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Big Data, Actionable Information, Scientific Knowledge and the Goal of Control

Big Data, *información procesable, conocimiento científico y la Meta del Control*

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Abstract

Big Data is control. Consider Technological "watching" (veillance). Whether it is lists of banned books, files and interrogation reports on arrested people, or algorithms searching massive databases, it isn't about voyeurism, but instrumentalist power. Established distinctions between data, information, and knowledge from computer science are a helpful sorting device for understanding why some forms of Big Data are more effective for control than others. Political struggles and corporate hype over veillance Big Data obscures how unuseful it has been so far, and how different "data" of any sort is from actionable information (intelligence). Even then, action doesn't promise effectiveness. Affordances, agency, network architectures, semantics and the political economy determine effective communication and control. Thls is

clear from the role of Big Data in neuroscience, which is making great instrumentalist progress. Specific, rigorous knowledge is much more powerful, and dangerous, than data of any size or information, no matter its origin.

Keywords

Mind control, neuroscience, technology, power.

Resumen

La “mirada” tecnológica (vigilancia) está vinculada al control. Ya se trate de listas de libros prohibidos, expedientes o informes de interrogatorios a personas arrestadas, o algoritmos de búsqueda bases de datos masivas, no se trata de voyeurismo, sino de poder instrumentista. Establecer distinciones entre datos, información y conocimiento en las ciencias de la computación será un dispositivo de clasificación útil para entender por qué algunas formas de vigilancia son más eficaces que otras. Las luchas políticas y la moda empresarial del Big Data ocultan cuán inútiles han sido hasta ahora, y cómo los diferentes "datos" de cualquier tipo se encuentran en información procesable (inteligencia). Incluso entonces, la acción no promete eficacia. Potencialidades (affordances), agencias, arquitecturas de red, la semántica y la economía política determinan la comunicación y el control efectivo. Consideremos el caso especial de la neurociencia, que está a punto de hacer viable la lectura de la mente y el control del pensamiento. El conocimiento específico y riguroso es mucho más potente y peligroso que los datos de cualquier tamaño o información, sin importar su origen.

Palabras Clave

Control mental, neurociencia, tecnología, poder.

Summary

Sumario

Data, Information, Knowledge

> "Knowing is half the battle."
>
> GI Joe

As social creatures we are always observing, and responding to the observations of, others. Much of this mutual gazing is horizontal, peer-to-peer. But a significant part is not. In person we can gaze in admiration, in appreciation, in interest. We can also deploy a "commanding" gaze. But surveillance, the gaze "from above", is always about control. Now that watching can be geometrically expanded through electronic technology we live in a global panopticon, in which we never know which of our electronic communications, or even physical actions, might be under surveillance. Observing from above has long been a key link in systems of social control. The crudest form of the surveillance-control link is when observation is used to determine what books and people to burn, but detailed social information has always been used by ruling elites to pressure their subjects, sometimes with positive reinforcement, and sometimes negative. Now these processes mainly happen in the information technology realm. As human-machine systems (instantiated especially in "Big Data") are under consideration analytics from informatics are used (network architecture, affordances, knowledge typologies) to understand how power is mobilized and deployed (or not) in the context of our current political economy and its constituent discourses. Understanding is measured by useful designs, predictions and interventions, proof of which is found in the real world.

Today, most veillance is about electronic forms of these processes/dynamics so the speed and volume of observation is increasing exponentially. What does this mean in cybernetic terms? Systems depend on feedback — positive, negative, and paradoxical. If a system is set up with the assumption that collecting more data is always better (the NSA), then positive feedback will result in a runaway attempt to collect all data. In such an institution, negative results from massive data collection are seen not as indications that the premise is faulty, but rather that a threshold has not been reached. Finally, when a system is observed, the observer paradoxically becomes part of the system and changes it inevitably (Heisenberg's Uncertainty Principle). This changes the whole dynamic of data collection, for example through the impact (often subconscious) on the average citizen of the growing network of public and private

security cameras, and of massive electronic surveillance by security services. The observing networks also change, assuming their collected data automatically produces instrumentalist power when this is far from proven. These effects, categorized as second order cybernetics, are almost always ignored by most veillance regimes, their world view is Newtonian, not cybernetic. They think they stand "outside" the systems, but they don't. All of us are embedded in systems that are flows of information, energy, and matter, subject to the laws of information and physics. Every gaze is about information, but when the goal is control it becomes clear that a number of other factors are crucial for understanding what is effective and what is not. Among the most salient: affordances, semantics, and agency. They all operate in the context of the political economy, the regime of acceptable meanings that decide access to resources and power and how it is framed morally.

Affordances are the possibilities all objects and systems offer for use. Consider how a china mug makes a poor screwdriver, an adequate weapon for close combat, and an excellent drinking vessel. Certain systems map onto some uses more effectively than others. Hierarchical bureaucracies (such as the US military) seem almost incapable of mobilizing power from distributed systems, unlike social movements which are distributed systems themselves (Gray and Gordo 2014).

Semantics, broadly conceived, is about shaping and knowing meanings. To determine meaning is to exercise control (in military terms, winning "hearts and minds"). And this is exactly the realm where much Big Data manipulation fails. Determining meaning from human discourse (actions that include speech and writing "acts") is profoundly difficult, subject to multiple (often paradoxical) interpretations (that can all be "right") and particularly susceptible to Heisenberg's Uncertainty Principle, since naming meanings often changes them. As Elaine Scarry demonstrates in *The Body in Pain: The Making and Unmaking of the World*, acts of violence (such as war and torture) are about imposing meanings. Surveillance is the same. But there is a big difference between using observations to create information one can act on, and using observations to organize the imposition of meaning on others. There are many ways this process can go wrong, from a failure to collect the right information to misinterpreting the information itself, to not understanding the consequences of what actions the information inspires. So to collect massive amounts of data on a culture, as with the Human Terrain project in Afghanistan, does not mean that this data will foster more effective control, as the US defeat there demonstrates.

Having agency, doing something, does not guarantee efficacy. Veillance of all forms involves agency. Gazing is acting and acting on, but not always effective. To collect massive amounts of data no doubt *feels* effective to the bureaucrats of the NSA but what does it really accomplish? Unless the data collected becomes information that is understandable in a full knowledge system, it might well be more of a problem than a solution. To have data on the movements of leaders of an enemy network, and to have the drone technology to try and remotely kill them, encourages bureaucrats (up to the President of the United States) to order attacks that in the larger context are clearly failures. But the illusion of effective action is hard to resist; agency can be intoxicating.

Agency is a contentious topic in science and technology studies. Many observers confound the complexity of certain systems with ascribing agency for "things" as a way of explaining difficult patterns of causality (Gray 2014). But in the long run this is not just unhelpful but dangerous politically. The massive electronic surveillance programs of national security states such as the US, the UK, China and Russia, do not involve any decisions or desires of machines. The decisions and desires are those of the policy makers. Why they make the choices they do is the issue. Note that the agency of the gaze is clearly to be found in human actors, whether they are surveilling or sousveilling or autoveilling (from self-awareness to the new mania for the quantified self). But, of course, this all takes place in a cultural context that allows some things, and not others, the political economy of the discourse system.

Societies are systems of discourses. Actions and other forms of expressions have to be considered permissible by the rule and meta-rule systems that make up what can be called a regime of truth (after Foucault). The term political economy is used here to make it clear that assumptions about gender, class, race, ownership, justice, power and productivity are decisive aspects of any culture and they determine the framing of all understandings. But, however they are described, understandings come in many levels of complexity and usefulness.

Always in the computer industry, and sometimes in philosophy, distinctions are made between raw data, processed data, information, knowledge, and wisdom. This is a valuable framework for analyzing why certain kinds of Big Data have proven useless for exerting effective control while others are proving much more efficacious. In general, the more sophisticated the understandings the more useful the data/information/knowledge. While raw data is everything collected, processed data is what is culled and when organized at a higher level it is in form(ation). Knowledge is what puts formations of data into a useful context. Wisdom is the ability to use incomplete data, conflicting information, and paradoxical knowledge to make effective (pragmatically and morally) decisions.

A good illustration are current National Security Agency practices: Raw data is all the inputs from all the collected messages (across the spectrum) the NSA makes. Processed data is some of this signal data manipulated by machines to make it searchable. Information is what comes out of the processed data when programs are run on it to pick out patterns and anomalies in specific areas, searching for key words, specific addresses, listed names, correlations, and overlaps. Knowledge is what humans deploy when they look at the information that is flagged as possibly important. This knowledge may eventually conclude that the signals indicate some possible attack. Wisdom is what we is needed to deal in a balanced way with this knowledge.

This framing is useful from the other side of effectiveness as well. If all one wants to do is marginally increase the sales of colored sugar water, Big Data can be mined for insights on selling strategies and finding susceptible consumers effectively enough, but if the aim is to remake an ancient and unique foreign society into a client state of empire, forget it. It is crucial to differentiate the power of governments to control and the ability of corporations to sell (the level of knowledge needed, the importance of all types of feedback, and finally the amount of control required) because they are all quite different. It is important to remember that the desire for control is a necessary part of human success: control of our selves, control of others, control of our environment. Our hunger for data, our quest for information, our love of knowledge, are all about control. But control has its dark side, especially if you are the one being controlled.

Big Data is one of the newest socio-technical realms where a wide range of institutions think they can mobilize improved veillance to exert control. In this analysis, this includes the big data behind contemporary scientific projects. While. It is not usual to call the data behind technoscience BIG DATA, it obviously is. So why isn't it analyzed along with social media, finances and demographics? Consider how scientific “progress” is packaged and marketed. Suddenly, decades after atomic physics and informatics have transformed society (and the Earth itself), we are told that nanoscience and nanotechnology and nano deodorant are going to change everything. But what is smaller than atomic processes (way smaller than the 1/billioneth of a meter nano refers to), unless it is just the idea of the bit (yes/no), instantiated in electrons, or photons? Now, as scientists and engineers and military planners and corporate leaders are beginning to leverage massive amounts of data in all sorts of wonderous and/or horrific ways, we are told, BIG DATA is just arrived, in the form of the “cloud”, e-communications that the NSA can capture, social media, the interweb in general.

It isn't that these things are not important. Of course they are, but this is hardly the advent of "Big Data"; it is just its latest manifestation.

Big Data, Human Intelligence and Power

> "…we are pursuing a conflict between rival organizational principles, not between specific networks or individuals."
>
> CrimethInc.com (n.d., p. 8)

The origins of Big Data are clear. Not only has computer processing power continued to increase under Moore's Law, but the costs of storage have fallen just as fast (sometimes called Kryber's Law), so collecting and keeping incredibly large amounts of data is now relatively cheap. Still, there is no consensus on what "Big Data" even means (Ward and Barker 2013; Editors, *MIT Technology Review* 2013). This has allowed some commentators to make some sweeping claims. For example, Gerd Leonhard proclaims:

> For the purpose of this discussion lets define 'big data' with my 5V's (expanded from Gartner): the exponential growth of data -velocity, -variety, -volume, -virility and -value. In other words, a lot like before but vastly larger, faster, more varied, more viral and massively valuable - and in the aggregate of these 5 trends lies its mind boggling potency. IMHO, Big Data's economic and social importance will rival that of the oil economy by 2020- and mobile devices are already the key driver of big data, globally.
>
> (Leonhard 2014)

It is not a very balanced definition and the measure "virility" is not one usually found in technical discussions of data bases. In many ways, the best definition might just be that "big data is data that challenges current paradigms and practices" but equally helpful are definitions that give actual sizes (Intel's that "big data is 300 terabytes weekly"), qualities (complexity along with size) and the wry admission that the whole issue is slippery (Microsoft's "seriously massive and often highly complex sets of information") (Ward and Barker 2014). But the hype cannot be avoided. Chris Anderson gives a classic example of how wild it can get in his article "The End of Theory: The Data Deluge Makes the Scientific Method Obsolete":

> This is a world where massive amounts of data and applied mathematics replace every other tool that might be brought to bear. Out with every theory of human behavior, from linguistics to sociology. Forget taxonomy, ontology, and psychology. Who knows why people do what they do? The point is they do it, and we can track and measure it with unprecedented fidelity. With enough data, the numbers speak for themselves.
>
> (Anderson 2008)

Written in 2008, this could be the theory behind the NSA's massive data collection program. And we can now say with certainty, the numbers do not "speak for themselves." It isn't just the failure of massive data collection to win the wars in Afghanistan and Iraq as it failed to win the Vietnam War 50 years ago (Gray 1997). It has been given many names: *The Electronic Battlefield*, *Total Battlefield Awareness*, the *Human Terrain*, but it has never produced victory. Even by more limited standards, stopping terrorism or pursuing criminality, Big Data has failed.

An important analysis by two computer science professors at Yale asks, "Is amassing mountains of privacy-sensitive 'metadata' *technically necessary* for effective, lawful electronic tracking and surveillance of legitimate targets?" and answers, "emphatically *no*." (Feigenbaum and Ford 2014, original emphasis). The NSA itself, in a report released in 2014, claims that in all of 2013 it was only seeking information on 248 individuals in the US even as it collected phone data on almost everyone in the country (Ackerman 2014). And a number of studies of Big Data applications in the real world have shown that it is often not as successful as they first seemed. Marc Parry (2014) reviews this debate in an article for *The Chronicle of Higher Education*, beginning with the failure of Google Flu Trends (analyzing flu-related Google searches) to accurately model the spread of flu (by a factor of 100%). He also looks at research that indicates that the use of Big Data by the Obama campaign was not an important factor in its victories, although in India there seems to have been more success (D'Monte and Gadgil 2014), and another study that "exposed flaws" in attempts to "mine social-media behavior to discover people's demographic traits." While some social scientists write this off as the "birthing pains" of a "new kind of social science" and promise that Big Data can "address" such big issues as "the origins of tastes and norms", where "desires come from" and how "individual actions" lead to collective phenomena," how this will happen is not explained, accept to gush over how much data is being collected (quotes from Parry 2014).

But the difficult part of human perception, and academic studies, is usually not the limits on the amount of data that can be sucked up, it is evaluating, categorizing, and understanding it. Gary Marcus and Ernest Davis (2014), professors of psychology and computer science respectively at New York University, lay out some of the "problems with Big Data." For example, correlations (a major tool of Big Data mining) don't prove causality, or even a connection. Many are just artifacts produced by chance. Murder rates from 2006-2011 correlate "with the market share of Internet Explorer" but who really thinks there is a relationship between them? They go on to detail the gap between information from Big Data and scientific knowledge, the problem of gaming Big Data algorithms (such as the automated grading of student essays or reverse engineering Google search criteria), the poor quality of results even from exemplary projects (Google Flu trends), the echo-chamber effect, and the inability of Big Data to analyze the unusual.

That Big Data projects have not produced the results some fans expected is interesting, but the important issue is why. The heart of the answer is in the distinctions from the computer industry introduced above: data, information, knowledge. It is exactly the opposite of what Chris Anderson claimed in his article, quoted above, "The End of Theory: The Data Deluge Makes the Scientific Method Obsolete." It turns out, that data without theory is worse than useless, it is counterproductive. And that Big Data in the service of the Scientific Method is the opposite of obsolete, it is the most potent form of data there is. Because unlike the theories of bureaucrats (political or military), the scientific method is open ended, and is predicated on continual self-correction. This is why the deployment of Big Data in the military world has proven so difficult. It isn't enough to commit to C3I (Command, Control, Communication and Intelligence) or even (as happened briefly in the 1980s C4I2--Command, Control, Communication, Computers, Information and Interoperability) (Gray 1997, pp. 62-3). Ideologies, especially as manifested in bureaucratic slogans, are not knowledge.

Intelligence is the military term for information. It's importance has been recognized for thousands of years, going back to Sun Tzu's *Art of War* (Gray 1997). The issue with intelligence, as with information, is determining how reliable it is, how it fits into your knowledge of your enemy and the military situation, and what to do with it. The United States national security establishment has a term, "actionable" intelligence, that is revealing. Consider the information that has convinced the US to launch drone strikes in Iraq, Afghanistan, Pakistan, Somalia and other theaters of operation. That it is sufficient to act on

(actionable) does not mean that it produces positive results. The action threshold is shaped by political and personal judgments, and is profoundly influenced by the actions of the "targets." Many commentators, even within the military, think the drone strikes have been counterproductive. It cannot be denied that the US military faces defeat in all the major theaters they've been deployed.

For complex systems such as war, involving incredible loops of cultural and moral interactions, having massive amounts of data does not automatically produce military victory. It did not in Vietnam, where massive amounts of data were first used, and it has not since, actually. The huge amount of data actually seem to open the door for political elites and military leaders to make whatever decisions they wish, they "mine" it for the conclusions they want. So far, the only successes for what is commonly called Big Data are in selling things. Mechanized stock trading makes macro profits out of micro differences in the floods of data. The same attention to small differences, perhaps of the tastes of consumers, can produce large profits at scale.

Netflix's sophisticated system for categorizing movies is a case in point. Here effective analysis of massive amounts of data is a real advantage in the marketplace. But Alexis Madrigal, in *The Atlantic* (2014), explains that it is actually not a pure Big Data mining operation, but rather it is a hybrid system. Netflix has combined detailed algorithmic analysis of the millions of viewing choices their customers make, with the opinions of hundreds of trained movie analysts to generate 76,897 micro genres. So Netflix's algorithms married to human expertise have proven very effective at suggesting new movies to watch for their customers. But not all such mobilizations of Big Data for marketing are so benign.

A 2013 report by the United States Senate Commerce Committee explores the operations of Data Brokers ("a multi-billion dollar industry") whose goal is to "collect and maintain data on hundreds of millions of consumers, which they analyze, package, and sell generally without consumer permission or input." Credit reports are used to target "financially vulnerable consumers" and related categories such as "widows" and the "buckets" (Leber 2014, discussed below). They collect information on offline behavior for the use of online marketers. "Data brokers operate behind a veil of secrecy." (US Senate 2013) Ironic, in that the privacy of people is what they violate and sell to make their money.

While "market research" has been going on for over 100 years, "What is new in recent years, however, is the tremendous increase in the volume and quality of digitally recorded data – and the technological advances that have facilitated access to, storage, analysis, and sharing of this information." (US Senate, 2013, p. XX) In 2000 "only one quarter of all the world's

stored information was digital" and "the rest was preserved on paper, film, and other analog media," by 2013 "less than two percent of all stored information is non-digital." (US Senate 2013, p. xxx; citing Cukier and Mayer-Schhoenberger 2013)

One clear social effect is the exploitation of certain groups who are defined as good markets for short term credit schemes and the like. Data mining is used to define many specific demographic categories. Inevitably (given the current economic realities) many of these groups (called "buckets" in the trade) are disadvantaged. The groups have such names as: "rural and barely making it", "Ethnic Second City Strugglers", "Fragile Families", "Zero mobility", "Living on Loans: Young Urban Single Parents" and so on. Big Data is used to create these categories, to decide how and what to market to them, and to find target customers in the "buckets" to apply the sales campaigns to (Leber 2014). This approach has led to clear discrimination (Gangadharan and Woolley 2014), even racism. In Google results, calling up arrest record databases, for example, when African-American names are searched for (Bosker 2013). Other algorithms produce results clearly influenced by classism and regional prejudices (Diakopolous 2013).

But the power of Big Data is much greater than marketing, when it is merged (as with Netflix) with knowledge. Consider its origins. The first sets of Bigger Data were about the physics of nuclear weapons. At the same time, climate models became larger and larger. Then came the command and control of weapons of mass destruction and various sets of financial records. As biology went digital, biodata (especially genetics) became another area producing massive amounts of measures and algorithmic assumptions. The latest area to explode into Bigger Data, is neuroscience, seeing and representing complex neurological processes. It promises to develop the potential for levels of social control that have only been dreamed of in the wilder fantasies of tyrants.

Knowledge, Neuroscience, and True Control

> "The most futuristic medical treatment every imagined is now a reality. But it won't be long before brain implants are even more amazing and troubling."

David Noonan (2014, p. 38)

The philosopher Ian Hacking (1983) has shown how the power of science to manipulate reality starts with its ability to effectively observe phenomena and represent it in some way. This allows for intervention. The acts of observing and representing are dynamic (effected by Heisenberg's Principle) and are limited, but they often lead to successful interventions.

The developing regime of global surveillance ("Collect Everything" is the unofficial motto of the NSA) is aimed at creating a representation of the social world with the goal of manipulating it successfully. While the approach is massified, the targets are individuals. Out of the masses of data key ideas, actual networks, and specific people are the targeted entities. Targeted for more surveillance, or manipulation by sister intelligence agencies, or for prosecution, persecution or execution. But not only is this approach crude, it has failed to produce good results because the "fit" between hierarchical governments and the affordances of horizontal networks is not close (Gray and Lopez 2014), and the models of human consciousness and agency used in either bureaucratic or computerized understandings just don't work. Corporations, seeking profits, have had more success for they form a distributed landscape and they seek to evoke just one behavior (buying), instead of meeting the complex goal of military operations: loyalty, or at least submission (Gray and Gordo 2014). But for real efficacy in technological interventions in politics, we need to look at the emerging science of mind control.

There are three major reasons for the recent progress in the area of technological mind control: 1) improved observational and modeling technologies; 2) the continued improvements in electrical implant research; and, most importantly; 3) the new field of optogenetics.

1) Real time 3-D brain tomography and the visible brain and other imaging technologies have been improving over the last 20 years. Recently, a major DARPA funded program at Stanford University has developed a technique, called Clarity, for "washing" brains of their fats so as to reveal the actual nervous system architecture (Tucker 2014a). A key step toward controlling minds is effectively visualizing and modeling them. It is knowing them, at least in terms of their material functions. Higher order reasons for having minds are not amenable to scientific deconstruction and appropriation.

2) Electronic chips and electrical probes on and in brains have a long history, including the sad story of the icepick lobotomy craze (Gray 2001) and extreme electro-convulsive

therapy. While lately there have been some important breakthroughs in this area of deep brain stimulation with over 100,000 patients implanted (Noonan 2014), it will soon be supplanted by the new approach of optogenetics. Chips, probes and electrical shocks are crude physical insults compared to broadcast light.

3) Optogentetics is the technoscience that involves genetically modifying brains (so far flies, worms, rats and nonhuman primates) so that even on the level of one neuron, they can be manipulated by light of different colors. Brain control "in a flash of light" as one overview put it (Gorman 2014). With one set of genetic modifications blue light activates neurons: with others orange light depresses their activity.

Consider the following text, from the "Optogenetics" entry of *Wikipedia*. Not for its scientific accuracy, although it is well documented that Wikipedia has a very high level of accuracy in the natural sciences, but rather as a current distillation, in this case for popular consumption, of the potent specificity of the "big data" and incredible knowledge behind the technoscience of optogentetics:

> Drosophila (fly) rhodopsin photoreceptors for controlling neural activity in cultured mammalian neurons first demonstration of a single-component optogenetic system, beginning in cultured mammalian neurons, using channelrhodopsin, a single-component light-activated cation channel from unicellular algae)... Leptosphaeria maculans fungal opsins, and enhanced bacteriorhodopsin (eBR) have been employed to inhibit neurons including in freely-moving mammals...Building on prior work fusing vertebrate opsins to specific G-protein coupled receptors a family of chimeric single-component optogenetic tools was created that allowed researchers to manipulate within behaving mammals the concentration of defined intracellular messengers such as cAMP and IP3 in targeted cells...The development of genetic targeting strategies such as cell-specific promoters or other customized conditionally-active viruses, to deliver the light-sensitive probes to specific populations of neurons in the brain of living animals (e.g. worms, fruit flies, mice, rats, and monkeys), and 2) hardware (e.g. integrated fiberoptic and solid-state light sources) to allow specific cell types, even deep within the brain, to be controlled in freely behaving animals. Most commonly, the latter is now achieved using the fiberoptic-coupled diode technology introduced in 2007, though to avoid use of implanted electrodes, researchers have engineered ways to inscribe a "window" made of zirconia that has been modified to be transparent and implanted in mice skulls, to allow optical waves to

> penetrate more deeply to stimulate or inhibit individual neurons...To stimulate superficial brain areas such as the cerebral cortex, optical fibers or LEDs can be directly mounted to the skull of the animal.
>
> ("Optogenetics", *Wikipedia*, July 1, 2014.)

Note the technical details of this knowledge (and this is but a mid-level abstraction). It is based on Big (one could say GIGANTIC) Data about brains, genetics, biochemistry, electricity and so on, but ends up going beyond information in the understanding of intertwined causes and effects that allows for powerful and precise manipulations. And what does this knowledge make possible? A survey of some of the latest optogenetics breakthroughs is revealing. It has gone significantly past speculation. The early stages of neuroscience have come to an end with the development of a wide range of specific and effective tools, starting with better observation systems of human cognition. Complex brain maps, DNA charting of specific neurons, real time three-dimensional brain tomography, and other recently developed observational (and therefore modeling) tools have made it possible to create effective ways of directly intervening in the human mind. And what interventions do they have in mind? So far, experiments have produced the following effects in subjects (usually mice, sometimes monkeys, occasionally humans): Brain fingerprinting and brain enhancement, brain-machine interfaces and drone control, mind influencing, lie detection and mind reading, techno-telepathy, inserting thoughts in dreams and memories into the mind, memories on or gone at the flick of a switch, mind control of other animals and humans, programming minds.

➔Brain Fingerprinting and Brain Enhancement: While brain "fingerprinting" is straightforward, building off the incredible advances in brain modeling and visualizing, "enhancement" is more complicated. But both are being driven, in neuroscience terms, by security and military priorities. On the knowledge level, one can mix talk of arguments, memes, norms, insights, inspiration, genius, gurus, discipline.... All enhancing according to someone. The lines dividing education, training and engineering are vague. There is also significant research in psychopharmalogical interventions as well. Amphetamines have been replaced by much better stimulants and coffee is outclassed by a number of drugs (Moreno 2013).

➔Brain-machine Interfaces and Drone Control: This work is a number of years old for crude yes/no and left/right, up/down types of control, which can be done by brain states (read

with scalp mounted sensors) or shallow electrodes. Optogenetics promises much more sophisticated interfaces.

➔Mind Influencing: The work that is currently deployed here doesn't involve implants at all, but rather uses brain, eye, and facial feature veillances to carry out neuro-marketing projects (Hipperson 2012). The goal is to find hot button issues (nostalgia for Coke, for example), unconscious desires (visible in eye and facial patterns), and surprising linkages. For certain systems (gambling machines, video games) biometrics such as these and others, and mining Big Data, are used to create machines that are "addictive by design" (Schüll 2012).

➔Lie Detection and Mind Reading: In the U.S., brain scan analysis that shows if someone is looking at a new stimuli or an old one is admissible in court as lie detection. ("Did you ever see this murder victim before?") With improving real time three-dimensional brain tomography, sophisticated brain maps, and tinier electrical and fiber optic sensors constantly being developed it is inevitable that effective general lie detection, and even the ability to read specific thoughts, will soon exist (Smith 2013).

➔Techno-telepathy: Scientists at Duke University have transferred thoughts (motor and sensory information) from one rat to another (Heaven 2014).

➔Inserting and Deleting Information in Dreams and Memories: At MIT specific information is implanted in rats while they sleep (Alok 2013; Bendor and Wilson, 2012) while at the University of California at San Diego a team has developed a system that allows them to turn memories (fear of a stimulus in this case) on or gone (off) at the flick of a switch (Fikes 2014).

➔Read and Control Emotions: DARPA (Defense Applied Research Projects Office), the U.S. military's preeminent research arm has funded a set of projects to create implants for "controlling emotions" in wounded soldiers and psychologically disabled veterans. Among the seven "mental illnesses" targeted are "addiction," "anxiety, and "depression". They are seeking to develop "control-commands" and "affective brain-computer interfaces" to control those emotions, which means increasing as well as decreasing them. The project is funded by DARPA's Systems-Based Neurotechnology for Emerging Therapies program: $79 million in two grants, one to the University of California Medical School in San Francisco and another to Massachusetts General Hospital (Regalado 2014). Video and images on this project are available from UCSF/UCB Center for neuroengineering and prosthesis (Berkley Newscenter, 2014)

Emotional manipulation is clearly a very powerful from of control, and it interests businesses as well. Facebook (FB) joined with academic researchers from Cornell and the University of California to regulate the Facebook feeds of 689,000 users so as to manipulate their emotions. They exposed them to more or less positive and negative inputs from FB friends in order to study "emotional contagion." While no specific consent was obtained, there is language in the boilerplate agreements every FB user consents to that they claim justifies the manipulation (Booth 2014). Even more troubling is the researcher's claim that they have proven that minor manipulations of FB input can strongly influence the emotions of people (Kramer, Gulliory, Hancock 2014).

This is a long standing interest of the US military as well, which has tried to predict tipping points in individual and group feelings using social media such as Twitter. As Lt. Gen. Michael Flynn, in chair of the Defense Intelligence Agency, puts it: "The information that we're able to extract from social media — it's giving us insights that frankly we never had before." He goes on to admit he worries people might stop using Facebook! (Tucker 2014b)

➔Mind Control of Other Animals and Humans: Scientists at Washington State have already turned chimps, and fellow scientists, into "meat puppets" where their limbs are controlled by someone else (Armstrong and Ma 2013).

Viewing, Representing and Intervening: The Future of Agency

> "A technology so powerful it can only be used for good….or evil."
>
> Firesign Theater

All of this work is part of what could be termed the consciousness studies industry, an emerging "military-industrial-spiritual-scientific complex" that has mushroomed now that it seems neuroscience (especially psychopharmacology and optogenetics) is on the brink of major advances in the instrumentalist control of mentation (Gray 2007). Not only have a number of government studies on the ethics of neuroscience recently come out (Royal Society 2012: Nuffield Society 2013) but the US government has committed to major funding for President Obama's BRAIN (Brain Research Through Advanced Innovative Neurotechnologies) project (US Executive Office of the President 2014; US Government 2013; Diettrich 2012).

Scientific breakthroughs, such as those described above, have made the direct mapping and even the control of consciousness seem not just possible, but inevitable to some observers. While full understanding and control are probably impossible, certainly in the foreseeable future, significant interventions will clearly be available soon. These projects are developing the ability to reprogram human minds. Reprogram, because we are all programmed into our worldview through the nurture of our culture, the nature of our bodies, and our experiences. But in the past reprogramming was messy and unreliable, depending on various types of coercion (including war and torture, whose real goal is this reprogramming, as per Scarry) and other forms of influence.

For all of this research the official goals (even of military projects) are officially limited to treating medical problems: delaying Alzheimer's and dementia, controlling Parkinson's, overcoming Post-traumatic Stress Disorder and depression. Some of the work is clearly aimed beyond the medically ill, at the socially "ill" as well. Sophisticated theories of social control (going back to Sun Tzu's *Art of War*) focus not on instrumentalist violence but the management of perceptions and values. Much of this has been, and is, very crude: terror, black/gray/white propaganda, programs to win "hearts and minds", brainwashing and drugging (Artichoke, MK Ultra). But the current wave of neuro-technologies promises something more precise and effective. And it isn't just for the "enemies" abroad.

Since the Vietnam War it has been official Department of Defense policy that the "home front" (domestic opinion) is the crucial weakness of the US's ability to project military power. So, unsurprisingly, much of the focus of social control research and operations of the military and other security services is on the US itself (see Gray 1997 for a history of this perspective). This focus is being pursued today with such initiatives as the NSA's massive domestic surveillance, Homeland Security regional centers (used to coordinate the shutdown of the Occupy camps across the US), the building of social databases on anarchist activists (as with the Federal Grand Jury in Seattle) (Gray and Lopez, 2014) and a significant campaign to monitor and manipulate Occupy and others through social media (Quinn and Ball, 2014).

There is no evidence that these initiatives will be successful in the long run. They are more likely to inspire increased resistance to US governmental policies, just as drone killings have in Pakistan, Afghanistan and Somalia. The point being, that as the ability to "see" more and more expands, the ability to control increases as well. But it isn't always a direct relationship, it depends on the type of seeing and the types of control. And much of

what is feared now, the NSA for example, isn't the biggest danger, for their seeing isn't sophisticated. In other realms (such as neuroscience), where it is linked to real knowledge systems (neurology, psychology, medicine), Big Data veillance promises much more, and threatens much more.

It's power will be multiplied by how it transforms other dynamics. Big Data is linked integrally to a number of other transforming processes, from ubiquitous computing (Alvaro 2013) to human sociality. How do we untangle the good from the evil possibilities if they are knotted together so tightly? By shaping what comes next. The ultimate danger of Big Data in the social media world and of Big Data neuroscience in our individual brains is the same – a loss of autonomy and agency, the ceding of our self-control to those with the data. The only way to prevent the actual implementation of effective mind control some day is mobilizing knowledge democratically, in open, horizontalist, decentralized, sustainable and ethical ways. The processes that produce the next 20 years of Big Data and veillance will determine if our future is a dystopian nightmare or something survivable. Yes, effective mind control represents a tremendous sea change in human-technology relations, as did the development of nuclear weapons. So there is much reason for pessimism. After almost 70 years of atomic and nuclear weapons (perhaps the first world changing product of a logic similar to that of Big Data), the best we have to show for it is the policy of Mutually Assured Destruction. So things could look pretty bad pretty soon.

But we can also project another vision (or is it a definition?) of Big Data. It is context, environment, the sensorium. It is what we can know. Electronic Big Data is an abstraction of certain parts of reality amenable to enumeration, but it isn't all that there is. We can't sense all that there is. That is why data is never enough. It takes knowledge and wisdom to transcend our epistemological limitations. And this is why big data from below is needed. Wikipedia, Wikileaks, the whole Open Source, commons, the committed, distributed horizontalist network of systems, is in opposition to the secret files of the security services. Neuroscience is in both worlds: In the official openness of science and the desires to heal; and in the empower clash with the demands of profit and power. Will neuroscience heal the wounds of the mind, or subjugate the mind, or both? Will it be produced by centralized, hierarchical processes or autopoesis, homeostatic conscious self-control, evolution and emergence? What is the role of our agency as citizens and human beings in this?

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