POLICING THOUGHTS
DEEP BRAIN STIMULATION A FUTURE CRIME PREVENTION MODEL

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The Command College Futures Study Project is a FUTURES study of a particular emerging issue of relevance to law enforcement. Its purpose is NOT to predict the future; rather, to project a variety of possible scenarios useful for strategic planning in anticipation of the emerging landscape facing policing organizations.

This journal article was created using the futures forecasting process of Command College and its outcomes. Defining the future differs from analyzing the past, because it has not yet happened. In this article, methodologies have been used to discern useful alternatives to enhance the success of planners and leaders in their response to a range of possible future environments.

Managing the future means influencing it—creating, constraining and adapting to emerging trends and events in a way that optimizes the opportunities and minimizes the threats of relevance to the profession.

The views and conclusions expressed in the Command College Futures Project and journal article are those of the author, and are not necessarily those of the CA Commission on Peace Officer Standards and Training (POST).

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"Imagine one way or another, all our experiences are chemically conditioned, and if we imagine that some of them are purely 'spiritual,' purely 'intellectual,' purely aesthetic,' it is merely because we have never troubled to investigate the internal chemical environment at the moment of their occurrence."

-- Aldous Huxley

Policing, in most instances, is a collection of protocols used to control people's behavior. A gang member killing a rival gang member is an example of behaviors police attempt to control. Strategies employed to control this behavior range from prevention to incarceration. No matter the strategies' efficacy, policing cannot monitor individuals constantly. Limited resources cause gaps in policing systems allowing for continuation of violent criminal acts.

Technological solutions are perfect gap fillers because they can provide constant, portable and reliable monitoring. Extending on Huxley's imagination, think of a world where a device the size of a pacemaker can change a person's violent tendencies. Brain augmentation accomplished by surgical procedures or pharmaceuticals is not new. Future medical applications, though, may allow portable microprocessors to sense specific brain functions and respond to violent behaviors.

If neurologists identify specific brain regions causing violent behaviors, then brain scan devices could detect activity in these areas and trigger a counteracting stimulus to interrupt a

violent behavior. This device becomes a highly desirable crime prevention tool if it targets violent brain functions and ameliorates violent tendencies from parolees. In the future, scientists may develop a system using this technology to send a pulse to the specific brain regions that control violent behaviors. If they do, the question becomes; will we use it?

Hula Hoops and Violent Thoughts

Envision a scenario of two kids playing independently. A boy playing catch with a ball and glove runs to retrieve a missed catch. As he enters the area occupied by a girl hula-hooping, his attention is diverted to the girl. He is astonished by her ability to maintain the hula-hoop. Instantly, he becomes jealous and uses his glove to touch the hula-hoop, knocking it out of its orbit around the girl and down to the ground. Startled, the girl stands there without acting our saying a word. Her friend, also hula-hooping, stops and tracks the boy as he continues running after the ball. Being a good and dedicated friend, she runs to catch him. Without hesitation or fear, she demands he apologize to her friend, and threatens to punch him if he does not comply. In this example, two acts of violence were conceived in the brains of two individual kids. How did both children transfer sensory input into violent action or threat of a violent action? Accepting that both children's brains functioned normally, what areas of their brains allowed them to process different stimuli and develop a course of action based on an emotion? Science may provide answers to these questions as we start to learn more about the brain.

The human brain is the primary organ separating humans from other biological organisms and allows humans to master and overcome their geospatial environment. Motor neurons, sensory neurons, and interneuron integration allows a person to walk across a room (Kandel & Jessell, 2009). In the case of the girl chasing the boy to demand an apology, the perceptual gyrus located in the frontal lobe sent a signal via a neural network to her leg muscles (Britannica,

2008). In her spinal cord, interneuron connections alternated the inhibition of motor and sensory neurons causing the girl's leg muscles to expand and contract in a speedy gait allowing her to catch the boy (Kandel & Jessell, 2009). Science provides the identification of various brain regions necessary for human movement. Therefore, future scientific discoveries may map brain regions responsible for committing a violent act.

Your Brain – A Short Primer

The human brain is divided into three components, and controls all aspects of voluntary and involuntary human behavior (Britannica, 2008). The cerebrum comprises the majority of the brain's mass. It controls higher functions such as recall, problem-solving, cognitive functions and emotions. It also controls movement. The cerebellum, at the lower rear of the brain, controls balance and coordination. Finally, the brain stem connects the brain to the spinal cord, controlling our autonomic functions such as breathing, heart rate and blood pressure. Language is a function of the integration between all three main components of the brain (Kandel & Jessell, 2009). If injury or illness disables one component of the language system, then the complex function of language is disrupted. More concisely, the girl who demanded an apology for the hula-hoop incident could not use language to interact with her adversary. The understanding of the language process was result of over a century's worth of scientific research, which has also worked to uncover much more about the mysterious organ resting roughly between your ears.

One of the remaining significant challenges to determine how the brain works is to be able to target a specific brain region that controls behaviors; in our case, violent behaviors. Watching a group of nine-year-old children playing in a group makes one believe violent tendencies are innate to all humans. To discuss this phenomenon, defining violence is a necessary first step. A simplistic definition of violence is an act causing harm. Schoolyard

aggression is an analogy not meant to lead the reader to believe parents should implant a behavior control device on a child, no matter how tempting. Aggression is a human characteristic that normal maturation of healthy people controls without the aid of medical intervention. Environmental and biological factors prevent normal development of some people, (i.e., psychopaths) for whom a surgically implanted behavior modification device may provide relief to unwanted emotions or behaviors.

Implants and Imaging

Brain implants to modify behaviors or feelings are in use today. One such use is in the treatment of depression. For some, traditional therapies offer little to no relief. In 2003, though, doctors began experimenting with deep brain stimulation. Neurologists implanted electrodes deep into the subgenual cingulated region, an area of the brain resting beneath the cerebrum that serves, in part, as an emotional region of the brain (Trudeau, 2005). Surgeons connected the electrodes to a wire threaded through the skull and under the skin to the front of the chest where the leads connect to a tiny power pack implanted beneath the skin (Trudeau, 2005). The power pack emits a constant mild electrical pulse directly to the brain region where emotions are developed (Trudeau, 2005). After device activation, the patients experienced a change in their depressive mood as was seen in earlier implant studies with Parkinson's patients (Bejjani M.D., et al., 1999). The device improved the behavior and mood of the patient better than tradition pharmaceutical therapies (Trudeau, 2005). The use of neural implants has shown effective to immediately alter mood and perception; advances in the electronic scanning of the brain are also showing promise in work to actually control behaviors.

New advances in brain imaging may produce discoveries about how the brain processes violent thoughts and actions. Imaging technologies have been used to capture brain functions for

over one hundred years (Vagg, 2008). The earliest forms of brain imaging used radioactive dyes injected into the brain intravenously and X-rays to capture images of brain areas showing blood flow deformities or displacements (Britannica, 2008). Computed tomography still uses X-rays with assistance from a computer to capture intracranial images of the brain. These types of brain scans allow scientists to detect brain abnormalities caused by illness or injuries that affect brain functions (Britannica, 2008). The risk to the test subject is obviously great due to the amount of radiation present in both techniques. Other forms of brain scans are numerous and offer limited surface level evaluation of the brain or use radiation, which is harmful to subjects on a prolonged basis.

Magnetic resonance imaging (MRI) and near infrared spectroscopy (NIRS) offer safer techniques to map brain regions (Britannica, 2008). MRI uses a powerful magnetic field to resonate atoms in the brain. A second magnetic field produces binary pulses causing certain atoms to resonate differently (Britannica, 2008). The result is an image of the brain that provides minute-to-minute variations in brain activity. A functional MRI (fMRI) provides the same three-dimensional picture of the brain with an additional feature to detect oxygenated blood in the brain (Johnson, 2004).

As brain activity in various brain regions ebbs and flows, a fMRI captures real time video of the brain activity. This allows a researcher to observe integrated brain regions function under test conditions allowing the researcher to pinpoint a brain region responsible for a specific behavior (Johnson, 2004). Dr. Kent Keihl of the University of New Mexico has used a fMRI to study prison inmates at the New Mexico State Prison and produced ground breaking results (Vagg, 2008). Dr. Keihl's study found approximately one in twenty inmates had a psychopathic personality disorder where some brain systems identified as a region affecting morality had not

developed normally (Vagg, 2008). Additional, Dr. Keihl found some psychopathic inmates' brains displayed a disconnection between the frontal cortex, region used for reasoning, and the amygadala, a small area of the brain responsible for fear, learning, and memory (Vagg, 2008).

On average, psychopaths have a 17 percent smaller amygdala than a person with a normal brain (Vagg, 2008). Dr. Keihl's study found a high correlation between serial killers and people who have a poorly developed communication system between the frontal cortex and smaller amygdalas. Where the frontal cortex developed a normal communication system, the person with a smaller amygdala tended to function normally in society (Vagg, 2008). If only violent criminals could be monitored by an fMRI constantly. Unfortunately, an fMRI is a five-ton $2 million machine making this concept impossible (Johnson, 2004).

A near infrared spectroscopy (NIRS) may offer a solution. This device is portable and relatively inexpensive (Britannica, 2008). It uses lasers to monitor blood flow observing how much light is refracted back from the brain (Britannica, 2008). Optical tomography is then used to draw maps of the brain and can assess cellular changes arising from neurons firing (Britannica, 2008). This process is quick and can provide changes in neural activity in well under a second (Britannica, 2008). A scaled down version of a NRIS is a perfect complement to the concept of deep stimulation device previously discussed.

Combining a NRIS and deep brain stimulation device creates a biofeedback loop to control a violent criminal's behavior. A wearable NRIS could detect this change in neural activity registering its findings on a central processing unit contained within a small power pack surgically implanted in the person. The CPU identifies this brain function as a potential violent behavior. Electrodes extending from the power pack deliver a low voltage stimulus to the Reticular Activating System (RAS) located in the brainstem and the frontal cortex. The stimulus

produces a sense of fatigue slowing down the person and simultaneously stimulating the frontal cortex producing elevated levels of reasoning to dissuade the perpetrator from the act prior to execution.

Timing is an essential consideration to control the thoughts of a violent offender. Since metrics are available to assess the process speed of perceiving a stimuli and neural reactions, it becomes theoretically possible to build a device fast enough to intercept the stimuli and neural reaction. The question then becomes how long will it take computers to become fast enough to intervene between thoughts and actions. The answer is now. Personal computers can already process information faster than the human brain. Therefore, the theory of surgically implanted behavior modification devices has a platform from which to launch. That leaves us with the social, political and moral choices of balancing the rights of the individual versus the safety of society.

To Implant or Not To Implant

Device implantation is an option that must be weighed against the status quo and other medical alternatives. Surgically implanted cardiac defibrillators and implants for deep brain stimulation are viable options seeing increasing acceptance by society. This acceptance will further promote the use of such devices and create a demand for continued application. It should also stimulate research and development, and possibly link their use to other illnesses or social issues such as a violent behavior control device. Recently, scientists have made improvements in the type of electrodes used in brain implants. This new technology will improve the use of brain implant devices that monitor brain illnesses and brain injuries. Partly made of ultrathin polyimide-silk arrays, the new electrodes are about five times the thickness of a human hair

(Kim, 2010). As the device becomes more convenient for patients, the volume of applications and diversity of use is likely to follow.

As technological advances are juxtaposed against the criminal justice system, impact on society, and the political environment raise many questions pertaining to the issue of using a surgically implanted device to control one's behavior. The questions range from how to legislate the use of such a device to issues of public acceptance of its use. Will a convicted person voluntarily use the device or will a court force a medical doctor to implant a device into a person, an invasive procedure that may be cruel and unusual? Will society accept the government using "mind control"? What are other technological trends that may make this concept obsolete? To answer these questions, a non-traditional research method was employed.

A panel of experts convened to discuss trends and events impacting these questions. The panel consisted of a pharmacist, a technologist, a computer scientist, a forensic psychologist, a procurement specialist, an attorney experienced in civil rights matters, a supervising parole agent, and a police lieutenant. The panelists were subject matter experts and well respected within their respective disciplines with a collective 200 years of experience.

As expected, much debate concerned the efficacy of a surgically implanted behavior modification device. How quickly this technology assimilated into the criminal justice arena was a top issue of the panelists. As they pointed out, prisoner rights groups may find the intrusiveness of the surgical implant into a prisoner's brain outside the limits of a reasonable punishment. Legal injunctions against this method of controlling a convicted persons' behavior would likely arise to challenge its application. Another insight brought forward was the complexity of the human brain in a sexual offender's mental processing of stimuli that trigger violent sexual encounters. For a sexual offender, the stimuli may be anger as opposed to sexual

arousal. Scientist would have to develop a brain implant robust enough to control both sexual arousal and anger within the human thought processes. Though theoretically conceivable, much more research is necessary to employ a device that could achieve the full range of desired results without creating any adverse outcomes.

Of course, there are emerging issues that may enhance interest in implants to control adverse behaviors. The current prison overcrowding issue facing the California Department of Corrections and Rehabilitation is fertile ground for policing agencies to begin assessing the possibility of county or local policing agencies using devices to monitor released prisoners. Los Angeles County Sheriff Leroy Baca's controversial idea for deputy sheriffs to supervise released prisoners supports the premise that released prisoners will influence operational aspects of all government policing and corrections agencies (Faturechi, 2011). As Sheriff Baca said, "It's kind of a cultural clash for probation officers to think law enforcement can do the same work they do. (Faturechi, 2011)" Though Sheriff Baca's statement provokes reactions on both sides of the argument, what is gleaned from his statement is the future is approaching and changing how policing agencies view released prisoner management may be a valid contemporary consideration.

Currently, local policing agencies are only indirectly involved in managing released prisoners. Parolees are allowed to reenter their communities of residence upon agreement to certain conditions. If a parolee violates a condition of his/her parole, then the parolee will return to prison after a CDCR due process hearing. A local policing agency can arrest a parolee if it becomes aware of a violation of parole conditions either passively or proactively. Police departments do not monitor parolees or participate in other aspects of assimilating a parolee into the community. The overwhelming intent of a police officer and parolee contact is to send that

person back to prison. On the contrary, CDCR parole agents incorporate rehabilitative protocols into their assessment of parolees.

New housing tolerances forced by court decisions may also force a new approach to how State, County, and local policing agencies manage released prisoners. Low-level non-violent offenders are being released back to their communities of origin without previously accepted parole conditions, many with only the equivalent of summary probation. County probation offices will assume the managing role of these release prisoners. Due to their summary probation status, many parolees will enjoy a non-revocable parole status. Revocable parole status has been a significant tool in local law enforcement's repertoire to solve gang member issues that sometime plague a community. The new system of releasing prisoner will substantially affects many Los Angeles County communities that have high concentrations of parolees.

This impact will be exacerbated when a released prisoner who was serving a sentence on a non-violent commitment offense reenters the community where his or her arrest charge was a violent offense. More concisely, defendants who plead to lesser non-violent offenses will meet the release criteria when in fact a violent offense had been committed. In theory, perpetrators of batteries, robberies, and some sex offenses will be released back into the community because their commitment offense was a non-violent drug charge. Without proper monitoring, the released prisoner must commit and be convicted of another offense in order to be placed back into prison.

Lastly, the county probation system may be over extended with the new workload. One may assume that the rehabilitative services formerly provided by the State may not follow the transition of prisoner management from the State to counties. The social service system may

become overwhelmed with prisoner reentry. Gaps within an overwhelmed criminal justice and social service system may be correlated with increased residential burglaries and strong-arm street robberies. Due to limited social service resource capacities for a released prisoner population who has poor job skills, a typical released prisoner may find fencing stolen property more economical. This generalization may not apply to the majority of released prisoners. However, even a small uptick in certain crimes will be dramatic in communities that live with a perception of fear. These and others factors will be motivating forces in society's desire to find ways to limit the impact of violent crime, and to control offenders effectively. While it is too early to tell how the privacy issues, effectiveness of implants technologies and social acceptance might impact the concept, the ability to end violent crime as we know it is a compelling vision. Actualizing that vision, although contentious, is a goal worth pursuing.

Conclusion

Certainly, there are a myriad of other issues to be addressed as science opens the doors of possibility. A surgically implanted behavior modification device could fill the gaps in the current model of public safety and exploit emerging technology to enhance traditional behavior changing methods.

Prison populations have increased to a maximum point in some states and violent behaviors of some released prisoners has not improved while in prison. Unfortunately, some behaviors have worsened, causing significant concern for the general public and government agencies sworn to protect society. The increased population of released prisoners will significantly influence local policing agencies. Developing new methods to mitigate the behavior and actions of persons posing a violent threat to society is a call to duty for all policing experts. If a biomedical device alters the mood and motor functions of patients, then can the

same device alter their level of (or absence of) aggression? The concept of using brain-altering devices to control behavior may be one future solution for society, and continues Huxley's investigation to its logical end.

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