ONETREES

THE FAQS

A BIOINFORMATIC INSTRUMENT BY NATALIE JEREMIJENKO

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INSTRUMENT BY
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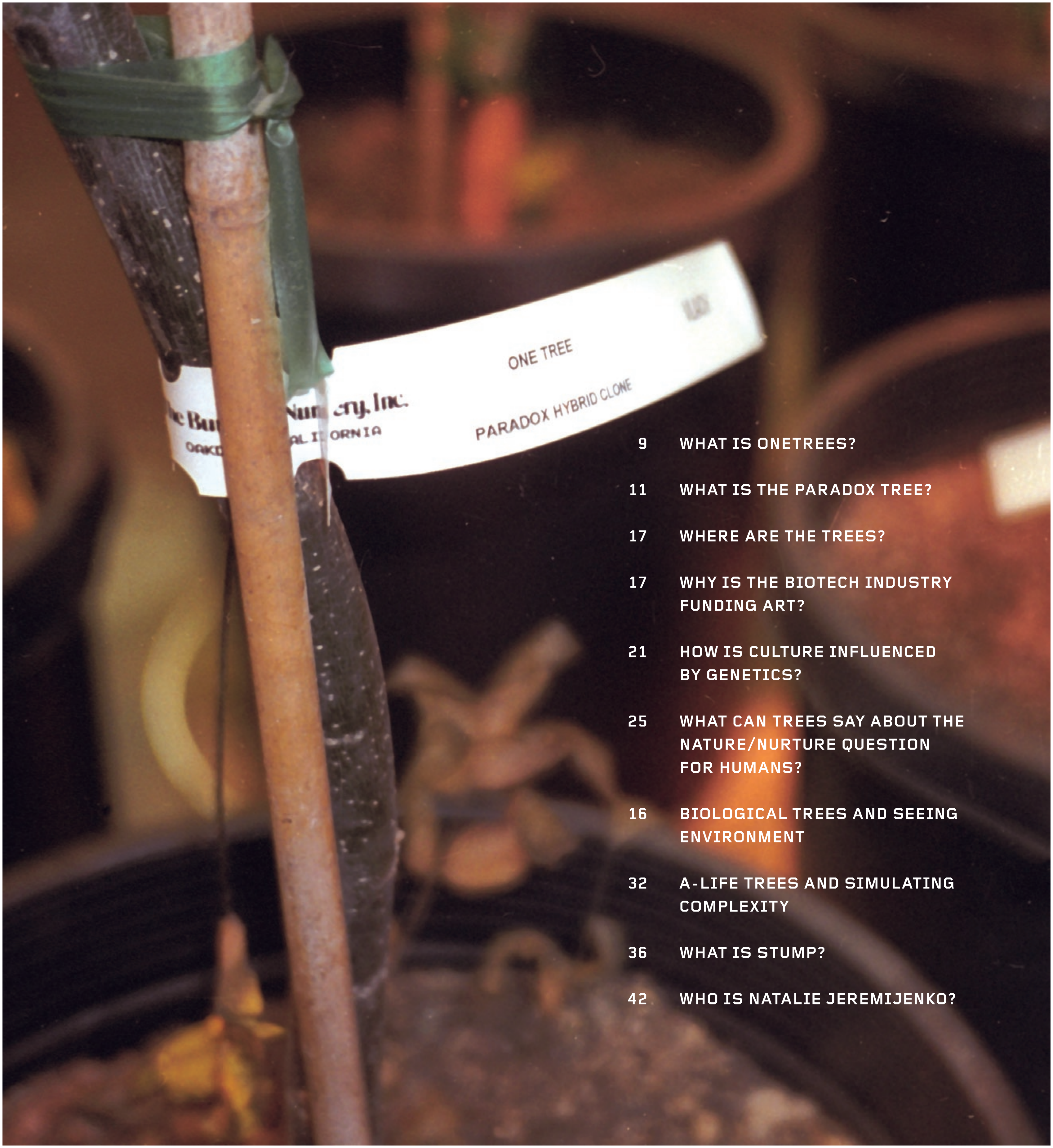

ONE TREE
PARADOX HYBRID CLONE

WHAT IS ONETREES?

Cloning has made it possible to Xerox copy organic life and confound the traditional understanding of individualism and authenticity. In the public sphere, genetics is often reduced to 'finding the gene for ... (fill in the blank),' misrepresenting the complex interactions with environmental influences. The debate that contrasts genetic determinism and environmental influence has consequences for understanding our own agency in the world, be it predetermined by genetic inevitability or constructed by our actions and environment. The *OneTrees* project is a forum for public involvement in this debate, a shared experience with actual material consequences.

OneTrees is actually one thousand trees, clones, micro-propagated in culture. The clones, were exhibited together as plantlets at Yerba Buena Center for the Arts, San Francisco, Exit Art in New York and the Exploratorium. This was the only time they were seen together. In the spring of 2003 the clones will be planted in public sites throughout the San Francisco Bay Area including: Golden Gate Park; 220 fronting property owners; SF School District Schools; BART stations; Yerba Beuna Performing Arts Center; Union Square and other sites. POND and Friends of the Urban Forest have provided assistance with coordinating the planting. Because the trees are genetically identical, in the subsequent years they will render the social and environmental differences to which they are exposed. The tree(s) slow and consistent growth will record the experiences and contingencies that each public site provides. They will become a networked instrument that maps the micro-climates of the Bay Area, not connected via the Internet, but through their biological material. However, there are also electronic components of the project which include Artificial Life (A-Life) trees that simulate the growth of the biological trees on your computer desktop. The growth rate of these simulated trees is controlled by a Carbon Dioxide meter(CO_2). The project juxtaposes the simulated A-Life trees and their biological counterparts, so doing demonstrate that simulations don't represent as much as what they do.

Each of the trees can be compared by viewers in the public places they are planted, to become a long, quiet and persisting spectacle of the Bay Area's diverse environment and a demonstration of a very different information environment. ↖

WHAT IS THE PARADOX TREE?

“Paradox” is the actual name of this tree variety. So named by Luther Burbank at the turn of the century for its paradoxical vigor. The Paradox is an F1 (1st Generation) hybrid of the native walnut tree commonly called the Northern California black, or Juglans hindsii, crossed with the English Walnut (aka the Persion walnut), or the Juglans regia.

The black walnut flower is fertilized with the English Walnut and will occasionally throw a paradox. The Paradox is much more vigrous than either of its parents, growing much larger and faster. However it does not produce fruit, and therefore has no significant amounts of pollen. This makes it a practical urban tree. Fruit and nut dropping trees are considered ‘tripping hazards’ and an insurance liability in urban environments; and walnut pollen can be an allergen.

The Vlach Clone

The Paradox Vlach clone is derived from the Paradox tree growing on the corner of Dakota and North Ave., in Modesto CA. It was planted in 1904 by Jake Cover. The seedling grew from a planted black walnut seed collected from an unknown black walnut tree. The tree has a circumfernace of about 30 feet, measured 4.5 feet from the ground. The person who lives in the house is Mr. Vlach, hence the name of this clone. This tree is the original source for the tissue that was used to generate the OneTree clones.

This clone is being commercially produced but the Burchell Nursery who are generously supporting this project. The clone is also being studied in the Walnut Improvement Program at UC Davis as a genetic standard used to compare the natural disease resistance of genetically diverse Paradox seedlings. ‘Vlach’ has shown good vigor in the nursery and is being tested in orchard trials. The commercial application is to use the Vlach as root stock on which to graft the commercial walnut producing trees.

Tree Cloning Process

Micropropogation techniques reduce the somatic variation results if one uses mature tissue (e.g. when you clone a tree by taking a cutting). The micro-propogation techniques while promoting ‘sameness’ and ‘standardizing’, also allows for extraordinarily large numbers of plantlets to be propagated starting from a small clump of adventitious tissue (i.e. juvenile undifferentiated tissue). The process involves aseptic conditions, plant hormones and pro-prietary techniques. These clones are indepted to the pioneers of these micropropogation techniques for the Paradox and other Walnut cultivars, Jim McKenna and Peter Viss. This work was also generously supported by Burchell Nursery and California Carnations.

Garage Biotech

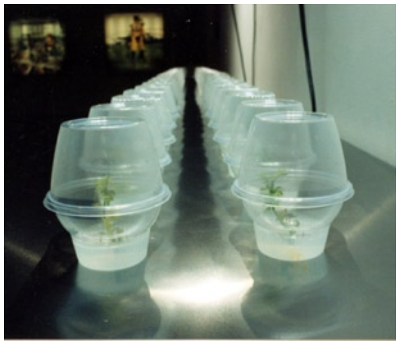
For do-it-yourself Garage Biotech tips, visit the BIOTECH Hobbyist, where you can learn to clone and micropropogate plants, grow your own human skin, sterilize in the microwave, and more.

Champs-Elysées Smart Trees

(Reuters, 12:15 pm, Feb 3, 1999 pst) "Welcome Bugs for Parisian Trees" "It takes less than 15 minutes to embed a 3-centimeter long computer chip in the trunk and enter the data in a computer,' said Christian Mantaux, a tree surgeon for two decades. (...) "The chips contain an identification number which, when read by a mobile computer, gives a readout on the trees' location, age, and condition."

Smart Trees and Rendering Growth Responses

The Champs Elysées Smart Trees project and the ONETREE project provides a fruitful comparison of representation strategies. The former, as reported by Reuters, represent these valuable trees as three data points: "location, age, condition". Produced by high end, state of the art information technology, it is these 3 data points that count as the information about these trees. It's entertaining to think that this instrumentation is used to get the updates on the trees location—not something likely to change—but this is also a radically reductive representation of the trees.



The ONETREES instrument however, captures a different way of conceiving of information with respect to the trees. Not information packets produced as simplified data product to be passively consumed, rather, it privileges a conception of information that requires interpretation. It demonstrates that this complex to get the updates on the trees location—not something likely to change—but this is also a radically reductive representation of the trees.

The *OneTrees* instrument however, captures a different way of conceiving of information with respect to the trees. Not information packets produced as simplified data product to be passively consumed, rather, it privileges a conception of information that requires interpretation. It demonstrates that this complex multi-parameter phenomena of growth can be understood in many way, can sustain many interpretations and can be 'read' from the material phenomena itself, not as a pre-interpreted digested data packet, not delivered by an expert, not wrapped in the incontestable authority of science. It facilitates and instruments a more active understanding of information, not as complete, accurate and factual, but interpretable, partial and incomplete. The evidence being more persuasive and somehow more precise for this understanding of its partiality.

WHY IS THE BIOTECH INDUSTRY FUNDING ART?

The Industry Behind the Curtain

by Jackie Stevens

“Paradise Now: Picturing the Genetic Revolution” (Exit Art through October 28), is a downtown art show with a Madison Avenue publicity budget. But one thing you could never learn from the billboards on Houston or Canal, the full-page ads in national media, the reviews and interviews, or (especially) the curatorial text, is that its sponsors hope the show will help biotech companies avoid in the U.S. and developing countries the marketing fiascos such firms face in Europe.

To a public skeptical that corporations will do the right thing, a Monsanto ad for Bt corn makes it as palatable as the pesticide DDT, so biotech— like other beleaguered and “misunderstood” industries—is turning away from Saatchi et al. and towards diverse groups of artists and curators, some of whom may even wish to highlight the industry's dangers and wrong-doing.

The reason is simple: art about biotechnology, especially with a critical edge, serves to reassure viewers that serious concerns are being addressed. Even more importantly, biotech-themed art implicitly conveys the sense that gene manipulation is a “fact on the ground,” something that serious artists are considering because it is here to stay. Grotesque and perverse visuals only help to acclimate the public to this new reality. While companies like Affymetrix, Orchid BioScience, and Variagenics all lurk among the sponsors of “Paradise Now,” the “man behind the curtain,” as one curator called him, is Howard Stein, who has joined forces with another “Paradise Now” sponsor, Noonan/Russo Communications, a public relations firm boasting a client list of dozens of biotech firms. (In reviewing the website I noticed they are employed by my own Claremont University Consortium's Keck Graduate Institute, now fighting a local referendum and court challenge so that it can pursue partnerships with the biotech industry.)

Stein, who led the Dreyfus Corporation and is credited by some as the father of the money market fund, told me the secret of his business success: “My luck in the world is by being aware of things that have a future. Things like Haloids. Never heard of them? They changed their name to Xerox.” Stein told one of the show organizers, Ann Pasternak, that he “knew to invest in biotech stocks because he always put his money where he sees the government investing.”

Stein is investing in the government-subsidized future like there was no tomorrow, and with considerable imagination. “Had Monsanto done what they should have been doing,” Stein told me, “then there might not have been so much of a problem.” And what they should have been doing, à la Stein, is supporting art shows about genetics.

Not surprisingly, when Stein visits nonprofit art spaces and rattles his spare change—all told he put up about $500,000 for “Paradise Now” alone—biotech receives some good press. Consider the “Paradise Now” brochure: “The major benefits of sequencing the human genome are yet to come. Medicine will be transformed, diagnoses will be refined, and side-effect-free drugs will target specific diseases, working the first time they are administered.” Not only that: “Biotechnology will be…increasing the nutritional value of crops and making them easier to grow.”

These are of course not facts in an “objective,” “unbiased” and “educational” show, as curators Marvin Heiferman and Carole Kismaric tell the media, but an industry-friendly spin on hotly disputed possibilities. And these phrases echo, to the word, things Stein told me in our telephone interviews.

“Paradise Now,” like Stein's other genetic-art investments (e.g. www.geneart.org) is funded by his private charitable organization, the Joy of Giving Something (JGS). JGS means that Stein receives a tax writeoff for his media buys and no one knows who's behind them. The JGS web page links to an art book celebrating commercial DNA analyses, an industry-affiliated webpage that soft-sells the inevitability of a corporate-genetic future, and even to Stein's personal gene art collection.

Stein's most substantial workhorse for the biotech industry, the Gene Media Forum (GMF), organized a panel for “Paradise Now” and fed “objective” information to the curators and Creative Time (which is responsible for the billboards). Stein initiated the GMF and remains its primary sponsor, funding it to the tune of at least $450,000 annually. The GMF, which shares a logo with Stein's JGS webpage, is excellent for promoting the biotech industry because unlike Noonan/Russo, it operates under the unimpeachable imprimatur of the S.I Newhouse School at Syracuse University. Alan McGowan, GMF President, told me they sought the affiliation because “the Newhouse School has a name and presence in the media community; it's a worthwhile association to have.”

The tie misleadingly implies the GMF is a neutral clearinghouse. Yet its advisory board includes such genetics cheerleaders as Celera's Craig Ventner and Cal Tech President David Baltimore, and not one representative from organizations questioning this work. When asked if the board was balanced, GMF Co-Director Don Torrance gave a fast “No.” He said non-industry folks were invited, but he refused to name them. McGowan gave me a different account of the selection process: “I asked my friends.”

The curators brush off concerns about Stein's agenda and conflicts of interest. “In the world of art Howard is naïve. He really believes art can change people,” said Kismaric, who co-owns a curatorial firm. Defending her independence, Kismaric pointed out that some of the “Paradise Now” installations criticize the corporate gene culture, including one by Candid at ®TMark, where I manage the Biological Property Fund.

Yet as Stein and Noonan/Russo understand, the show's content is irrelevant. Stein told me he agreed with the lukewarm reviews: “I think the critiques in the New Yorker and Times were on target. The show's really, you know, a mish-mash,” and he volunteered that his favorite, a work by Helen Chadwick (which like several other pieces in the show is from Stein's

WHY IS THE BIOTECH INDUSTRY FUNDING ART?
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personal collection) was "hung badly."

Stein is less interested in the exhibit—half a million dollars, after all, could put on more than 20 run-of-the-mill downtown gallery shows—than in desensitizing the audience to its subject matter. Drawing an analogy to President Clinton's impeachment, Stein explained that "open discussion" is more likely to alleviate anxieties "than if someone is saying here it is, take it or leave it. Once the information about Clinton's activities was in the open, the public had the feeling 'but I don't want the president to be impeached.' And so there was no impeachment." Likewise, exposed to shows such as these, the public will be inured to troubling and dangerous corporate agendas, and will more easily accept the latest biotechnological developments. The "Paradise Now" curators on the JGS payroll are currently organizing other art projects on genetics as well as grants to artists who do work in this area. And GMF is gearing up to saturate the media in the developing world, with the aim of "educating" African farmers and activists opposed to corporate-designed crops. As Stein told me, "This is just the beginning." ↖

HOW IS CULTURE INFLUENCED BY GENETICS?

The Sound of OneTree Cloning

by Stefan Helmreich

With the TOPO TA Cloning® Kit by Invitrogen(tm) Life Technologies, clean clones of amplified genes can be yours in five minutes. Examining this kit in the laboratories of the Monterey Bay Aquarium Research Institute, where scientists clone DNA from the seas, my mind wandered back to trees, and to Natalie Jeremijenko's "OneTree," a distributed art installation and science project consisting of two hundred genetically identical trees and their online, digitized Doppelgängers.
I first saw Jeremijenko's cloned trees asseedlings at the Yerba Buena Center for the Arts in San Francisco and later encountered three of them as saplings in a Soho gallery in New York City.
In line with what I took to be the intent of their display, I tried to squint past the invisible, genetic similarity of this crowd of Paradox trees to see their visible, bodily uniqueness and walnutty difference from one another.
In the hall of mirrors connecting the real and the replicated, Jeremijenko's trees supply an image for reflecting on genetic determinism and indeterminacy.
And indeed, the visual seems to be the favored register for meditating on the mixtures of the natural and the artificial enabled by the latest technologies of genetic engineering. One has only to recall spectacular pictures from the archives of popular science and culture — of bananas spliced with tomatoes, of mice with human ears on their backs, of photocopying machines spitting out two-dimensional images of sheep.
Jeremijenko's innocent little trees turn these images on their innards, asking us to think about the teensy-weensy interior unity of these trees and the weird parallel-processing geography this cloned kinship describes. But what would happen if instead of always shuttling across this boundary between the visible and the invisible when considering clones - do they really look alike? isn't it what we can't see that matters? help! - what if, instead of thinking visually, we leapt over to the world of sound and listened to the sound of cloning, to the sound of OneTree cloning? The noises associated with the TOPO TA Cloning® Kit provide some preliminary soundings.
With this cloning kit, scientists mix a freshly made polymerase chain reaction product - that is, an amplified genetic substance of which they want more copies - with salt solution, water, and the TOPO® vector. Mixing the reaction gently and incubating for five minutes at room temperature yields multiple clones. The mixing is done by hand, by transfer of small volumes in test tubes. The incubation is done on a device like

Forma Scientific's Orbital Shaker. Jeremijenko writes "Cloning has made it possible to Xerox copy organic life." And indeed, at 225 RPM, the Orbital Shaker does sound like a photocopying machine, lurching in a steady rhythm as clones are grown up on its hula-dancing hot plates. At slower speeds, the Shaker starts to sound like a washing machine. Slower still, it becomes a quiet oceanic rumble, echoing, perhaps, the deep-sea hydrothermal vent ecologies from which the polymerase in the polymerase chain reaction is often drawn, and the swaying kelp forests from which agarose, the gel on which chain reaction products are analyzed, is often derived. But if scientists in Monterey are cloning genes from the sea, with the aim of screening them for intriguing code, the sounds, one imagines, would be little different if they were cloning DNA from trees. If I were to imagine the sound of OneTree cloning, with its associated micropropagative techniques for making full organisms from undifferentiated plant tissue, I might also listen to the sounds of technicians paging through cloning kit instruction manuals, shuffling through the processed paper on which cloning instructions are provided. And I would listen to the pulp fiction of printouts of confirmatory sequence data. The OneTree project, as it turns out, has the sound of printouts as an integral component. A CD-ROM associated with the project and available to users who wish to follow the progress of the trees contains a program that monitors the printer queue and prints out a cross-section of a tree when the number of pages printed by the user equals one tree. The sound of these trees cloning might resemble [The User]'s "Symphony # 2 for Dot Matrix Printers."

These trees in turn are shadowed, ghosted by a collection of on-screen virtual trees created using Lindenmeyer systems, computer algorithms for generating branching patterns. These trees are trees in the logical sense; that is, they are ramifying patterns unfolding from mathematical rules. In an attempt to inject the contingencies that real trees face, however, Jeremijenko has linked the generation of these cyberspace trees to carbon dioxide sensors attached to the serial port of the computer on which these software structures exist. She hopes that "puncturing the separation between virtual/digital and the actual environment," will provide "the opportunity to contrast the idealized computer models of the algorithmic trees and actual complex growth phenomena." One imagines whirring disk drives clicking along with sensors' ambient hums. Jeremijenko has promised that her physical Paradox trees, once old enough, will be planted in public sites throughout the San Francisco Bay Area, recording and embodying the social and environmental differences in which they come to exist. The wind that blows through their leaves will be the sound of clean air, of smoggy air, of toxic air, depending on where they grow up. They will constitute a network of environmental monitors, speaking in the tongues of trees. Because of their genesis as clones, all traveling forward in time together, their family tree will not be a branching pedigree at all, but rather a candelabrum. The lateral connections between them, effected by humans visiting them in cars, on bicycles, and on foot, will provide a webwork of meditation on difference, similarity, neighborhood, and territory.

This will not be like the cyberspatial reserve for digital organisms proposed nearly ten years ago by Artificial Life scientist Tom Ray (1994), who hoped that self-replicating computer programs could blossom into a virtual ecosystem on a web of computers worldwide. That project depended on a definition of life as digital information processing. Jeremijenko's Paradox trees—children of an Artificial Life epistemology, to be sure, with biogenetic stuff seen as a key site for intervention in manufacturing new biological entities—spin their web of signification in the world of chloroplasts, tree rings, and leaves. Listening to their growing pains, to the sound of OneTree cloning in this distributed forest, gives us a stereo image of genes and environment, a groove against the grain of genetic determinism. These woody genes are not just information, but tangible things—things not rendered digitally, but rather available to manipulation by the branching patterns, the digits, of human hands, cat claws, insect arms. The sounds of stretching, climbing, and clutching will be the signs of life in this forest of sonic symbols. ↖

References

Ray, Tom 1994 A Proposal to Create a Network-Wide Biodiversity Reserve for Digital Organisms. Paper presented at Artificial Life IV, MIT, Cambridge, MA, July 6-8.

[The User] 2002 Symphony #2 for Dot Matrix Printers. Asphodel.

WHAT CAN TREES SAY ABOUT THE NATURE/NURTURE QUESTION FOR HUMANS?

Pairwise: ONETREES and the Legacy of Human Behavioral Genetics

by Dalton Conley

Sociologists would like to do experiments, but we can't. We can only fantasize about randomly letting some kids into Ivy League schools (and arbitrarily rejecting others) in order to see the value of a Princeton degree. We can only dream about mixing up gender roles and seeing how kids develop. We can merely theorize about radically changing the income distribution to see what would happen on a variety of social indicators.

One of my personal all-time fantasy experiments would be to take two identical twins, raise one in the impoverished inner city and raise one, say, out in Greenwich, Connecticut, or some other rich suburb. Then we'd really know what the effect of living in a poor, urban environment is versus living in a rich, suburban environment. We could put an end to this quibbling about nature and nurture, once and for all. Or, not quite.

My little project wouldn't get at the issue of race. So, I would really need to have four quadruplets, and I would get in there, do a little genetic engineering, and make two come out dark-skinned and two come out light-skinned, and raise one of each color in the inner city and one of each color in the rich suburbs. Then we might really figure out what's the effect of economics, and what's the effect of race in America. Of course, then I'd have to move to octuplets, and vary their X- and Y-chromosomes as well, in order to model the effect of gender. And, to be fair, I would really needs lots of sets of these clones—20 or so would do—in order to be sure the results for one set are not just a random fluke.

Natalie Jeremijenko does not have to fantasize about cloning experiments; she is doing them with OneTrees. We may not be able to find out how social and environmental inequality affects children's personality and life success, but she is showing us how those same forces affect trees. From there it is not a huge leap to infer that if the social and physical environment is rendering actual noticeable differences in how trees grow, it is probably affecting us as well.

OneTrees occupies a unique space in a long history of human twin research. The methodology of twin comparisons that has been traditionally been used by behavioral geneticists within human populations to estimate the genetic component—i.e. the heritability—of traits ranging from height to schizophrenia to yearly earnings. Put simply, the idea is that the difference between how similar identical twins are and how similar fraternal twins are presents an accurate indicator of the genetic component.

The guiding assumption is that both sets of siblings shared the same family environment, the same age, the same womb. The only difference is the extent of the genetic similarity between them. If genes determine success, then identical twins should be much more similar on socioeconomic measures than are fraternal twins. This is indeed the case, but there is a simple alternative explanation: identical twins also share more similar environments. Of course, on an intuitive basis we know that this is true: Identical twins occupy a very unique social space in society.

Behavioral geneticists are aware of this problem of special "twin-ness" and try to take into account how similarly twins are treated. This is called the problem of genetic-environmental (GE) covariance. How much do genetic similarity and environmental similarity go hand in hand? And how do they affect each other (additively, multiplicatively, etc.)? The truth is, no one knows. Behavioral geneticists have also tried to deal with the issue of assortative mating—that is the tendency for mating partners to not be randomly paired with respect to the genes under question.

Identical twins are not only the "gold standard" for the influence of genes on social behavior, they also provide a way to understand the influence of environmental differences. To this end, twins are used to rule out genetics in order to understand the influence of specific environmental influences. Twin difference methods (as they are called) enjoy a considerable legacy in economics—specifically in attempts to understand the relationship between education and earnings. Estimating the "true" economic value of staying in school has been difficult. The problem is that individuals who finish high school (or college) might earn more because they actually learned something and got a degree, or they might have earned more anyway because people who stay in school (take your pick): are innately smarter, know how to work the system, come from better off families, can delay gratification, are more efficient at managing their time, or all of the above. In other words, someone who graduated from Yale might not have needed to go to college to earn higher wages; they might have shined anyway.

Identical twins provide a solution to this problem at first glance. Since they share the same genetic endowments and are generally raised in similar environments, some economists assume that any differences in schooling between twins are random, the result of chance differences (like getting pregnant or the luck of having an inspiring teacher) and therefore are more akin to the experiment of assigning kids to have different education levels and seeing how they turn out.

However, what if the random event (like getting pregnant) has its own influence on wages? How do we know that the twin who did not go onto college earns less because she did not go to college and not because her work patterns are burdened by early motherhood? Second, this approach assumes that these twins are exactly alike in every way. But what if there are differences between twins that are not random? What if, instead, there are real systematic differences between twins that affect how they do in school and in life? In other words, what if the twin who got pregnant had always taken more risks (for whatever reason) and thus it was almost preordained that if one of the twins were to get pregnant, it would be her? Then it could be the case that some underlying difference really affected their life outcomes and not random chance, pregnancy, or schooling. The horns of this dilemma expose the outer limits of what we can know about cause and effect in human development.

Trees, Jeremijenko shows us, are a different story altogether. By comparing not individual pairs of twins, but 100-tuplets, the experimenter increases her power immensely. Systematic differences in the rate of similarity across tree families do not exist (as in the case of human twin sets) since all the trees come from the same genetic stock. By planting genetically identical trees in various environmental conditions—toxic ghettos and manicured suburbs—we can attribute the systematic differences between the sites to the impact of "nurture" and the similarity across sites to "nature." Of course there is a lot of noise and messiness in measuring trunk dimensions, canopy density or leaf color. This is where the pairs come in. Differences within the pairs sited at the same place reflect seemingly random (or at least immeasurable) differences between the trees—the noise. This within-pair correlation can be differenced out from the between pair correlation to yield a measure of the "signal." This tells us the impact of the measured environmentally different conditions across the sites. Since Jeremijenko did not plant randomly selected non-kin trees, we cannot deduce the genetic component. One variable is missing. The genetic equation is underspecified. This is not to take away from the project of a public experiment, legible to a wide public. It's enough to make a sociologist green with envy.

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