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The Mighty Mouse: Communicating addiction research through computer art

By Tiffany Holmes

On June 6, 1988, the Reverend Donald Wildmon, leader of the media watchdog group National Federation for Decency, claimed that on a recent episode of Mighty Mouse, the lead character snorted cocaine. The show's creator, Ralph Bakshi, publicly denounced Wildmon's comment in insisting that Mighty Mouse inhaled from a bouquet of daisies to gain strength: "He sniffed a flower just like Popeye sniffed his spinach. There are scenes in all the Fleischer films of Popeye doing exactly the same thing, sniffing spinach up his nose because his hands were tied and he's trying to get to it, so it was an action we saw a million times before in animation. But he never sniffed cocaine."[1] Nevertheless, the scene was cut, or rather, censored from repeat CBS broadcasts due to the network's skittish attitude towards connecting drug use with youth culture.

Misunderstandings about drug use and drug addiction remain a serious public health issue with wide-ranging effects on people of all ages. The use of addictive drugs, such as cocaine, causes severe long-term physical and psychological harm. While alcohol and tobacco usage has decreased in teen populations, the number of minors experimenting with psychostimulants like ecstasy is steadily increasing. [2] The lack of education and general awareness about the science of drug abuse is a primary factor behind this persistent problem. There is an urgent need for the development of new educational media and visual materials that inform the public, young people in particular, about the devastating facts of drug addiction revealed by contemporary scientific research.
On a more personal note, I intend to raise public awareness on addiction studies as important people in my life, one family member and two friends, struggle with the life-long biological effects of chemical dependency. My early work as a fourth grade teacher in a rural Carolina elementary school and as an art teacher in an inner city Baltimore middle school proved the need for a more diverse array of educational programming and literacy-based projects focused on issues of drug addition. The remainder of this article will focus on the development of an art exhibition that introduces a new public dialogue about issues related to drug use.

In the fall of 2002, I began a dialogue with Dr. Tolga Uz, a neuroscientist studying the science of cocaine addiction in mice at the University of Illinois at Chicago. [3] One purpose of this essay is to communicate how collaboration between an artist and a scientist begins and what the potential outcomes of such an alliance might be. While artists and scientists have obvious differences in research methodology, these partnerships seem to be catalyzing a whole panoply of exciting work -- though often designed for and presented to very specialized audiences. Much of this collaborative work falls into the very relevant category of "art with potential corporate sponsorship" -- think Jonah Brucker-Cohen's new project H2O/IP that uses water as an organic network between two computers. [4]

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Unlike some of the institutionally supported "art-science" collaborations, the project I describe below has no commercial application though it pos-

sesses tremendous capacity for collective education. The first section consists of my own attempts to elucidate for the average reader the intricacies of recent developments in drug addiction research -- please prepare to be surrounded by a whole family of unfamiliar acronyms. The second half of the essay explores the potential for productive collaboration between an artist and a neuroscientist -- how laboratory data might be fused with artistic processes and creative expression for a larger purpose. In our case, we hope to design a museum exhibit that educates and informs the public about drug addiction in a responsible yet sensorially gratifying manner. Throughout this discussion, I will address differences in artistic and scientific research practices: how research aims are selected, how studio or laboratory outcomes are measured, and how research of all sorts is publicly circulated or displayed. Overall, this essay is a personal examination of my own experience as an artist collaborator -- the opinions and reactions that I offer below are not necessarily shared by Tolga as we come from understandably different academic backgrounds.

First laboratory visit

Ten shoebox-sized glass cages stand empty in the small laboratory, dimly lit by a single red bulb. The rotating door to the darkroom creaks -- admitting a boisterously cheerful lab technician carrying twelve rodent specimen. As the lead scientist calls the number "seventy five," the technician drops the mouse with a corresponding ear tattoo into the appropriately labeled enclosure. Soon, the small space fills with the sounds of rustling as the mice explore their new environments, sniffing about the litter and occasionally clambering atop the custom wire-mesh roofs.

This above-described room is the epicenter of drug addiction research in Chicago. The researcher barking numbers is Tolga Uz, a UIC neuroscientist studying the science of cocaine addiction -- specifically, he wants to show how gene expression and circadian rhythms affect cocaine addiction and drug sensitization. Tolga works primarily with animal subjects as it is impractical and illegal to repeatedly inject humans with pharmaceutical grade coke. Mice are the ideal animals for drug addiction studies and others in related fields like oncology and pathology. The mouse has one feature that is unique when compared with other research animals -- genetic tractability. For nearly each gene in the human genome, a counterpart can be identified in the mouse. Genetic manipulation within the living rodent is totally routine, and can be done with unbelievable accuracy.

My presence at the epicenter of drug addiction research is unusual to say the least. I am a "painter turned new media artist" currently exploring ways of representing motion through the fusion of languages from different disciplines. Tolga and I met through another UIC neuroscientist, Neil Smalheiser, who purchased a series of drawings done by one of my mice performing at a large art festival. Given our mutual appreciation for tiny mammal research subjects, we had been talking for some weeks about the possibility of working together on a project. Following a series of preliminary conversations, I was invited to observe experiments on December 6, 2002.

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After the fifteen minutes of roaming, most of the mice chose a corner in their new cages and went to sleep or rested quietly. One or two twitched excitedly when I moved toward their cages -- Tolga explained that these were the mice that were highly sensitized to the drug and eagerly seeking more of it. After checking the precise time on the computer, Tolga shook a vial stocked with clear liquid and filled a syringe. With his forefingers, he deftly grabbed a mouse by the loose skin around its neck and flipped it over, grabbing its tail with his pinky thus rendering the small body motionless. As he poked the needle into the soft pink tissue of the abdomen, I promptly sank into the only available chair in the cramped space to fend off a wave of nausea. While I handle my mice at home constantly, I was unprepared for my own adverse reaction to the needle. Fortunately, the discomfort passed quickly, and I regained my footing as Tolga injected the last of the animals with twenty milliliters of cocaine. The effects of the drug were instantaneous. In the first two or three minutes after injection, mice strolled loopily about their cages. For the following twenty minutes, the mice accelerated their pace; they scurried in circles, shoving the pine bedding to the edges of the square cubicles. Oddly, all seemed to be marching clockwise. The computer records the amount of motion every fifteen seconds via the three infrared beams that cross each cage. Each time a mouse breaks two or more beams the computer augments the ambulation count by one. Ambulation rates tend to be very high with psychostimulant use -- the drug forces increased locomotor activity in the animals.

Current trends in addiction research

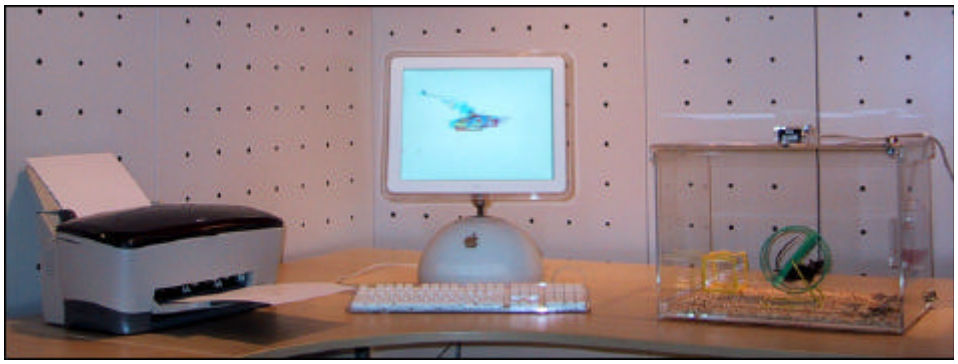
The use of inbred mouse strains in drug addiction studies has brought new understanding of how subtle genetic differences affect the formation of addictive behavior, or sensitization. In the laboratory, Tolga gathers data to show that there is a gene that stalls addiction to psychostimulants; his research investigates the effects of two proteins on cocaine sensitization in mutant mice at various times of day. The C57BL/6J or "knockout" mouse strain lacks the

gene to create the AANAT protein that leads to the production of another important protein, NAS. Made in the pineal gland, NAS follows circadian rhythms (low during the day, high at night). NAS can also be converted into melatonin, a hormone secreted in the pineal gland that regulates cycles of sleep in animals. Cocaine increases the formation of AANAT proteins and thus the synthesis of NAS and melatonin. The bottom line is that without the particular gene, the AANAT-mutant C57BL/6J mice, or "knockout" mice can't metabolize NAS or melatonin. They get addicted to cocaine much faster than the AANAT-normal mice.

Scientists like Tolga have found that repeated doses of melatonin combined with cocaine prevented the development of drug-induced sensitization, which is considered a model for cocaine addiction. In other words, the presence of melatonin during the first few times that cocaine is administered may limit the long-term effect of the drug. Since AANAT-mutant C57BL/6J are more prone to develop cocaine-induced sensitization than AANAT-normal mice, Tolga hypothesizes that the AANAT and NAS proteins are crucially involved in the process of cocaine addiction. He believes that study of the AANAT / NAS / melatonin system could reveal therapeutic targets for biological agents that might prevent or limit cocaine abuse. [5]

Because there are no drugs available that target psychostimulant addiction, the research offers tremendous practical application. Due to the intricacies of the laboratory experiments, the work remains anonymous and hidden to the general public. Our collaboration is about making this information publicly accessible in the form of an art exhibition. The next section of the essay describes our collaborative union to create an alternative forum to communicate the highlights of Tolga's research.

Revisualizing scientific research through art



Tiffany Holmes, Follow the Mouse, 2001, CPU, printer, spy camera, and live mouse

Tolga and I plan to organize an exhibition for the general public that fuses the latest findings in addiction research with multimedia installation work. As perhaps expected, I hope to create a strong visual representation of the overall laboratory experience, while Tolga is more focused on the public understanding of data-driven laboratory research. But how might one artistically display the very real differences in locomotion between the AANAT-mutant C57BL/6J mice and the AANAT-normal mice? How might one represent rodent motion graphically in a computer environment based on Cartesian coordinates?

Much of my previous work as a multimedia installation artist has focused on ways to invent a visual language to capture bodies in motion, both human and animal. When Tolga analyzes the ambulation numbers recorded on the computer during the laboratory experiments, he constructs bar graphs. In my world, if I confront a large array of numbers, I begin thinking about ways to map such figures into automated drawings based on hacked algorithms. In a previous installation work, Follow the Mouse, the viewer confronts an office workspace controlled by the actions of a live mouse instead of a standard input device. The drawings on the monitor are generated in real time by the mouse's movement in the cage. Every ten minutes, the style of mark making changes; the placement of the marks, however, always correlates with the location of the mouse in the cage. The animal produces drawings with different styles: simple geometric forms, linking black lines, famous animated mice, and headlines from the New York Times that contain the word "mouse." The mouse's position determines location of shapes; height and width of the icons are controlled by how fast the mouse is pacing; opacity is controlled by the overall amount of motion in the cage. This particular manner of representing the movement of animal bodies certainly played a large part in our overall conceptualization of our collaborative project.

For the "Mighty Mouse" exhibition, Tolga and I conceived four principal projects: a multi-channel video installation, a drawing series, a web art game, and a testimonial-style video -- each of which is described in some detail below. The video installation consists of twelve wall-mounted monitors connected to DVD players. The video on each monitor displays the results of a drug addiction study using AANAT-mutant and C57BL/6J mice. Each monitor displays information derived from one mouse occupying one of the twelve cages. This multimedia wall installation will use video and animation to visually narrate the trajectory of the experiment, beginning with clips of each animals' locomotion patterns prior to the introduction of psychostimulants, then transitioning to animate the locomotion patterns of the animals under the influence of cocaine. Differences in ambulation rates between the mutant and the standard C57BL/6J will be visible via color shifts and size of animated icons.

A drawing installation will translate scientific data from day and night experiments that display the effects of repeated cocaine administrations on genetically modified mice. Mice become less sensitized to cocaine at night when there are elevated levels of melatonin. Ink drawings of squiggly concentric circles exhibit the artifacts of an artistically modified scientific experiment. A large mouse wheel with an attached drawing stylus will be employed in a series of experiments modeled after the actual experiments that test the locomotor-stimulating effects of cocaine. The data and statistics from this experiment are not mapped coordinately. Instead, the artifacts are abstract drawings produced during the laboratory experiment when the rodent subjects ran on the wheel. Larger and darker circles thus correspond to higher rates of ambulation.

The web art game is modeled after the classic arcade game, Pac-man. In the original version from 1980, Namco game designer Moru Iwatani had players guide Pac-man, an animated mouth, around a maze eating dots, while avoiding four ghosts who escape from a cage in the middle of the screen and are bent on destruction. In each corner of the square field is a large dot that, when eaten, will turn the ghosts blue for a brief period. Here, the tables turn and Pac-man can eat the ghosts, leaving only the apparently indigestible eyes that make their way back to the cage for reincarnation into another ghost. At each level, a treat appears for the player under the ghost-cage, in the form of fruit or a bell or some other symbol waiting to be devoured. In our game, the Pac-man is a mouse ferreting out food from a maze of seeds. The four ghosts are different types of psychostimulants: speed, ecstasy, cocaine, and caffeine. In our game simulation, injesting drugs affects the mobility and speed of the mouse character. Prolonged contact with one of the ghosts ends the game. A clock in the lower left of the screen lets players know whether it is day or night -- the time of day affects the mouse's ability to tolerate the drug consumed. Treats consist of "safe protocols" for travel when using psychostimulants: taxi, bus, or a car driven by a sober friend.

Finally, the two-channel video installation is configured on two projections that face each other. One side displays a continuously running clip of a single mouse pacing in circles around a cage. On the opposite wall, a series of short video testimonials loop. These short clips display people of different ages, races, and backgrounds discussing their answers to questions targeting stereotypes associated with drug use: when and why people tend to take psychostimulants, what are the long term effects of psychostimulants, and how multiple doses of psychostimulants affect an individual. The wall between the two videos displays a list of different psychostimulants and facts derived from research about their long-term effects on the body and brain.

Conclusion

The "Mighty Mouse" exhibition aims to enhance the public knowledge about the biology of drug abuse. In preparing video installations and analog drawings that show subtle differences in locomotion in mice being sensitized to cocaine, Tolga and I hope to raise awareness and understanding about the determinative components of addictive behavior: genetics, gender differences, and environmental factors. Collaborating with a neuroscientist has opened my eyes to the undeniable importance of animal use in laboratory experiments. In December of 2002, Nature ran an entire issue devoted to landmark breakthroughs in the mouse genome; online, the journal has a page devoted to this creature titled: "Hail the humble mouse." [6] 2003 seems an auspicious year to mount an exhibition of art derived from mouse locomotion, as testimony to this animal's pivotal importance in defining new therapies for people dealing with drug addiction.

Acknowledgements

Thanks to Dr. Tolga Uz for devoting his boundless energy and enthusiasm to our collaborative project.

NOTES:

[1] http://www.theavclub.com/avclub3644/avfeature_3644.html
[2] http://www.cnn.com/2000/fyi/news/12/15/teen.drugs.ap/
[3] More about Dr. Uz's research: http://www.psych.uic.edu/faculty/uz.htm.
[4] Click the projects link from Jonah's ever-changing exciting web site: http://www.mle.ie/~jonah.
[5] In 2002, Tolga received a $600,000 grant from the National Institute on Drug Abuse to fund his research that may lead to drug therapies to combat addiction. More information: http://www.psych.uic.edu/thisweek/news_4_23_02.htm.
[6] http://www.nature.com/nsu/mouse

Tiffany Holmes is a multimedia artist whose practice blends traditional materials and new media in large-scale interactive installations. Her work explores the relationship between digital technology and culture with an emphasis on technologies of seeing. Her recent work explores the movement of both human and animal bodies and the visual languages from different disciplines used to capture that movement. She has exhibited and lectured in international and national venues, including the J. Paul Getty Museum in Los Angeles, the Interaction '01 biennial in Japan, ISEA, SIGGRAPH 2000, World@rt in Denmark, Digital Salon '99 in New York and Madrid, and the Viper media festival in Switzerland.