculean task of sorting the ten useful sites from the 5,990 that are a waste of time. Whether embodied in flesh or silicon, it is intelligence—and not information—that will enable students of on-line art to extract what they need from the flood of words and images streaming into their modems.

To be sure, the software agents currently on the market are no match for the Leo Steinbergs and Rosalind Krausses of academe. Topic Agents (<http://www.verity.com>) and similar engines can do boolean searches across web pages—with criteria like *find all occurrences of the string 'abstract expressionism' with a date before '1955'*—while Smart Bookmarks (<http://firstfloor.com>) can lie in wait and report significant changes to favorite websites. Other companies such as PointCast (<http://www.pointcast.com>) and WebCompass (<http://www.quarterdeck.com>) have developed prototypes for an electronic newspaper, the so-called Daily Me, that features only news and articles tailored to each individual interest—whether Middle East peace negotiations, stock market quotes, or Miami Dolphins scores. Again, however, the features are selected by category or keyword, which requires users to know what they're looking for in advance. This is hardly the sort of apparatus one would expect to lead a revolution in aesthetic theory; more likely, it will simply wear down the grooves of existing aesthetic categories rather than venture onto untested artistic territory. And these agents aren't as nimble at applying more abstract or philosophical criteria; try telling one to find an on-line artwork that exemplifies "mimesis" or "rhythm."

The agents that will revolutionize the way artworks are reviewed and evaluated will be not glorified search engines such as these, but a new generation of agents with distributed intelligence, designed to learn from their users' preferences and extrapolate them.

Mechanized Subjectivity: The Prosthetic Ego

Chris's computer screen fills with a list of websites, which she visits one by one. "Are they supposed to be in some kind of order?" asks Sandy. "No," replies Chris. "At first the agent just spits out sites randomly to get a handle on your preferences. Most of the suggestions it gave me the first few sessions were totally useless—I rated them all 0 or 1 except for a few vaguely interesting sites. Now that I've been apprenticing the agent for several months, I regularly dole out an 8 or 9 with every batch." The first site, Jenny Holzer's Please Change Beliefs, downloads on the screen. "No surprises there—anything she does is an 8 on my scale." The next two, some rather dry articles on Victorian photography, she begrudges a measly 4. "Thought you liked photography," says Sandy. "Yeah, but something bothers me about those sites, I'm not sure what—I'm just not interested in that today." "What's this?" blurts Sandy, as a Hustler pictorial fills the screen. "Must be its stochastic function," mumbles Chris, as she types a 0 in the pop-up window next to the site. As the next site downloads, geometric forms swirl across the screen. "Not another fractal screensaver," murmurs Sandy. "Yeah, but I kind of like this one," says Chris. "The funny thing is that even after three months of training this agent, the sites it gives me still don't seem to have anything in common—except that I'm finding its suggestions more and more interesting."

The notion of a prosthetic ego, an agent that learns a user's tastes and amplifies them, is not pure fantasy. There are at least three models for this kind of agent accessible right now on the Web, though each relies on a somewhat different mechanism to determine its recommendations.³ One model is collaborative filtering. Firefly (<http://www.fireflycorner.com>), currently the most popular example of this technique, solicits the preferences of thousands of users to create a database of likes and dislikes. In its resource for music lovers, for example, Firefly offers the visitor to its website a list of ten pop musicians ranging from Madonna to Tracy Chapman and invites the user to rate them, from "the best" to "it's alright" to "hate it!" (*fig. 1*). When done, the user clicks a button marked *more* and Firefly presents ten more albums, this time a little closer to the user's tastes. The user rates them again and clicks *more* to see more albums. In theory, by the time the user has repeated this process six or seven times, Firefly should consistently be listing albums the user prefers (and perhaps some the user hasn't heard of but would like anyway). Now, Firefly is no supercomputer programmed with aesthetic principles; it's only a database of people's likes and dislikes. Firefly doesn't know why people who like Tracy Chapman tend to prefer James Taylor over AC/DC. It just knows that they do. Firefly's database correlates a user's responses with other people's, and the more people who use it, the better it gets.⁴ This communal database is a kind of aesthetics with-

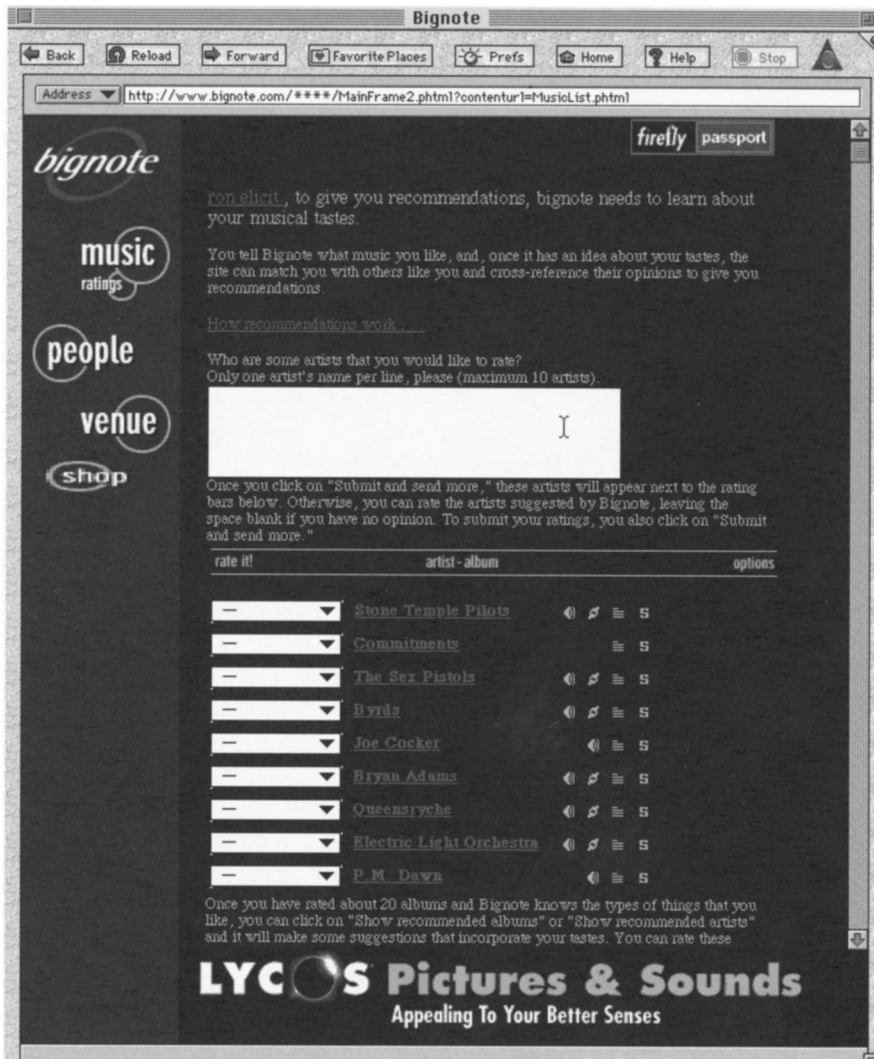


FIG. 1 Detail of the music rating page from Pattie Maes's Firefly website (<http://www.firefly.com/>). Copyright Firefly Network, Inc.

out exclusion. No one's in charge, and theoretically, no one's taste is more important than anyone else's.

Besides its original incarnation as a music resource, Firefly has just within the past few months begun a collaboration with the search service Yahoo that applies collaborative filtering to help identify interesting web pages. Users can jump-start the process by submitting their bookmark files to Firefly for recording; Firefly will then prompt the user with addresses for new websites that correlate with those the user has already bookmarked. (To access this service, the user must first establish a MyYahoo site at [<http://edit.my.yahoo.com/config/login>], then click on the *my agent* button.)

There is a visual analogue to Firefly's registration of users' tastes called interactive genetic art—for example, the International Gallery of Genetic Art on the Web (<http://robocop.modmath.cs.cmu.edu:8001>)⁵—but it operates on a very different principle from Firefly's. Again the first screen gives the user the opportunity to rate eight examples of something. In this case, they're nine examples

of bad computer art: squiggly lines, circular patterns, garish fractals. Again the user clicks *more* and sees new images that get more and more interesting. But in this case it's not other viewers' responses that are determining what the new ensemble of images will look like, but the splicing of the program code—the "breeding"—of the computer algorithms that created the original nine images (*fig. 2a, b*). Furthermore, the algorithms whose images the viewer rates highest get the most computer code passed on to the next generation of images, while the algorithms with the poorest ratings don't get any of their DNA passed down to the collective progeny. So if the user likes one algorithm that makes circles and another that makes squiggly lines, the next generation might have squiggly circles. (Fortunately, like human sex, the results are usually harder to predict than this simplistic example.)

Even more than Firefly and interactive genetic art, the Tierra project (<http://vml.arc.org/tierra/index.html>) represents an experiment in decentralized aesthetics. When users select circles and squiggly lines in interactive

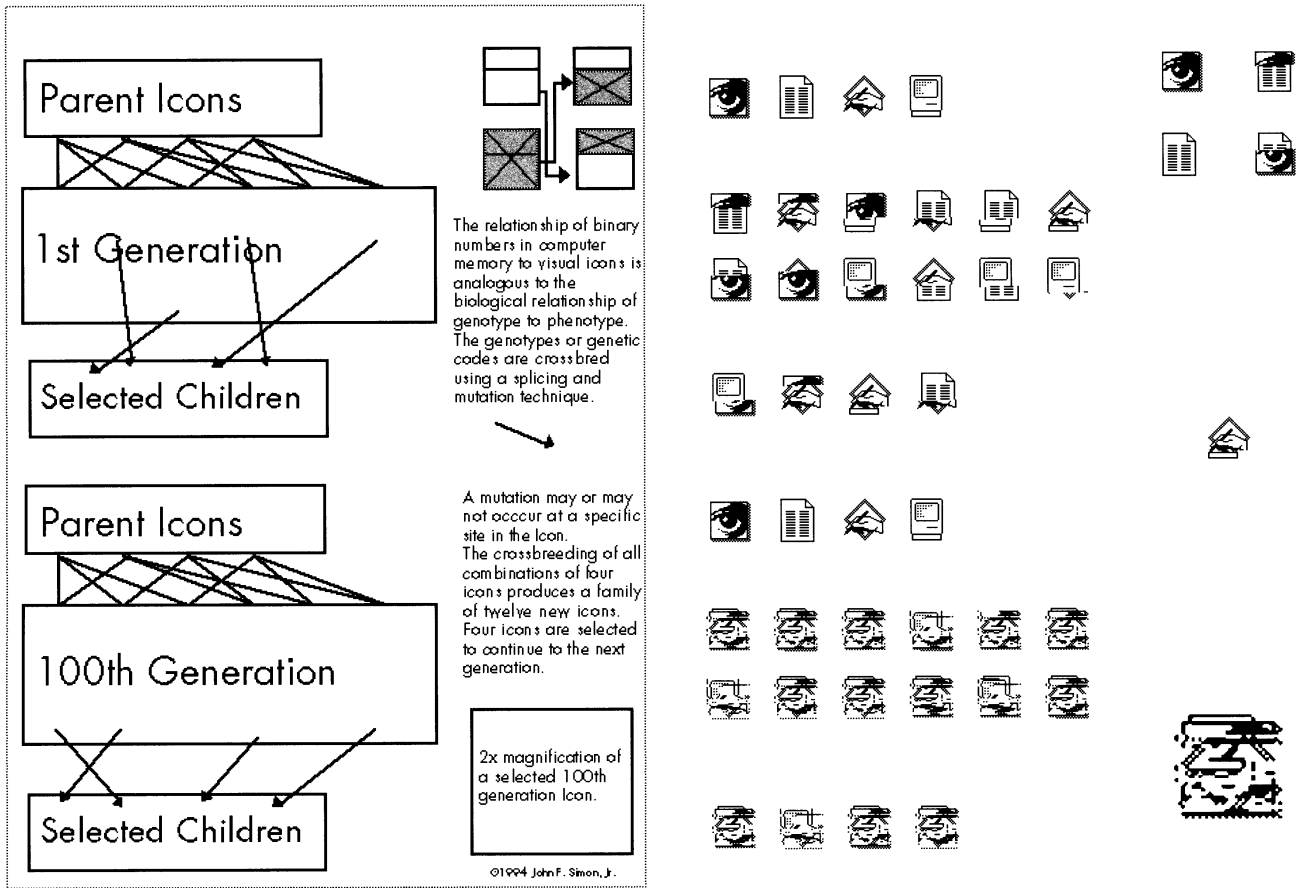


FIG. 2a, b Diagram illustrating how genetic algorithms can be interbred to produce new images. At left: the selective culling of the offspring of an initial set of “parent” icons. At right: sample icons produced by such a procedure. Copyright 1994 John F. Simon, Jr.; images courtesy the artist.

genetic art, they are deciding which characteristics are to be passed on to future generations. Tierra is so decentralized, however, that there is almost no human intent wielded whatsoever. The idea behind this project, by Tom Ray of the University of Delaware and the Advanced Telecommunications Research laboratory in Tokyo, is to create algorithms whose survival is determined by natural selection rather than human selection. To activate this “wildlife sanctuary” for computer programs, Ray copies a few short strings of machine code onto his computer. Every so many minutes, the computer’s operating system executes all of these algorithms, which are designed to reproduce the way computer viruses do: by making copies of themselves on the hard drive. Of course, if left unattended, pretty soon these prolific little creatures would take up all the room on Ray’s PC, so Ray built in two checks on their proliferation. First, every few cycles the operating system inserts some random mutation into the program code of one of the algorithms. Usually this “bug” prevents the algorithm from reproducing, but occasionally it enables the algorithm to

reproduce *faster*, thus outstripping the older, unmutated algorithms. Second, the operating system punishes an algorithm that performs too poorly. Every time the misfit algorithm generates an error condition—say, by using an unrecognized command like “cpoy” instead of “copy”—it gets a demerit. Too many demerits and the operating system erases it from the hard drive: it becomes extinct. What makes Tierra a radical approach to the construction of knowledge is that once Ray has configured his computer to handle mutations and demerits, all he has to do is let some primitive algorithms loose on his PC and watch them evolve. There’s nothing guiding their evolution except for their competition for territory (disk space) and food (CPU time). Yet self-guided evolution has given rise to artificial forms of protolife that Ray could not have imagined. Tierra’s indigenous population now includes parasitic strings that rely for their reproduction on being embedded in longer host strings (*fig. 3*); symbiotic organisms that reproduce each other in alternating generations; and nocturnal creatures that migrate to the dark side of the earth to seek

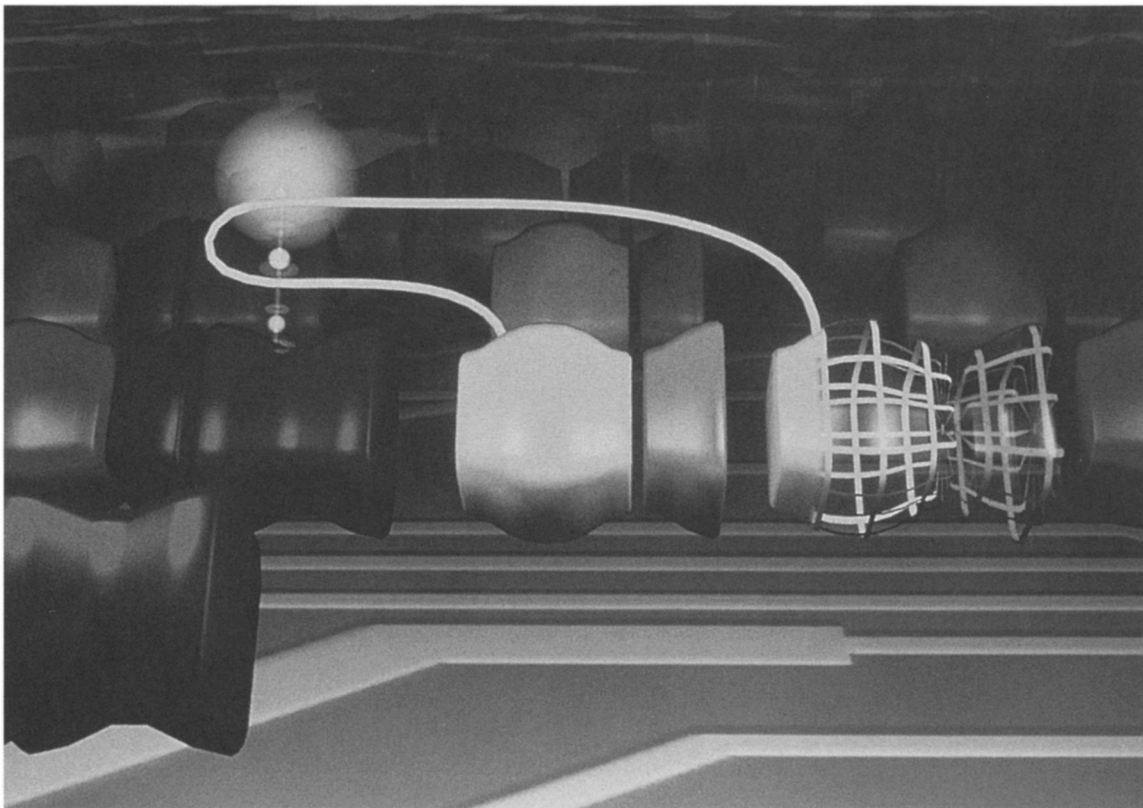


FIG. 3 Image from *Tierra: Evolution in Another Universe*, video by the Anti-Gravity Workshop, courtesy of Tom Ray (<http://www.hip.atr.co.jp/~ray/pubs/images/images.html>). In this conceptual rendering, a Parasite (two-piece object) executes the code of a neighboring host organism to replicate itself, producing daughter parasite (two-piece wire frame object).

out inactive hard drives on a computer network. In some sense, *Tierra* is a device for generating possibilities—with a minimal intervention of human will.

Despite the variety of approaches represented by *Firefly*, interactive genetic art, and *Tierra*, at the heart of each of them is a distributed approach to knowledge.⁶ This distributed approach could make possible the mechanism of subjectivity, in the form of the agent described in the scenario at the beginning of this section. This agent would encode an individual's aesthetic sensibility in software, acting as a prosthetic ego that could faithfully reproduce—and even predict—that person's artistic tastes. Such a prosthetic ego would not be beholden to the self-containment, exclusivity, and reliance on instruction that makes more traditional models of criticism ill-suited to the Internet, yet because it disavows those principles it would pose a challenge to the notion of an aesthetic theory—or any theory for that matter. By their nature, theories chunk phenomena into generalities that can be applied to future cases of similar phenomena. Some of these aim to be universal (as in Aristotle's claim that all art functions by mimesis or rhythm); others aim to be contextual (as in Nelson Goodman's claim that art tends to display symptoms like syntactic repleteness and metaphoric exemplification). In no sense, however, can the aesthetic criteria of the prosthetic ego be boiled down to a set of axioms or symptoms;

the criteria are spread out across the entire computational system and can only be invoked by applying the entire system to a given circumstance. (In the case of *Tierra*, the criteria aren't even affected by a user's input, but are an emergent property of the competition among organisms).⁷

Because they are based on generalized criteria, aesthetic theories often inspire their adherents to establish a canon of artworks that fits those criteria, which are presumed to apply to any artwork viewed by any audience at any time. This one-canon-fits-all approach is diametrically opposed to the prosthetic ego, which does not assume that every person desires or needs the same kind of art experience. A given user may choose to exclude figurative painting from her purview by rating that work consistently low scores, but that doesn't mean that Francis Bacon and Philip Pearlstein might not simultaneously be at the top of another user's pantheon. Unlike most aesthetic theories, prosthetic aesthetics can easily accommodate—indeed, help to cultivate—the development of many mutually contradictory aesthetics within the same enveloping culture.

Because prosthetic egos would be customized for individual users, the distributed aesthetics they embody could not be taught, only apprenticed. Professors at Columbia are free to expound on their aesthetic criteria to lecture halls full of impressionable students; writers for *Artforum* are free to pass judgments that thousands of people will

read when the magazine hits their doorstep; but because it learns by example rather than by instruction, each prosthetic ego must be trained by an individual user. For those used to expressing aesthetic judgments in words, it may seem odd that the aesthetic criteria learned by prosthetic egos cannot simply be distilled into a Cliff Notes version and passed on. After all, one of the main reasons to store information in electronic circuits is so it can be instantly liquefied: downloaded from a website, squeezed through a modem line, or massaged into a table or histogram or pie chart. What a prosthetic ego acquires, however, is not information but intelligence. There is no single sector on a hard drive, no single subroutine of program code, no particular string of 1s and 0s that corresponds to a specific bit of aesthetic sensibility that a prosthetic ego has learned. That sensibility is embodied in the overall state of the agent. So how does one go about teaching aesthetics if the content one is teaching is nowhere in particular?

Unfortunately, if a prosthetic intuition can't be put into words, it's rather difficult to talk about it—which points to an important limitation of mechanized subjectivity that would probably prevent it from ever completely supplanting conventional criticism, even for on-line artworks. Fundamental to the aesthetic experience is not just the refinement of one's own sensibility, but the sharing of that sensibility with others.

“So you're really into jazz,” says Sandy, as Chris tunes the radio to Miles Davis's Flamenco Sketches. “Yeah—I didn't used to like it, but a friend lent me some tapes, and after you listen to it for a while it kind of grows on you. When different performers play the same tune, it sounds totally different—even when the same performer plays at different times.” “I don't know,” says Sandy, “jazz musicians always sound to me like they're just fooling around, like they don't know where they're going.” “They don't,” replies Chris, “that's the excitement of it. Jazz greats like Miles Davis take risks, which is what art is all about.”

This kind of dialogue about art, whether it occurs at a CAA panel or in a car on the way to work, is essential to the propagation and maintenance of culture as we know it. Without such a social dimension, the prosthetic ego could merely refine individual users' areas of interest without exposing them to unfamiliar styles or methods. It is interesting to note in this regard that much of the rhetoric, and presumably the impetus, for collaborative filtering comes from marketing; Digital's each-to-each technology (<http://www.each.com>), one of Firefly's competitors, offers a toy recommendation site—doubtless to hone Junior's shopping acumen. Is this the fatal flaw in the mechanism of subjectivity, that it would discourage aesthetic dialogue and encourage the fragmentation of culture into myriad market niches of nonoverlapping taste?⁸

From Apprenticeship to Breeding

There are a number of potential solutions to this predicament, as exemplified by the three models of distributed aesthetics discussed above. The creators of Firefly solved the problem by encouraging conversation among its constituents. Registered Firefly users have the option of making their own homepages, on which they can list their favorite bands, making it easy for others of like mind to e-mail them or meet them on-line in chat rooms to pursue a dialogue in real time. Prosthetic egos might be passed back and forth in an analogous dialogue: once users have apprenticed their agents well enough, they could simply exchange agents—essentially trying on someone else's taste for a day. Ultimately, however, this isn't much different from simply trading favorite CDs. Like the dialogue among Firefly's users, the exchange of prosthetic egos would rarely put users in touch with art radically different from their own tastes, since they would naturally gravitate to users who like the same artists they do. The advantage of collaborative filtering is in some ways its downfall: if all the relationships in the community are based on shared taste, what incentive is there to strike up a relationship with someone who thinks differently?

The example of interactive genetic art, on the other hand, suggests a more radical approach to the exchange of aesthetic tastes. Each user's prosthetic ego is ultimately a computer program, a set of adaptive instructions that executes every time the user invokes that agent. In that sense, these agents are directly analogous to the graphic algorithms of genetic art and could therefore theoretically be bred in an analogous way by splicing their program codes. The result, a cross-product of two totally subjective faculties, would have no parallel in our culture today. Through the mechanized splicing of program code, the imagination of one human being could be mated inseparably to that of another. Nor need this breeding of subjectivities be restricted to only two parents, since it is not much harder to splice three or ten program codes than to splice two. They can even be interbred in different proportions: (2)G + (1)N + (-1)K could represent the offspring of two parts prosthetic Greenberg, one part prosthetic Nochlin, and one part prosthetic antiKramer (i.e., an agent whose ratings are the mathematical opposites of Hilton Kramer's).

The above scenario still leaves human beings in charge of the breeding of subjectivities; it would be up to the breeder whether to cultivate ever more refined or ever more eclectic tastes. People might try to control such interbreeding with the electronic equivalent of kinship taboos. Or perhaps eugenic laboratories would crop up across the country, cultivating hothouse aesthetics with the goal of gaining the most market share with a superior breed of art critic. The Tierra project, however, points the way toward a final stage in mechanizing the subjective: letting prosthetic egos evolve on their

own in a wildlife sanctuary for feral subjectivities. What would it mean to have an experimental laboratory for aesthetics, proliferating outside the influence of academics, critics, and historians, a population of artificial critics on the loose?⁹

The prospect of detaching from the conscious mind an aspect of culture so profoundly human may threaten our sense of control, but it is important to remember that there are already countless selections made for us every day at an unconscious level—within our own biological envelope. It was once thought that the human immune system worked in a way analogous to the way that aesthetics does today: a white blood cell that encountered an “interesting” foreign body in the bloodstream “learned” its chemical signature and then somehow instructed the other lymphocytes in the body to latch onto other bodies with that signature. In accordance with this paradigm, critics act like the lymphocytes of the social body: after first “discovering” an artist, they teach others that this artist is worth attention. (Of course, the artistic newcomer is “tagged” for success, while the bodily newcomer is tagged for destruction by a killer t-cell.) But lymphocytes don’t attend classes, and the bloodstream is no university; so biologists realized there had to be a less hierarchical, more adaptive mechanism at work. Research by Gerald Edelman, based on a theory first proposed by Sir Frank MacFarlane Burnet in the 1950s,¹⁰ revealed that the human immune system is based not on instruction but on selection. Every lymphocyte in the body’s population is outfitted with a receptor that recognizes a different unfamiliar protein.¹¹ When a lymphocyte with the right receptor happens to come in contact with a piece of an alien microbe, the successful fit triggers the lymphocyte’s genetic machinery to go on a reproductive spree, dividing into hundreds of thousands of clones of itself. These clones then spread throughout the bloodstream, latching onto other copies of the microbe and marking them for destruction.

One of the interesting consequences of this mechanism is that the immune system has a somatic memory quite independent of the brain’s. If a given body has been attacked by the measles bacillum in the past, there will be a disproportionately large population of measles-sensitive lymphocytes in the bloodstream, left over from the proliferation of these lymphocytes when the body first encountered the disease. This makes the body better prepared to deal with the disease in the future; the same somatic memory explains the success of vaccines. Perhaps by creating a population of independently evolving prosthetic egos, we can inoculate culture in advance to prepare it for future aesthetic developments. Whether or not this happens, there can be little doubt that as on-line art proliferates, we will need as much help as we can get in coming to terms with it all—whether that help is from human aesthetes or their mechanized equivalents. —

Notes

The Web addresses published in this essay were current at the time of writing but are subject to change.

1. If there is a conventional critical theory that applies to meandering through electric neighborhoods, it is probably sociology rather than aesthetics. The e-mail “chain letter,” for example, is a beautiful exposé of the intersection of professional and casual networks of power.

2. Warren Sack explored the undervalued role of the computer as “privileged questioner” in “Online Language Games,” a paper given at the College Art Association panel “Cyberspace: Trojan Horse or Roman Holiday: A Discussion of Our Electronic Future” on February 12, 1997. More information on this conference is available at (<http://idea.ucdavis.edu/caa/intro.html>).

3. Although it is not currently employed on the Web, the most effective technology for implementing prosthetic intuitions may be neural networks, interconnected weighted logic cells that can be trained to recognize simple patterns and navigate mazes. Some similar technologies currently in development are the Footprints program of Pattie Maes and Alan Wexelblat and the Darwin data mining program of Thinking Machines Corporation.

4. Technically speaking, Firefly constructs a vector from the weights each user assigns to different albums and runs a statistical comparison of this vector with those of other users.

5. Karl Sims is perhaps the best-known practitioner of interactive genetic art, but to date only descriptions of his work are directly available on the Web.

6. In fact, a system that unites all three approaches is already being explored by Pattie Maes and Alexandros Moukas, though not much information was available on it at the time of this writing. The project they have proposed, Amalthea, would be an artificial ecosystem of competing agents that discover and filter information. More information can be found at (<http://www.media.mit.edu/~moux/research.html>).

7. The contrast between the axiomatic model of conventional theory and the emergent criteria of the prosthetic agent has a mathematical analogy in the contrast between integrable and iterative equations. Integrable equations, for centuries the favored tool of mathematicians for modeling nature, are those whose solutions can be deduced by mathematical manipulation (they can be “integrated”). The solution to an integrable equation can be written down in a compact formula useful for calculating the state of the system at any future time. Over the last thirty years, however, physicists have realized that most situations from real life cannot be directly integrated; the only way to find the future state of such systems is to calculate the time evolution of the system for one moment, then calculate it for the next, and so on. While mathematicians are adept at finding closed solutions to integrable equations with pencil and paper, the tedious step-by-step analysis required for iterative equations is best accomplished by a computer.

8. Jaron Lanier has criticized conventional agents on different grounds: he claims they dumb down human judgment. While it is true that some researchers in the field have made extravagant claims for the way agents will personalize users’ experience of the Internet, Lanier ignores the potential usefulness of agents in other capacities. (Would he accuse a screwdriver of dumbing down construction workers?) Consistent with his disdain for artificial intelligence in general, he denies the possibility that any intelligent agent of the future could possibly approach the subtlety characteristic of human thought. If by subtlety one means unpredictability, then Lanier’s criticism does not apply to distributed intelligence, whose output for a given input cannot merely be reduced to a set of predetermined criteria. Lanier is closer to the mark in his claim that intelligent agents may be susceptible to bribing or hacking by advertisers. The example of TV is not terribly promising: consider how much of an average nightly newscast is outright, or indirect, advertising.

9. The advent of artificial life has brought new meaning to Marshall McLuhan’s dictum that humans are the reproductive organs of machines.

10. Gerald M. Edelman, *Bright Air, Brilliant Fire: On the Matter of the Mind* (New York: Basic Books, 1992), 74–78.

11. This is made possible by the fact that the lymphocyte genes responsible for the shape of that receptor are especially prone to jumbling during their formation. See *ibid.*, 77. Why then, don’t some of these randomly produced lymphocytes latch onto the body’s own proteins and mark them for destruction? Because these lymphocytes are programmed to self-destruct if they attach to molecules present in the thymus gland, where proto-lymphocytes develop. See Richard C. Duke, David M. Ojcius, and John Ding-E Young, “Cell Suicide in Health and Disease,” *Scientific American*, December 1996, 82.

JON IPPOLITO is an artist whose work is now on view at Sandra Gering Gallery Online (<http://www.interport.net/~gering>). As exhibition coordinator at the Guggenheim Museum, he has curated and coordinated shows of new media since 1993.