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NEW HIGH: A FUTURE-ORIENTED STUDY OF AMERICAN DRUG POLICY

by

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December 2017

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Drug policy in the United States is reactive and unprepared for burgeoning phenomena related to the convergence of drugs and technology. In the twenty-first century, innovations are disrupting society with unconventional rules. This thesis investigated how emerging technologies and global megatrends might converge to affect the future of United States drug policy. Through a scenarios-based future studies methodology, global megatrends and other nascent variables intertwine in two fictional scenarios to highlight regulatory and ethical challenges. Thesis findings underscore how it is critical for the United States to remain adaptable and identify general long-term, cyclical forces. Subsequently, it is imperative to analyze how these forces might influence the environment of illicit drug use before current regulatory drug frameworks become obsolete. Thesis findings recommend that the U.S. government decriminalize illicit drugs and transition drug policy from the domain of law enforcement to a strengthened public and behavioral healthcare system. Finally, this thesis also recommends the creation of a national biotech ethics committee and an office of the future.

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NEW HIGH: A FUTURE-ORIENTED STUDY OF AMERICAN DRUG POLICY

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ABSTRACT

Drug policy in the United States is reactive and unprepared for burgeoning phenomena related to the convergence of drugs and technology. In the twenty-first century, innovations are disrupting society with unconventional rules. This thesis investigated how emerging technologies and global megatrends might converge to affect the future of United States drug policy. Through a scenarios-based future studies methodology, global megatrends and other nascent variables intertwine in two fictional scenarios to highlight regulatory and ethical challenges. Thesis findings underscore how it is critical for the United States to remain adaptable and identify general long-term, cyclical forces. Subsequently, it is imperative to analyze how these forces might influence the environment of illicit drug use before current regulatory drug frameworks become obsolete. Thesis findings recommend that the U.S. government decriminalize illicit drugs and transition drug policy from the domain of law enforcement to a strengthened public and behavioral healthcare system. Finally, this thesis also recommends the creation of a national biotech ethics committee and an office of the future.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADHD	attention-deficit/hyperactivity disorder
AI	artificial intelligence
BBI	brain-to-brain interface
BCI	brain-computer interface
BRAIN	Brain Research through Advanced Innovative Neurotechnologies
CSA	Controlled Substances Act
DARPA	Defense Advanced Research Projects Agency
DEA	U.S. Drug Enforcement Agency
DHS	U.S. Department of Homeland Security
DIYbio	do-it-yourself biology
FBI	Federal Bureau of Investigation
FDA	Food and Drug Administration
IoT	Internet of Things
LDS	lysergic acid diethylamide (also acid)
LOC	lab-on-a-chip
MAT	medication-assisted treatment
PCP	phencyclidine (also Angel Dust)
RFID	radio-frequency identification
VNS	vagus nerve stimulation

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EXECUTIVE SUMMARY

The United States' war on drugs has become a war of innovation, as criminals adapt new technologies faster than the government can regulate them.[1] Evaluative analysis of research and literature regarding the U.S. war on drugs indicates that the war is a systemic public policy failure.[2] The problem with losing the war on drugs is twofold. First, the United States has an ineffective drug policy that is not evidence-based, thus producing harmful consequences rather than real benefit to Americans.[3] The second problem is that it makes U.S. drug policy reactive and unprepared for emerging trends shaping the landscape of illicit drugs.

Disruptive technologies ignore conventional societal rules.[4] The history of illicit drug use in the United States is one of resilient adaptation and deviant innovation. A burgeoning technological revolution may change the landscape of the current policy environment with the introduction of such emerging technologies as embodied intelligence augmentation, synthetic biology, unmanned aerial vehicles, and the ability to use 3D printers to create new drugs. The literature on emergent trends and forces is rife with anticipation about how accelerating technological innovation could affect illicit criminal enterprises. It is critical that the United States identify long-term, cyclical forces, and analyze how these forces might influence the environment of illicit drug use in the country.

This thesis answers the question how might emerging technologies and global megatrends converge to affect the future of United States drug policy? Society often portrays drug policy reform through a false dichotomy: prohibition or full legalization.

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[1] Marc Goodman, *Future Crimes* (New York: Anchor Books, 2016), 429.

[2] Dan Baum, *Smoke and Mirrors: The War on Drugs and the Politics of Failure* (Boston, MA: Little, Brown and Company, 1996), vii.

[3] Fiona Godlee and Richard Hurley, "The War on Drugs Has Failed: Doctors Should Lead Calls for Drug Policy Reform," *BMJ* 355 (November 2016): 1, doi: https://doi.org/10.1136/bmj.i6067.

[4] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston, MA: Harvard Business Review Press, 2013), 98.

Between these two policy extremes, it is possible to envision alternative and preferred futures. New technologies warrant changing behavioral norms and cultural values. If U.S. drug policy is not adaptable, emerging technologies could ultimately make the ability to regulate illicit drugs obsolete due to digital convergence.

To capture the most relevant uncertainties and driving forces related to the landscape of illicit drug use, this thesis uses a future studies methodology. This methodology facilitates the exploration of present trends and potential systemic interconnections to identify forces that may influence the future. Occurring at the intersection of many trends, megatrends are large, transformative global forces in societal development expected to affect the probable future.[5] The megatrends driving this thesis include globalization, urbanization, Internet of things/hyper-connected society, and exponential technological growth.

This research uses a three-point Likert scale to classify emergent variables into three categories: *likely* (marijuana legalization, synthetic drugs), *possible* (nootropics, digital currency), and *radical* (artificial intelligence and brain-computer interfaces/neural stimulation). Combining megatrends with these emergent variables categories, two fictional scenarios underscore the challenges in defining a drug, governing its use, and incorporating ethical considerations into regulatory frameworks. The utility of scenarios is in their ability to highlight irreducible uncertainty and draw attention to the notion that the future is not predetermined.

The future may not emerge as a linear extrapolation of the present. Findings from each scenario underscore a challenge for how society decides to define a "drug." Furthermore, each scenario highlights the difficulty in regulating emergent forms of drug use, as well as potential ethical issues resulting from these nascent technologies. The United States needs a new social framework to incorporate rapidly growing technological innovations to change and modernize its drug policy.

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[5] Sue L. T. McGregor, "A Look Inside Creating Home Economics Futures: The Next 100 Years," *International Journal of Home Economics* 7, no. 1 (2014): 2.

The fictional thesis scenarios highlight countless interdiction challenges as the Internet has revolutionized an already lucrative transnational drug trade in a landscape of increasing global connectedness. Analysis of the fictional scenarios concludes that 1) people use drugs, 2) innovation is outpacing drug policy, and 3) the United States must rethink its approach to drug policy. The country is living through an era of exponential technological growth. The speed at which neoteric technologies emerge is unprecedented and beyond the ability of regulators to govern under current policy frameworks.

This research concludes that a national drug policy should reflect a deliberate system of doctrines leading to the intended outcome of reducing morbidity and mortality caused by drug use. To create a resilient, adaptable drug policy prepared for the future, the United States should decriminalize all drug use and move drug policy from the realm of law enforcement to public health. The federal government should also create an office of the future, as well as a national biotech ethics committee and strategy. Finally, a drug policy framework for the twenty-first century should actively promote expanded access to public and behavioral healthcare.

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I. INTRODUCTION

> After forty years, thousands killed, millions imprisoned, and $1 trillion spent…we are still no closer to controlling either the supply—or demand—side of the illicit drug trade.[1]

A. RESEARCH QUESTION

This thesis answers the question, "How might emerging technologies and global megatrends converge to affect the future of United States drug policy?"

B. PROBLEM STATEMENT

> Conformity to old ideas is lethal; it is rebellion that is going to change the planet.[2]

The United States has lost the war on drugs. Neuropsychopharmacologist Dr. David Nutt summarizes this claim with his assertion, "Anything that tries to measure or evaluate the success of the war on drugs inevitably finds that it has failed, so evaluation and measurement are either suppressed or not carried out in the first place."[3] Since President Richard Nixon infamously declared drug abuse "public enemy number one" in 1971, the United States continues to spend billions of dollars on the war.[4] Across the world, oil is the only industry larger than the illicit drug trade.[5] Analysis of the efficacy of the war on drugs consistently concludes that the herculean effort is a failure, as outlined in Figure 1.[6] According to Dr. Nutt, policies concentrated on decreasing the prevalence of illicit drug use are ineffective and "often cause more harm than good."[7] This is a policy problem.

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[1] David Nutt, *Drugs Without the Hot Air* (Cambridge, England: UIT Cambridge Ltd., 2012), 280.

[2] Joshua Cooper Ramo, *The Age of the Unthinkable: Why the New World Disorder Constantly Surprises Us and What We Can Do about It* (New York: Little, Brown and Company, 2009), 262.

[3] Nutt, *Drugs without the Hot Air*, 273.

[4] Evan Wood et al., "The War on Drugs: A Devastating Public-Policy Disaster," *The Lancet* 373, no. 9668 (2009): 989, doi: 10.1016/S0140-6736(09)60455-4.

[5] Nutt, *Drugs without Hot Air*, 276.

[6] Dan Baum, *Smoke and Mirrors: The War on Drugs and the Politics of Failure* (Boston, MA: Little, Brown and Company, 1996), vii.

[7] Ibid., 22.

Figure 1. Perverse Effects Caused by the War on Drugs[8]

Dr. Nutt, former chair of the Advisory Council on the Misuse of Drugs, outlines eight negative repercussions caused by the war on drugs:

1. Increasing the spread of infectious disease.
2. Causing terminally ill people to die in agony.
3. Increasing instability and unaccountability in financial systems.
4. Holding back research on new medicines.
5. Increasing levels of drug-related violence and crime.
6. Increasing the number of users by forcing them to become dealers.
7. Bringing the law into dispute; allowing discriminatory policing.
8. Diverting attention away from the dangers of alcohol and tobacco.

For decades, illicit drug use is causing rising morbidity and mortality across the United States.[9] According to the Substance Abuse and Mental Health Services Administration, in 2014, over 10 percent of Americans had used illicit drugs within the past month of the survey.[10] With over 27 million citizens admitting to using illicit drugs within the past month in 2014, the incidence of misuse of alcohol, tobacco, marijuana, prescription drugs, and other substances continues to rise. This trend is not new; research examining rates of lifetime substance use disorder indicate a national increase among adults from 10.3 percent in 2002 to 15.6 percent in 2013.[11] Additionally, the Centers for Disease Control and Prevention report that over 47 thousand citizens died from drug overdoses in 2014, indicating more than a doubling of the rate from 2000.[12] According to

[8] Ibid., 274.

[9] Christopher S. Carpenter, Chandler B. McClellan, and Daniel I. Rees, "Economic Conditions, Illicit Drug Use, and Substance Use Disorders in the United States," *Journal of Health Economics* 52 (March 2017): 63, doi: 10.1016/j.jhealeco.2016.12.009. 63–73.

[10] Sarra L. Hedden et al., *Behavioral Health Trends in the United States: Results from the 2014 National Survey on Drug Use and Health* (U.S. Health and Human Services Publication No. SMA 15-4927) Rockville, MD: Center for Behavioral Health Statistics and Quality, 2015, https://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.pdf.

[11] Bridget F. Grant et al, "Epidemiology of DSM-5 Drug Use Disorder: Results from the National Epidemiologic Survey on Alcohol and Related Conditions–III," *JAMA Psychiatry* 73, no. 1 (2016): 40, doi: 10.1001/jamapsychiatry.2015.2132.

[12] "Drug Overdose Deaths Hit Record Numbers in 2014," press release, Centers for Disease Control and Prevention, December 18, 2015, https://www.cdc.gov/media/releases/2015/p1218-drug-overdose.html.

the U.S. Government Accountability Office in 2017, illicit drug overdose is now the leading cause of death by injury in the United States.[13]

Illicit drug use is a homeland security problem. In 2007, the Department of Justice's National Drug Intelligence Center estimated that illicit drug use costs the United States over $193 billion dollars per year.[14] In fiscal year 2016, the U.S. government spent $30.6 billion on drug control alone.[15] Aside from the staggering economic impact, the high prevalence of illicit drug use affects other domains tangential to the homeland security enterprise. For example, according to the U.S. Government Accountability Office in 2016–2017, evidence demonstrates high rates of drug abuse among veterans.[16] The Federal Bureau of Prisons claims that approximately half of the federal prison population is serving sentences for crimes related to drugs.[17] Similarly, the U.S. Drug Enforcement Administration (DEA) spends considerable resources tracking more than 33,000 domestic gangs involved in drug trafficking and distribution.[18] The threat posed by illicit drug use is transnational.

The problem with losing the war on drugs is twofold. First, the United States has an ineffective drug policy that is not evidence-based, thus producing no real benefit to Americans.[19] The second problem is that it makes U.S. drug policy reactive and unprepared for emerging trends shaping the landscape of illicit drugs. This is important

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[13] "Illicit Drug Use," U.S. Government Accountability Office, accessed June 4, 2017, https://www.gao.gov/key_issues/illicit_drug_use/issue_summary.

[14] Economic impact cost estimate includes fiscal impact of healthcare, crime, and lost productivity; Sam Taxy, Julie Samuels, and William Adams, *Drug Offenders in Federal Prison: Estimates of Characteristics Based on Linked Data* (NCJ 248648) (Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics, 2015).

[15] *Statement of Diana C. Maurer, Office of National Drug Control Policy: Progress toward Some National Drug Control Strategy Goals, but None Have Been Fully Achieved* (GAO-16-660T) (Washington, DC: U.S. Government Accountability Office, 2016), http://www.gao.gov/assets/680/677235.pdf, 1.

[16] "Illicit Drug Use," U.S. Government Accountability Office.

[17] Ibid.

[18] Mary Ellis, "Street Gangs: A National Security Threat," *The Journal of Law Enforcement* 5, no. 2 (2016): 1, 2.

[19] Fiona Godlee and Richard Hurley, "The War on Drugs Has Failed: Doctors Should Lead Calls for Drug Policy Reform," *BMJ* 355 (November 2016): 1, doi: https://doi.org/10.1136/bmj.i6067.

because trends may emerge as a string of random unconnected dots on the fringe that eventually materialize into the mainstream.[20]

Since 1970, the Controlled Substances Act (CSA) has governed U.S. drug policy. The act established a federal drug policy regarding the manufacture, importation, possession, use, and distribution of certain substances falling under five schedules in accordance with such criteria as potential for abuse and currently accepted medical use.[21] In this categorization, schedule I drugs are the most highly regulated while Schedule V drugs are considered the least dangerous are less regulated. Schedule I drugs have a high potential for abuse, no currently accepted medical value, and a lack of accepted safety for use of the drug.[22] Examples of drugs in this category include heroin, ecstasy, and marijuana.[23]

A snapshot of marijuana use in America today provides evidence of how the war on drugs is failing to keep pace with a societal shift for legal access to the drug. While marijuana remains federally illegal as of 2017, 29 states and the District of Columbia have approved the use of marijuana for medicinal purposes. Further ignoring federal law, nine states and the District of Columbia have approved legislation for the legal recreational use of marijuana.[24]

Critics claim that politics—rather than evidence—formed the basis for the decision to classify cannabis as a schedule one drug.[25] To support their point, they point to research studies highlighting the medicinal benefits of using marijuana for treating a number of conditions including glaucoma, seizure disorders, chronic pain, muscle and

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[20] Amy Webb, *The Signals Are Talking: Why Today's Fringe is Tomorrow's Mainstream* (New York: Public Affairs, 2016), 48.

[21] Controlled Substances Act, 21 C.F.R. §812 (1970).

[22] David J. Nutt, Leslie A. King, and David E. Nichols, "Effects of Schedule I Drug Laws on Neuroscience Research and Treatment Innovation," *Nature Reviews* 14, no. 8 (2013): 577.

[23] Controlled Substances Act, 21 C.F.R. §812 (1970).

[24] The following jurisdictions have legalized the recreational use of marijuana: Alaska, California, Colorado, District of Columbia, Maine, Massachusetts, Nevada, Oregon, and Washington. NORML, "Legalization," accessed February 4, 2017, http://norml.org/legal/legalization.

[25] Stanley J. Watson, John A. Benson, and Janet E. Joy, "Marijuana and Medicine: Assessing the Science Base: A Summary of the 1999 Institute of Medicine Report," *Archives of General Psychiatry*57, no. 6 (2000): 547–552.

spasticity as well as helping patients with nausea due to chemotherapy.[26] To critics of the war on drugs, it appears incongruent to declare marijuana as more hazardous than cocaine, oxycodone, or methamphetamine—all of which fall into a lower Schedule II classification. This juxtaposition indicates the politicization of the scheduling of controlled substances. Furthermore, it highlights how conflicting information undermines public confidence as individuals look beyond government documents for sources of information.[27]

In contrast to findings in evidence-based and peer-reviewed literature, the United States continues to push forward with ineffective supply reduction strategies. According to the Office of National Drug Control Policy, domestic supply reduction measures include regulation, enforcing anti-drug laws, eradicating marijuana plants, controlling the supply of precursor chemicals, screening prisons for drugs, creating drug-free school zones, and the implementation of screening procedures at customs.[28] Internationally, supply reduction strategies include global accords, initiatives to prevent money laundering, drug-crop eradication, controlling precursor chemicals, and other means. As a strategy, supply reduction is not working.[29]

1. A War of Innovation

The war on drugs has become a war of innovation, as criminals adapt new technologies faster than the government can regulate them.[30] Illicit use of the Internet's dark web provides an example of deviant innovation. In 2017, illicit drugs are available

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[26] Kevin P. Hill, "Medical Marijuana for Treatment of Chronic Pain and Other Medical and Psychiatric Problems: A Clinical Review," *Journal of the American Medical Association* 313, no. 24 (2015): 2474–2483.

[27] Nutt, *Drugs without the Hot Air*, 31.

[28] "IV. A Comprehensive Approach," Office of the National Drug Control Policy, accessed February 22, 2017, https://www.ncjrs.gov/ondcppubs/publications/policy/99ndcs/iv-g.html.

[29] U.S.-Mexico border expert, Dr. Tony Payan, summarizes the failure of supply reduction strategies: "A frontal attack on a particular group providing an illegalized good may reduce the supply temporarily, but the demand does not go away and the supply is fairly elastic. Thus drug traffickers simply shift strategies to continue supplying drugs." Tony Payan, *The Three US-Mexico Border Wars: Drugs, Immigration, and Homeland Security*: 2nd ed. (Santa Barbara, CA: ABC-CLIO, 2016), 33–34.

[30] Marc Goodman, *Future Crimes* (New York: Anchor Books, 2016), 429.

for purchase online using technologies, like bitcoin and Tor, which make sales and purchases nearly impossible to track.[31]

The presence of pharmaceutical drugs continues to challenge federal, state, and local efforts to prevent illicit drug use. For instance, after federal and state governments strictly regulated abuse of prescription painkillers, the United States has developed an opioid epidemic.[32] The epidemic has claimed the lives of more than 33,000 Americans due to overdose in 2015 alone, as people substituted prescription opioids with heroin and other opiates like the drug fentanyl.[33] In 2017, pharmaceutical companies continue to produce more performance-enhancing drugs with strong, legal, direct-to-consumer marketing.[34]

Despite popular perception, illicit drug use extends beyond the realm of criminals and lower income populations. The World Chess Federation reports that players often test positive for the use of modafinil and Ritalin to enhance performance during chess matches.[35] Likewise, college students colloquially refer to Adderall, a drug frequently used to treat attention deficit hyperactivity disorder, as "Ivy league crack."[36] These "smart drugs" positively augment cognitive function, and researchers anticipate the development of even more effective compounds in the future.[37] Given their legal pharmaceutical status, current drug prohibition efforts make controlling illicit use a

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[31] James Martin, "Lost on the Silk Road: Online Drug Distribution and the 'Cryptomarket,'" *Criminology and Criminal Justice* 14, no. 3 (2014): 351–367.

[32] Robert L. DuPont et al., "Are Prescription Opioids Creating a New Type of Heroin User?" *Journal of Global Drug Policy and Practice* 11, no. 1 (2017): 18–24.

[33] Donald S. Burke, "Forecasting the Opioid Epidemic," *Science* 354, no. 6312 (2016): 529, doi: 10.1126/science.aal2943.

[34] Henry Greely et al., "Towards Responsible Use of Cognitive-Enhancing Drugs by the Healthy," *Nature* 456, no. 7223 (2008): 702–705.

[35] Andreas G. Franke et al., "Methylphenidate, Modafinil, and Caffeine for Cognitive Enhancement in Chess: A Double-Blind, Randomised Controlled Trial," *European Neuropsychopharmacology* 27, no. 3 (2017): 248–260.

[36] "The Drug Adderall, Also Known as 'Ivy League Crack,' Is Not What It's Cracked Up to Be," Wet Bin, December 10, 2017, https://wetbin.com/the-drug-adderall-also-known-as-ivy-league-crack-is-not-what-its-cracked-up-to-be/.

[37] Vince Cakic, "Smart Drugs for Cognitive Enhancement: Ethical and Pragmatic Considerations in the Era of Cosmetic Neurology," *Journal of Medical Ethics* 35, no. 10 (2009): 611–615.

daunting challenge that will only become more difficult as new pharmaceutical drugs enter the market.

A burgeoning technological revolution may change the landscape of the current policy environment with the introduction of such emerging technologies as embodied intelligence augmentation, synthetic biology, unmanned aerial vehicles, and the ability to use 3D printers to create new drugs. It is critical that the United States identify long-term, cyclical forces, and analyze how these forces might influence the environment of illicit drug use in the country.

2. Future Scenarios for Drug Policy Reform

This thesis operates under the premise that the war on drugs is a policy failure. A significant amount of literature on drug policy deliberates the ideological and moral foundation of certain drug laws. Other discourse focuses on the manipulation of drug policy for political convenience.[38] While this examination of drug policy is indispensable, there is a current knowledge gap regarding how emerging technology and global megatrends could influence the future of U.S. drug policy. New technologies warrant changing behavioral norms and cultural values. They also facilitate a confrontation of established beliefs based on outdated technology. At the core of social change are new technologies innovatively disrupting society with unconventional rules. If U.S. drug policy is not adaptable, emerging technologies could ultimately make the ability to regulate illicit drugs obsolete.

Forecasting visions of potential future drug use form the foundation for present action pertaining to policy.[39] Solutions proposed in literature on the war on drugs typically call for drug policy reform. For instance, the Global Commission on Drug Policy concluded that society must transform the international prohibitionist approach to illicit drugs with the creation of a policy regime grounded in science, health, and human

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[38] *13th*, directed by Ava DuVernay (Netflix, 2016), DVD.

[39] James Allen Dator, *Advancing Futures: Future Studies in Higher Education* (West Port, CT: Greenwood Publishing Group, 2002), 8.

rights.[40] Society often portrays drug policy reform through a false dichotomy: prohibition or full legalization. Between these two policy extremes, it is possible to envision, identify, and invent alternative and corresponding preferred futures.[41]

Using future studies research methodology, this thesis aims to explore present technological trends, global megatrends, and potential systemic interconnections to identify how these forces may influence the future of U.S. drug policy. The intersection of multiple forces shape important effects; scenarios aim to capture relevant uncertainties and driving factors to highlight different plausible futures.

C. LITERATURE REVIEW

There is no reason for any individual to have a computer in their home.

—Ken Olsen, Founder of Digital Equipment Corporation, 1977[42]

1. Futures and Megatrends

Reality is infinitely complex, and humans have a compulsive explanatory urge to interpret and understand personal experiences.[43] The future is both predictable and unpredictable, although these categories are not mutually exclusive. According to futurist Amy Webb, a trend is "a new manifestation of sustained change within an industry, the public sector, or society, or in a way that we behave toward one another."[44] Trends do not occur in a vacuum; compounding acceleration from changes in emergent technology influences how trends move from the fringe to the mainstream.[45]

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[40] Global Commission on Drug Policy, *War on Drugs: Report of the Global Commission on Drug Policy* (Geneva: Global Commission on Drug Policy, 2011).

[41] Jim Dator, *What Futures Studies Is, and Is Not* (Honolulu: University of Hawaii, 2007), www.futures.hawaii.edu/publications/futures-studies/WhatFSis1995.pdf.

[42] Niels Pinkwart, "Another 25 Years of AIED? Challenges and Opportunities for Intelligent Educational Technologies of the Future," *International Journal of Artificial Intelligence in Education* 26, no. 2 (2016): 771–783.

[43] Philip E. Tetlock and Dan Gardner, *Superforecasting: The Art and Science of Prediction* (New York: Broadway Books, 2015), 37.

[44] Webb, *The Signals Are Talking*, 47.

[45] Ibid., 57.

Occurring at the intersection of many trends, megatrends are large, transformative global forces in societal development expected to affect the probable future.[46] Occurring in the present, megatrends indicate a world in motion.[47] To forecast and envision plausible futures, it is important to first identify and investigate these long-term forces. Subsequently, understanding the interaction between overlapping trends is equally important. Seeking answers to epistemic uncertainty, megatrends research comprises broad trend analysis research, which evaluates social, economic, and political conditions forecast to change the environment in the near future. This research methodology does not present deterministic, succinct narratives of the future. Rather, megatrends research describes probable futures, recognizing that there are many possible futures. Moreover, there is always the chance of an unlikely wildcard event, such as 9/11, that can create counter-forces to established trends. For example, State Secretary Joergen Ørstrøm Møeller in the Danish Ministry of Foreign Affairs argues that the United Kingdom's 2016 decision to succeed from the European Union was partially due to a backlash against globalization.[48]

Literature on megatrends research primarily comprises reports, scholarly articles, books, and systematic reviews. In dealing with probable, possible, and preferred futures, the tone of existing literature varies on a spectrum from optimistic to pessimistic. Many articles have a tone of peril, warning readers of the threats of what could happen if society fails to act. Other articles focus on the potential of technological developments promising to improve the human condition. Reports differ based on the intended target audience. For instance, some research is specific to manufacturing industries. Other research is jurisdiction-specific, such as CSIRO Futures research, which focuses on how

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[46] Sue L. T. McGregor, "A Look Inside Creating Home Economics Futures: The Next 100 Years," *International Journal of Home Economics* 7, no. 1 (2014): 67.

[47] EY, *Megatrends 2015: Making Sense of a World in Motion*, EY, 2015, http://www.ey.com/Publication/vwLUAssets/ey-megatrends-report-2015/$FILE/ey-megatrends-report-2015.pdf.

[48] Joergen Oerstroem Moeller, "Trump and Brexit: Some Lessons for Southeast Asia," *ISEAS Perspective* 2017, no. 11 (2017): 1–6.

global trends will affect Australia explicitly.[49] Timeframes of megatrends literature generally remain within a 10–20 year time span. For instance, some reports contain 10-year projections, while other sources focus on megatrends expected to affect the next 15–20 years.

Researchers identify megatrends with a fair degree of consistency. Given labels for megatrends are variable, but many of the chosen classification schemes nonetheless appear to fall into the same category. For example, a megatrend focused on an increasing influence of technology is described across the literature with such diverse titles as "technological convergence," "technological breakthrough," "technological singularity," and "disruptive technology." Some publications also identify megatrends that are outliers, such as "multipolar geopolitics," which stand unique when contrasted with most other research in the field. Each source of information on megatrends varies in the number of identified megatrends, although most sources identified for this literature review comprised, on average, six to 10 distinct trends.

Despite variance in labeling and identification, common themes emerge across the literature on megatrends, which allows for the aggregation of perspectives. Globalization is taking place, and it is strongly expected to increase in the future.[50] The world economy is shifting west to east, with an anticipated surge in middle class growth and increasing urbanization.[51] Megatrends research forecasts demographic change as the world faces an aging population, increased discretionary spending power, class ascendancy, individualism, and surging opportunities for entrepreneurialism. Megatrends researchers anticipate exponential growth and a hyper-connected, digital world of prosperity, complexity, and acceleration wherein data is the raw material of the information age.[52]

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[49] Stefan Hajkowicz, Hannah Cook, and Anna Littleboy, *Our Future World: Global Megatrends that Will Change the Way We Live. The 2012 Revision* (Brisbane, Australia: CSIRO, 2012), doi: https://doi.org/10.4225/08/584ee9706689b.

[50] Claire Kramsch, "Teaching Foreign Languages in an Era of Globalization: Introduction," *The Modern Language Journal* 98, no. 1 (2014): 296–311.

[51] Stefan Hajkowicz, *Global Megatrends: Seven Patterns of Change Shaping Our Future* (Brisbane, Australia: CSIRO Publishing, 2015), 7.

[52] Alec Ross, *The Industries of the Future* (New York: Simon and Schuster Paperbacks, 2016), 182.

Interpretations of established megatrends vary. For example, there is a consensus that digital connectedness is leading to a change in social behaviors, but there is no clear agreement about how to elucidate this shift. Viewing this shift as positive or negative depends on the author's interpretation, as some reports focus on how people are moving away from corporations and toward the individual, while other reports focus on how digital connectedness is leading to an increased demand for personalized services and experiences. Evaluation of any trend can be portrayed in either a positive or a negative light. As concluded by research on megatrends, the most important factor is that society remains open and adaptable rather than working to oppose the force of change.[53] This requires an intellectual flexibility to reconcile probable futures with irreducible uncertainty.

Even with an abundance of research on megatrends, flaws and gaps in the literature remain. Forecasting methods often lack objective, scientific monitoring or evaluation to determine the accuracy of predictions. Methodologies across studies also differ as researchers use a wide range of techniques, including predictive modeling, foresight studies, scenarios, and analysis of trends databases. From these varied techniques, it is unclear how researchers rank the significance of megatrends in their analysis. This leads to inconsistent results, as some studies list urbanization, for example, as one of the top three megatrends likely to influence the future, while other authors rate urbanization lower on the list.[54] Literature on megatrends research appear to maintain a high degree of internal validity, though the accuracy of claims made in conclusions remain unknown for years. Additionally, megatrends research leaves certain areas unexplored. For instance, even if the megatrends occur as forecasted, it is unknown how societies will react to the forces. Moreover, it is unknown how these broad global megatrends may affect specific fields like drug policy.

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[53] Richard Dobbs, James Manyika, and Jonathan Woetzel, *No Ordinary Disruption: The Four Global Forces Breaking All the Trends* (New York: Public Affairs, 2015), 174.

[54] Urbanization is listed as the number one megatrend likely to affect the future: Sarwant Singh, "Top 20 Global Megatrends and their Impact on Business, Cultures and Society," *Frost & Sullivan*, March 10, 2014. In this source, published the same year, urbanization is only listed at number four: Matthew Burrows, *The Future, Declassified: Megatrends That Will Undo the World Unless We Take Action* (New York: Palgrave Macmillan, 2014), 89.

2. Trends and Forces Shaping the War on Drugs

In the same way that megatrends are transforming the global landscape, smaller trends are shaping the United States' war on drugs. As of 2017, social attitudes favor deregulation and call for reform of drug policy at the national level. Aside from this shift in social perception, as previously stated the United States is in the heart of an opiate epidemic claiming the lives of tens of thousands of Americans due to overdose.[55] Upcoming trends are visibly influencing the illicit drug ecosystem in ways that should not be surprising. This review focuses on the literature surrounding the forces shaping the war on drugs to inform an analysis to forecast future trajectories using currently available information.

Literature pertaining to drug policy and shifting dynamics comprises books, documentaries, studies, and peer-reviewed publications. Abundant news media and material supplied by advocacy organizations aim to reform U.S. drug policy.[56] Heavy bias plagues the majority of non-academic literature, typically calling for specific actions such as the recreational legalization of drugs. In writing for the purposes of achieving an agenda, these publications have a tendency to emphasize specific aspects of reform rather than taking an objective, wide-lens perspective to analyze critically how larger forces may be influencing the drug policy environment.

The most salient resources for understanding the trends affecting the current landscape of illicit drugs come from the application of trend analysis research. Four trends emerge from this literature review research: 1) criminals are early adopters of technology; 2) the creation of drugs outside of the law; 3) emerging technologies beyond the horizon; and 4) a shift in drug trafficking from land to air and sea.

Criminals and cartels are perpetual early adopters of new technologies and use them to their advantage, often before the government agencies prosecuting them do.[57] This is not a new trend. For instance, drug dealers adopted pagers before police officers,

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[55] Burke, "Forecasting the Opioid Epidemic," 529.

[56] NORML, "Legalization."

[57] Goodman, *Future Crimes*, 223.

and they use Square technology to sell drugs in cities like San Francisco.[58] Literature on drug cartels support the notion that this trend is continuing, and there is evidence that cartels use their own encrypted cellular radio telecommunications systems and divert significant resources to focus on cyberspace research.[59] At a time when the United States government is using Palantir to track drug cartels, narcotics organizations are already using social media to assemble their own intelligence on law enforcement.[60] Drug traffickers have exploited the digital underground through Tor, a software allowing for anonymous communication.[61] As law enforcement continually attempts to keep up with drug dealing organizations, they have already implemented broad sophisticated counterintelligence operations.[62]

A second trend appearing throughout the literature is a growing challenge to stay abreast of interdiction. There is a growing presence of drugs existing outside of the law as it is currently written. The format of the Internet scrambles the ties of drug trafficking organizations to geography as dealers are turning to the dark web on sites, such as the now shut down Silk Road to sell illegal items.[63] Moreover, the creation of new synthetic drugs such as "Spice," "K2," and "Scooby Snax" appear on the streets faster than they can be added to the CSA, the statute establishing federal drug policy.[64]

While dark web drug sales and unclassified synthetic drugs fall into the realm of illicit drug use, literature on the field of drug policy also covers an emerging field of legal smart drugs for cognitive enhancement. Also called "nootropics," these pharmaceutical compounds aim to augment cognitive function positively in areas such as focus, memory,

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[58] Michael Arrington, "Square: The Perfect Solution for Tricky Drug and Prostitution Transactions," Tech Crunch, August 28, 2010, https://techcrunch.com/2010/08/28/square-the-perfect-solution-for-tricky-drug-and-prostitution-transactions/.

[59] Goodman, *Future Crimes*, 2.

[60] Ross, *Industries of the Future*, 173.

[61] Goodman, *Future Crimes*, 245–246.

[62] Ibid., 127.

[63] Judith Aldridge and David Décary-Hétu, *Not an "Ebay for Drugs:" The Cryptomarket "Silk Road" as a Paradigm Shifting Criminal Innovation* (Amsterdam: Elsevier, 2014), doi.org/10.2139/ssrn.2436643.

[64] Kendall Fisher, "Chapter 627: Not All Spice is Nice," *McGeorge Law Review* 48 (2016): 708.

creativity, and/or motivation.[65] Peer-reviewed articles on this subject often equivocate over the ethical and pragmatic implications for the use of smart drugs. Researchers anticipate the future development of more of these types of compounds and predict that future formulations will be even more effective.[66] Researchers also debate the practicality of prohibition and relate the use of nootropics to using drugs for performance enhancement in sports. Literature on nootropics has not arrived at a consensus on the intrinsic ethics of using pharmacological substances to enhance mental function.

The third element across the literature on trends affecting drug policy focuses on the potential misuse of such emerging technologies as synthetic biology, 3D printing, robots, and artificial intelligence (AI). Synthetic biology, also known as "synbio," has the potential to disrupt drug trafficking as it creates economic incentives to engineer new pathways of producing illicit drugs without having to cultivate fields of real plants.[67] Already, researchers have genetically engineered THC from E. Coli bacteria and turned baking yeast into lysergic acid diethylamide (LSD) and opium.[68] The potential radical disruption of synbio may cancel the mediating role of existing players in the narcotics trade. This same set of issues related to supply chain simplification applies to the potential misuse of 3D printing as devices can be hacked to produce illicit drugs instead of the intended pharmaceutical compounds. Concern over the potential misuse of emerging technologies also extends to robots and AI. Literature on these subjects discusses the use of robots for surveillance and the ability to kill law enforcement officers or rival drug gang members.[69] Likewise, the cognitive abilities of AI present potential for the role of developing or selling drugs.

Finally, the fourth trend across the literature indicates that narcotraffickers are shifting distribution tactics from ground to air and sea. Researchers tracking drug trafficking illustrate the trajectory of the emerging use of drones and unmanned

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[65] H. Saiz Garcia et al., "Nootropics: Emergents Drugs Associated with New Clinical Challenges," *European Psychiatry* 41 supplement (2017): S877–S878.

[66] Cakic, *Smart Drugs for Cognitive Enhancement*, 611.

[67] Goodman, *Future Crimes*, 428–430.

[68] Ibid., 428–430.

[69] Ibid., 398.

submarine technologies.[70] Narcosyndicates in Latin America and Mexico are already using drones and reinvesting some of their funding into research and development for new technologically-based strategies, such as launching their own satellite systems for communication.[71]

Literature on the trends and forces shaping the war on drugs is rife with anticipation about how accelerating technological innovation could affect the illicit drug enterprise. However, what remains unknown is the social response to these changes, and whether they will influence perceptions of illicit drug behavior. For instance, society may be increasingly accepting the fallibility of humans as indelible data preserves people's' collective indiscretions.[72] In the future, society may need a new social framework to incorporate rapidly growing innovations.

3. The Failure of the War on Drugs

Evaluative analysis of research and literature regarding the United States' war on drugs indicates that the war is a systemic public policy failure as summarized in the problem statement above.[73] National and international shifts in language around this subject indicate a movement toward a paradigm of drug policy reform. An accumulation of contradictions surrounding the war indicates that the existing system is neither working nor matching the reality of citizens. Evidence conclusively points to the notion that targeting people who use drugs with criminal sanctions fails to reduce demand for illicit drugs.[74] Literature suggests the war has failed at decreasing both supply and demand at the same time that it infringes on civil and human rights, and politicians militarized the war instead of taking a public health approach.

Economists conclude that after over four decades of fighting, the United States has spent over one trillion dollars on the war on drugs, yet it has not decreased supply or

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[70] Rodrigo Nieto-Gómez, "A Director of the Present? Nowcasting Homeland Security's Challenges," *Journal of Homeland Security Affairs* XII (September 2016), https://www.hsaj.org/articles/11952.

[71] Goodman, *Future Crimes*, 393–394.

[72] Alec Ross, *Industries of the Future*, 179.

[73] Baum, *Smoke and Mirrors*, vii.

[74] Nutt, *Drugs without the Hot Air*, 22, 272.

demand.[75] Rather, supply reduction measures have led to unintended consequences, such as fueling a criminal black market.[76] Trend analysis research provides evidence that despite strong supply reduction efforts, access to illicit drugs is increasing as is drug purity.[77] Meta-analysis studies and systematic reviews conclude that disrupting drug markets actually increases violence and that prohibition has not succeeded in decreasing demand.[78]

Most literature on the subject of U.S. drug policy concludes that the U.S. war on drugs has led to mass incarceration, and millions of Americans in prison for nonviolent offenses.[79] The prison-industrial complex is fast growing; since 1980, the number of incarcerated Americans has increased by more than 450 percent.[80] Strict sentencing laws, such as mandatory minimum sentencing and "three strikes," have created an unprecedented growth in the number of people imprisoned in the United States. Mass incarceration has profound social and economic effects.[81] Because of strict drug laws, first time nonviolent offenders can receive *de facto* life sentences if the court prosecutes multiple trafficking convictions together.[82] Judges argue that mandatory minimum sentencing shifts the power of sentencing from judges to prosecutors.[83] Criminal justice experts argue that a system of mass incarceration leads to additional societal burden as

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[75] Ibid.

[76] Daniel Mejia, "Yet Another Dimension of the Ineffectiveness of Supply-Side Interventions in Illegal Drug Markets." *Addiction* 109, no. 12 (2014): 1968–1969.

[77] Lauren Martin, "Constructing the Border Wall–The Social and Environmental Impacts of Border: Mexico-U.S. Border Policy," in *Engineering Earth: The Impacts of Megaengineering Projects* ed. Stanley D. Brunn (New York: Springer, 2010), 1701, doi: 10.1007/978-90-481-9920-4_97.

[78] Wood et al., "The War on Drugs," 989.

[79] Michelle Alexander, *The New Jim Crow: Mass Incarceration in the Age of Colorblindness* (New York: New Press, 2012), 237.

[80] Mary Bosworth, "Golden Gulag: Prisons, Surplus, Crisis and Opposition in Globalizing California—The Prison and the Gallows: The Politics of Mass Incarceration in America," *British Journal of Criminology* 47, no. 5 (2007): 834, doi: https://doi.org/10.1093/bjc/azm042.

[81] Jenna M. Loyd, Matt Mitchelson, and Andrew Burridge, *Beyond Walls and Cages: Prisons, Borders, and Global Crisis* (Athens, GA: University of Georgia Press, 2013), 7.

[82] Eva S. Nilsen, "Indecent Standards: The Case of U.S. versus Weldon Angelos," *Roger Williams University Law Review* 11, no. 2 (2006): 538.

[83] Byungbae Kim, Cassia Spohn, and E. C. Hedberg, "Federal Sentencing as a Complex Collaborative Process: Judges, Prosecutors, Judge-Prosecutor Dyads, and Disparity in Sentencing," *Criminology* 53, no. 4 (2015): 597–623.

individuals exiting the criminal system face difficulties in employment, housing, and other areas such as the burden on families deprived of a person's income.[84]

Substantial discourse regarding the war on drugs focuses on the civil and human rights violations of the war. For instance, a body of research and literature provide evidence that the war on drugs disproportionately affects communities of color in the United States. Policy research supports the notion that U.S. drug policy leads to disparate criminal sentencing, wherein three quarters of state prisoners incarcerated for drug conviction are people of color, despite quantitative evidence that black and white citizens use drugs at approximately the same rates.[85] In an erosion of civil rights, law enforcement officers may confiscate property before a judge declares an individual is guilty; getting these items back is difficult even if the person is found innocent or not charged.[86] Furthermore, the war has led to expanded search and wiretap authorities.[87] Privacy advocates and experts in the field of civil rights challenge these policies pertaining to the drug war.[88]

The literature discusses the militarization of the war and the greater effort focused on criminalization rather than on treatment for addiction. Rather than following a public health approach to drug use, the United States concentrates most of its effort on law enforcement.[89] A zero-tolerance drug policy impedes public health approaches, subsequently marginalizing and stigmatizing those who suffer from the disease of addiction.[90] Researchers in healthcare fields claim that zero tolerance dismisses evidence-

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[84] *13th*, DVD.

[85] Alexander, *The New Jim Crow*, 99.

[86] Tony Payan, Kathleen Staudt, and Z. Anthony Kruszewski, eds. *A War that Can't Be Won: Binational Perspectives on the War on Drugs* (Tucson, AZ: University of Arizona Press, 2013), 278 [privacy], 232 [civil rights].

[87] Ibid., 278.

[88] Ibid.

[89] Gil Kerlikowske, "Drug Policy Reform in Action: A 21st Century Approach," *What's Happening* [blog], U.S. Office of National Drug Control Policy, April 24, 2013, https://obamawhitehouse.archives.gov/blog/2013/04/24/drug-policy-reform-action-21st-century-approach.

[90] Godlee and Hurley, *The War on Drugs Has Failed*, 1.

based harm reduction strategies, such as syringe exchange programs.[91] These types of counterintuitive policies affect students as well as hundreds of thousands of students are ineligible for federal financial aid due to laws prohibiting students convicted of illegally possessing a controlled substance from taking out student loans.[92] Without an education, individuals remain limited in the realm of job prospects for the rest of their lives.

While the majority of research on the war on drugs concludes that it is a public policy failure, there is often a discrepancy in proposed solutions for reform. Frequently, solutions across the literature pose a false dichotomy wherein the country either legalizes illicit drugs entirely or continues with prohibition.[93] Literature on U.S. drug policy contains a noticeable abundance of research with built-in bias or advocacy.

Many experts conclude that the United States should spend less on law enforcement and more on prevention, education, and/or treatment.[94] Limiting this notion, these solutions assume a stable trajectory in the status of illicit drug use. However, future trends will likely affect illicit drug usage. The scope of this thesis is not to contribute to the literature assessing whether or not the war on drugs is a failure; the objective is to identify megatrends influencing the future of drug policy. Nevertheless, it is important to establish a baseline understanding on the discourse surrounding the war before moving forward to analyze how megatrends might influence the future of U.S. drug policy.

This thesis comprises five chapters, as illustrated in Figure 2. The next chapter (Chapter II) describes methodology. Chapters III and IV present two alternative scenarios for the future. Finally, Chapter V contains analysis and policy recommendations arising from the two fictional scenarios.

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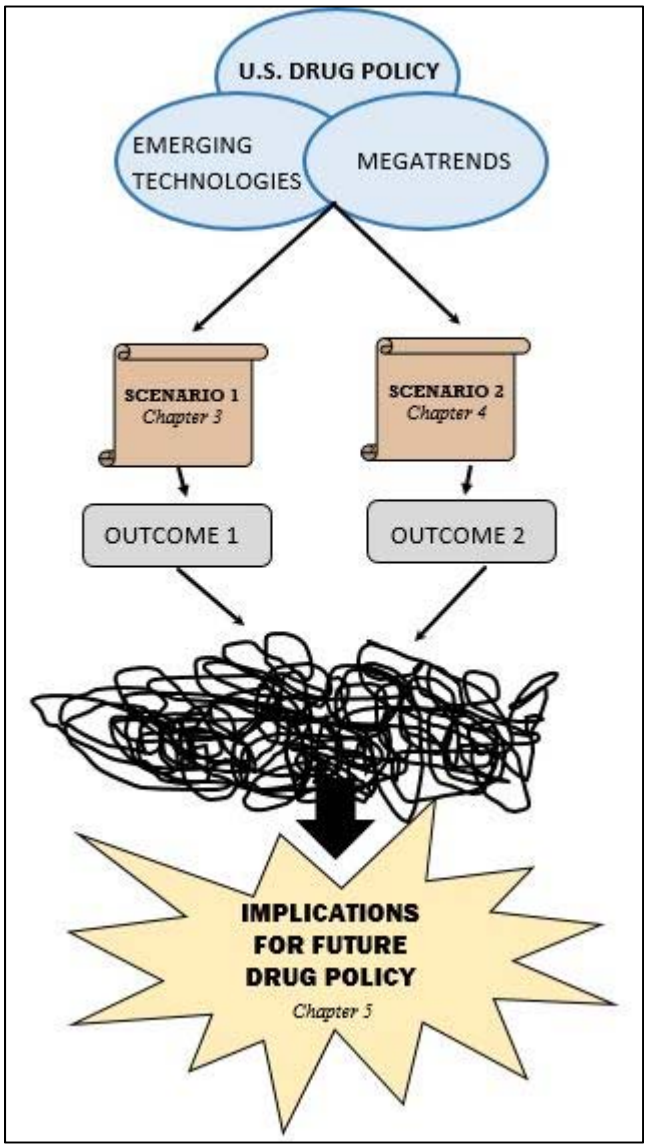
[91] Tim Newburn and Trevor Jones, "Symbolizing Crime Control: Reflections on Zero Tolerance," *Theoretical Criminology* 11, no. 2 (2007): 221–243; Lisa D. Moore and Amy Elkavich, "Who's Using and Who's Doing Time: Incarceration, the War on Drugs, and Public Health," *American Journal of Public Health* 98, no. 5 (2008): 782–786.

[92] Eric Blumenson and Eva S. Nilsen, *How to Construct an Underclass, or How the War on Drugs Became a War on Education* (Boston, MA: Suffolk University Law School, 2002), 68–69.

[93] Dainius Pūras and Julie Hannah, "Reasons for Drug Policy Reform: Prohibition Enables Systemic Human Rights Abuses and Undermines Public Health," *BMJ* 356 (2017): i6586. This source is one example of a paper posing a false dichotomy between legalization and prohibition.

[94] Global Commission on Drug Policy, *War on Drugs*, 10–17.

Figure 2. Overview of Thesis Format



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II. METHODOLOGY

If you don't like change, you're going to like irrelevance even less.

Eric Shinseki, Chief of Staff, U.S. Army[95]

To capture the most relevant uncertainties and driving forces related to the landscape of illicit drug use, this thesis uses a future studies methodology. The future is uncertain, but policymakers do not have to speculate "like blind men arguing over the colors of the rainbow."[96] Future studies, or "futures," is "the study of postulating possible, probable, and preferable futures and the worldviews and myths that underlie them."[97] By its own merits, Google Trends data can help researchers predict the present, allowing for a new form of contemporaneous forecasting.[98] This methodology facilitates the exploration of present trends and potential systemic interconnections to identify forces that may influence the future.

Using a three-point Likert scale and the process described in this chapter, the approach of this thesis weaves together megatrends and technological variables to form hypothetical scenarios. The utility of scenarios is in their ability to highlight irreducible uncertainty and draw attention to the notion that the future is not predetermined. In this thesis, two fictional scenarios frame possibilities for how low-impact emerging technologies may intersect with global megatrends to move illicit drug use issues into the realm of high impact.

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[95] Fast Company's Editors and Writers and Paul Brown, *Fast Company: The Rules of Business* (New York: Doubleday, 2005), 7.

[96] Ira Rutkow, *Seeking the Cure: A History of Medicine in America* (New York: Simon and Schuster, 2010), 98.

[97] Andreas M. Hein, "Evaluation of Technological-Social and Political Projections for the Next 100-300 Years and the Implications for an Interstellar Mission," *Journal of the British Interplanetary Society* 65 (2012): 330–340.

[98] Hyunyoung Choi and Hal Varian, "Predicting the Present with Google Trends," *Economic Record* 88, no. s1 (2012): 2–9.

A. DATA COLLECTION

This thesis presents an analysis of existing research to forecast future phenomena related to trends in illicit drug use.[99] Understanding this topic involves researching two primary domains: 1) emerging technologies and 2) global megatrends. The scope of this study is on timely and current trends. Thus, this thesis uses literature published primarily within the last decade (2007 and later). With the exception of informing background contextual information, the analysis does not focus on the failure of the war on drugs. As reviewed in the literature review in Chapter I, a substantial body of research already exists on this topic. Data sources primarily comprise academic literature, nonfiction books, international publications, and internal reports and/or records. Research also included peer-reviewed journal articles identified by querying PubMed, Google Scholar, Dudley Knox Library's Homeland Security Digital Library, and other relevant publications.

B. PROCEDURE

The procedure described in this section occurred after this researcher completed an extensive review of research on the topics of emerging technologies and megatrends. Future studies methodology incorporates systematic and pattern-based understanding to highlight trend analysis.[100] Accordingly, this thesis uses a systematic and deductive approach to assess specific technological developments and subsequently to deduce specific insights as to how these technologies could relate to illicit drug use. As outlined in this chapter, the methodology utilizes a diverse range of models and methods, mostly normative and qualitative in nature. Qualitative methods inform an examination of social systems and accompanying ambiguities to extrapolate future possibilities.

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[99] Forecasting involves the use of "nowcasting," a process of using current information to predict future trends to derive, subsequently, alternative future scenarios. Nieto-Gómez, "A Director of the Present?"

[100] Ziauddin Sardar, "The Namesake: Futures; Futures Studies; Futurology; Futuristic; Foresight—What's In a Name?," *Futures* 42, no. 3 (2010): 177–184.

1. Step 1: Megatrends Research

The researcher organized a compilation of megatrends literature sources from publications within the past decade into a table. Research on the subject of megatrends largely comprises reports listing and describing upcoming trends. Most publications postulated a range of around six to ten megatrends. Table 1 consolidates and organizes similar trends without changing the labels as written in individual publications. Due to the large number of sources reviewed, the Table 1 presents an example classification scheme in lieu of a lengthy appendix comprising all research materials. Double or triple "Xs" indicate reports listing multiple megatrends within a single consolidated box.

Table 1. Organizing and Categorizing Megatrends

	Example Source 1	Example Source 2	Example Source 3	Example Source 4	Example Source 5
#Megatrends identified by each source	4	6	8	6	10
-Globalization	X	X			X
-Climate change -Environmental crisis -Resource scarcity -Resourceful planet		XX	X	X	XXX
-Hyper-connected society -Digitization -Digital future -Network organizing -Communication		X	X		
-Demographic change -Aging population -Social change -Individualism -Social Inequalities	XX	X		XX	X
-Exponential technological growth -Technological convergence		X	X	XX	

	Example Source 1	Example Source 2	Example Source 3	Example Source 4	Example Source 5
-Technological singularity -Technological breakthrough -Disruptive technology -Acceleration					
-Urbanization -Rapid urbanization -Mega urbanization -Urban world	X			X	
-Shifting economic power -Rising emerging markets -Rise of middle class -Entrepreneurship rising -Prosperity			X		
-Health reimagined -Health and environment		X			
-Multipolar geopolitics	X			X	

Despite variance in labeling and identification, common themes surface across the literature on megatrends, allowing for the aggregation of perspectives. Sources with the greatest number of Xs are considered thematic, due to the repetition of their existence across the literature. From this meta-analysis, four prominent megatrends emerged for the purpose of this thesis: 1) globalization, 2) urbanization, 3) Internet of things/hyper-connected society, and) exponential technological growth. A description of each megatrend appears later in section C below.

2. Step 2: Variables

Myriad technologies and innovative disruptions contain potential to influence illicit drug use. The methodology for selecting key variables began with brainstorming a

list of emergent technology and topics mentioned frequently in literature covering emergent technology. A non-exhaustive version of this list appears in Figure 3.

Figure 3. Partial List of Potential Variables

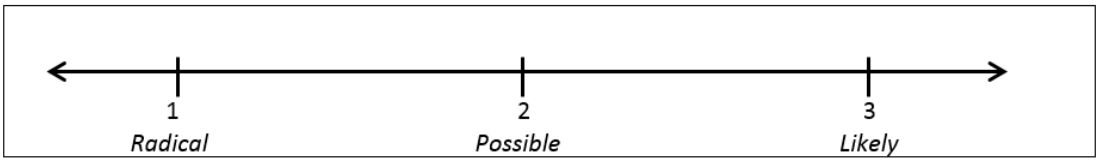
• Robotics • Virtual reality • Whole-brain interface • Nootropics • Genomics • Bio-printing • Nanotech • Precision guided firearms • Space travel	• Quantum computing • Embodied intelligence augmentation • Xenotransplantation • Artificial intelligence • CRISPR • 3D printing • Synthetic drugs • Mind uploading	• Bitcoin/ digital currency • Direct neural stimulation • Brain—computer interface • Drones • Hyper loop • Satellites • Marijuana legalization • Cloud computing • Autonomous vehicles

For practical reasons, the list of potential variables was too long to incorporate into one analysis. Some literature sources already linked items, like virtual reality, with potential for illicit drug use. In other cases, the potential illicit drug nexus of items on the list is more readily discernable. The ultimate purpose of this thesis is to describe how megatrends and emerging technologies may converge in the future to challenge the ability to regulate illicit drug use. Thus, the actual variables selected are irrelevant as they only exist for structuring scenarios to highlight future policy implications.

Next, this researcher developed a three-point Likert rating scale to categorize variables for the analysis within the following categorical parameters: *radical*, *possible*, and *likely*. The created Likert scale assigned a point-based rating for the nominal data.[101] The categorical labels indicated the plausible possibility of a variable changing the landscape of illicit drug use. As illustrated in Figure 4, the higher the plausible possibility of a variable, the higher the variable score.

[101] I. Elaine Allen and Christopher A. Seaman, "Likert Scales and Data Analyses," *Quality Progress* 40, no. 7 (2007): 64–65.

Figure 4. Possibility Likert Scale



Radical variables describe plausible extreme technologies that largely do not fully exist yet. These atypical gadgets and conceptual blueprints represent fringe signals of future technologies on the horizon. *Possible variables* designate uncommon and emerging phenomena. Most variables in this category are still in development, and their connection to illicit drug use may seem improbable as of 2017. Finally, *likely variables* define items appearing with frequency in public policy discourse. The high prevalence of their existence supports a strong likelihood that these variables will shape illicit drug use in the near future. Based on research assessing each variable individually, this researcher placed variables along the possibility scale as indicated in Figure 5. Discussion of individual variables in detail occurs later in this chapter.

Figure 5. Classification of Variables

1	2	3
Radical	***Possible***	***Likely***
• Brain—computer interface • Artificial intelligence	• Nootropics • Bio-hacking	• Marijuana legalization • Synthetic drugs • Digital currency

3. Step 3: Scenario Creation

This thesis is grounded on a fundamental assumption that the future is not singular. Thus, the final product incorporates multiple alternative scenarios. The intention of the fictional narratives is not to predict a likely future. Rather, the intention is to first stimulate a conversation about the utility of current drug policy and, second, to

proactively nowcast the potential influence of upcoming technologies as they relate to the realm of illicit drug use.

Megatrends paired with variables from all Likert classification categories create hypothetical, yet plausible, scenarios. The two-scenario format used in this thesis is based on an adaptation of the methodology used by Shell in its new lens scenarios.[102] Figure 6 outlines the structure of how megatrends and variables drive the two scenarios characterized in Chapters III and IV.

Figure 6. Megatrends and Variables for Thesis Scenarios

	Scenario 1		Scenario 2	
Megatrends	• Globalization • Urbanization		• Internet of Things: hyper-connected society • Exponential technological growth	
Variables *1. Radical* *2. Possible* *3. Likely*	1	Artificial intelligence	1	Brain-computer and neural interfaces
	2	Nootropics	2	Digital currency
	3	Marijuana legalization	3	Synthetic drugs

4. Intended Output

Literature on emergent trends and forces is rife with anticipation about how accelerating technological innovation could affect illicit criminal enterprises. While most articles focus on a singular technology, this thesis presents possible effects to illicit drug use when numerous future technologies exist congruently. The United States needs a new social framework to incorporate rapidly growing technological innovations to change and

[102] See, for example: "New Lens Scenarios: A Shift in Perspective for a World in Transition," Shell International BV, 2013, www.shell.com/energy-and-innovation/the-energy-future/scenarios/new-lenses-on-the-future.html. Shell creates two scenarios for the future by combining global trends and emergent issues related to the energy sector. Observing trends and trajectories, the scenarios highlight implications for public policy.

modernize its drug policy. Extrapolations from the analysis of emergent technological innovations suggest a new framework for conceptualizing domestic drug policy.

This thesis includes a definition and brief description of emerging technological phenomena and concludes with as a set of actionable policy recommendations. After presenting and analyzing relevant data, Chapter V includes recommended policy solutions for addressing future trends. The consequences and outcomes of each solution appear within the context of homeland security.

C. DESCRIPTION OF KEY MEGATRENDS

The following section provides a brief overview of the megatrends driving this thesis. As previously mentioned, these are 1) globalization, 2) urbanization, 3) Internet of things/hyper-connected society, and) exponential technological growth.

1. Globalization

Globalization refers to the dynamic movement of increasing connectedness across the world and between nations.[103] This connectedness is evident in the accelerating flows of capital, people, finance, and information. In a highly interconnected and growing global system, shifts in one region can stimulate unanticipated volatility in another region.[104] Amid this swirling, furious energy, a global marketplace of economic integration and democratization usher in increased opportunities for transnational organized crime.[105] Globalization occurs through multiple complex processes rather than through a single linear process.[106] In academia, globalization is often broken down into economic, cultural, and political categories, although it also exists under other lens such

[103] W. Neil Adger, Hallie Eakin, and Alexandra Winkels, "Nested and Teleconnected Vulnerabilities to Environmental Change," *Frontiers in Ecology and the Environment* 7, no. 3 (2009): 150–157.

[104] Dobbs, Manyika, and Woetzel, *No Ordinary Disruption*, 72.

[105] Harold Trinkunas, *The Network Effect: Trafficking in Illicit Drugs, Money, and People in Latin America* (Washington, DC: Brookings, 2015), https://www.brookings.edu/blog/order-from-chaos/2015/12/03/the-network-effect-trafficking-in-illicit-drugs-money-and-people-in-latin-america/.

[106] Colin Hay and David Marsh, eds., *Demystifying Globalization* (London: Palgrave Macmillan UK, 2000), 3.

as military or environmental globalization.[107] Globalization helps fuel an international cross-country illicit drug trade, making interdiction by law enforcement increasingly challenging.[108]

2. Internet of Things/ Hyper-Connected Society

Where globalization refers to cross-border flows, hyper-connected society refers to the skyrocketing digital flows of data and information in a converging, digitized society.[109] In the digital future, instant access to information will be omnipresent.[110] Fueled by social network organizing, ubiquitous mobile connectivity, and cloud computing, a quickly increasing number of devices are joining the "Internet of Things (IoT)."[111] More and more objects, such as household coffee makers, are transforming into digitized technologies. Digitization enables easy communication and for the collection of enormous amounts of data. As more devices join the IoT, cybersecurity threats become increasingly salient as all devices are becoming connected and dependent.[112] Criminals are perpetual adopters of new technology.[113] The same hyper-connectedness that benefits society is also benefitting drug cartels and powering a digital underground where illegal items are readily available for purchase on the dark web. Society's collective vulnerability to hacking is driving societal discussions on the values of privacy, transparency, and security.

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[107] Salvatore Barbones, *Studying Globalization: Methodological Issues* (Oxford: Blackwell Publishers, 2007), 146.

[108] Cláudia Costa Storti and Paul De Grauwe, "Globalization and the Price Decline of Illicit Drugs," *International Journal of Drug Policy* 20, no. 1 (2009): 48–61.

[109] Ovidiu Vermesan and Peter Friess, eds. *Building the Hyperconnected Society: Internet of Things Research and Innovation Value Chains, Ecosystems and Markets*, Vol. 43 (Gistrup, Denmark: River Publishers, 2015), xv.

[110] Ibid., 226.

[111] Ibid., 32, 45.

[112] Ibid., 147.

[113] Goodman, *Future Crimes*, 223.

3. Exponential Technological Growth

Exponential technological growth is transforming the world with disruptive technology. This change is taking place rapidly and in accordance with Moore's law, an empirical observational theory postulating that computer technology constantly doubles in the performance ratio of power versus price.[114] This means that breakthrough technology is developing expeditiously and affordably for consumers. The shift toward democratization of technology is accelerating, especially as different technologies merge into technological convergence. These technologies require diligent oversight; such technologies as additive manufacturing, synthetic biology, and robotics hold immense potential for misuse by criminal syndicates. Following the trend of innovation, the future of crime will be exponential, automated, and three-dimensional.[115]

4. Urbanization

Urbanization is occurring rapidly across the globe. An anticipated 67 percent of the planet will live in cities before the year 2050.[116] This trend generates a boost in social and economic opportunities for residents. Along with urbanization, however, arise policy challenges to make cities both sustainable and resilient. The rural-urban migration movement toward cities necessitates planning and investment in effective infrastructure. Living in cities exposes citizens to the stresses of urban life and creates enabling conditions for illicit drug use. As an indicator for modernization, urbanization is highly correlated with drug abuse.[117] While the proximity of healthcare providers and addiction treatment resources may help mitigate this increased risk, cities create conditions and opportunities allowing criminal enterprises to thrive, thus fueling illegal drug markets.

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[114] Scott E. Thompson and Srivatsan Parthasarathy, "Moore's Law: The Future of Si Microelectronics," *Materials Today* 9, no.6 (2005): 21, doi: 10.1016/S1369-7021(06)71539-5.

[115] Goodman, *Future Crimes*, 506.

[116] Gerhard K. Heilig, *World Urbanization Prospects: The 2011 Revision* (New York: United Nations, Department of Economic and Social Affairs, 2012), http://www.un.org/en/development/desa/population/publications/pdf/urbanization/WUP2011_Report.pdf, 4.

[117] United Nations Office on Drugs and Crime, *World Drug Report 2004*, Vol. 1 (New York: United Nations 2004), http://www.unodc.org/pdf/WDR_2004/volume_1.pdf, 28.

D. DESCRIPTION OF KEY VARIABLES

Disruptive technologies ignore conventional societal rules.[118] Embracing inherent unpredictability, innovation eventually produces social change. This section presents an overview of the key variables driving this thesis. Further analysis of each unique technology takes place in the following chapters.

1. Likely Variables

As mentioned earlier in this chapter, likely variables frequently appear in public policy discourse. The high prevalence of discussions regarding marijuana legalization and synthetic drugs indicate a high possibility that these variables will influence future drug policy.

a. Marijuana Legalization

The 1970 CSA governs U.S. drug policy. The act established a federal drug policy regarding the manufacture, importation, possession, use, and distribution of certain substances falling under five schedules according to such criteria as:

> (1) Its actual or relative potential for abuse. (2) Scientific evidence of its pharmacological effect, if known. (3) The state of current scientific knowledge regarding the drug or other substance. (4) Its history and current pattern of abuse. (5) The scope, duration, and significance of abuse. (6) What, if any, risk there is to the public health. (7) Its psychic or physiological dependence liability. (8) Whether the substance is an immediate precursor of a substance already controlled under this subchapter.[119]

Despite this classification, there is a multifaceted movement in the country to legalize marijuana.[120] As of 2017, nine states have taken unprecedented action to legalize the recreational use of marijuana.[121] Moreover, 29 states and the District of Columbia

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[118] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston, MA: Harvard Business Review Press, 2013), 98.

[119] Controlled Substances Act, 21 C.F.R. §811(c) (1970).

[120] Jonathan P. Caulkins et al., *Considering Marijuana Legalization* (Santa Monica, CA: RAND, 2015), 2.

[121] Legalization of recreational marijuana use is adopted in nine jurisdictions: Colorado (2012), Washington (2012), Alaska (2014), Oregon (2014), California (2016), Maine (2016), Massachusetts (2016), Nevada (2016), and the District of Columbia (2014). NORML, "Legalization."

have legalized the use of marijuana for medicinal purposes.[122] Change is a contagious force, and marijuana is a controversial topic hanging in legal purgatory. In the context of underscoring the research question of this thesis, it is important to address the national trend toward marijuana legalization as well as to question the implications that arise from states taking authority to ignore federal law.

b. Synthetic Drugs

First formulated in the 1920s and known by such nicknames as "bath salts," "spice," "plant food," and "synthetic marijuana," synthetic drug use has been on the rise in the United States since 2009.[123] From 2009 to 2014, the DEA identified approximately 200 to 300 new designer drugs around the country.[124] One factor contributing to the popularity of synthetic cathinones is the myth that these dangerous substances circumvent drug laws.[125] Seeking a "legal high" that will not be detected by a drug test, users report that synthetic drugs produce stimulant effects similar to cocaine or other amphetamines.[126] In response, legislators ban the precursor chemicals used to produce these drugs. Subsequently, manufacturers of synthetic cathinones rapidly replace these specific molecules to create newer versions of drugs.[127] This lack of consistency among synthetic drugs only furthers the danger to citizens who use them. The rising presence of synthetic drugs in the recreational drug market is engendering international apprehension.[128] The rising incidence of synthetic drug use signals a trend toward the

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[122] Ibid.

[123] M. Coppola and R. Mondola, "Synthetic Cathinones: Chemistry, Pharmacology and Toxicology of a New Class of Designer Drugs of Abuse Marketed as 'Bath Salts' or 'Plant Food,'" *Toxicology Letters* 211, no. 2 (2012): 145, 147, doi: 10.1016/j.toxlet.2012.03.009.

[124] "DEA News: Huge Synthetic Drug Takedown," U.S. Drug Enforcement Administration, May 7, 2014, www.dea.gov/divisions/hq/2014/hq050714.shtml.

[125] John P. Kelly, "Cathinone Derivatives: A Review of their Chemistry, Pharmacology and Toxicology," *Drug Testing and Analysis* 3, no. 7–8 (2011): 439, doi: 10.1002/dta.313.

[126] Laurent Karila and Michel Reynaud, "GHB and Synthetic Cathinones: Clinical Effects and Potential Consequences," *Drug Testing and Analysis* 3, no. 9 (2011): 552, doi: 10.1002/dta.210.

[127] Susannah Davies et al., "Purchasing 'Legal Highs' on the Internet: Is There Consistency in What You Get?" *QJM* 103, no. 7 (2010): 493, doi: 10.1093/qjmed/hcq056.

[128] Henry A. Spiller et al., "Clinical Experience with and Analytical Confirmation of 'Bath Salts' and 'Legal Highs' (Synthetic Cathinones) in the United States," *Clinical Toxicology* 49, no. 6 (2011): 499, doi: 10.3109/15563650.2011.590812.

consumption of drugs constructed from manufactured chemicals, regardless of their toxicity.

2. Possible Variables

Possible variables refer to technologies on the horizon that may influence drug policy in the future. These emerging phenomena are largely still in development and their potential association with illicit drug use may seem improbable in 2017.

a. Nootropics

Nootropics are pharmaceutical compounds that positively augment cognitive functioning in such areas as focus, memory, creativity, and/or motivation. While caffeine is an exemplar and culturally endorsed nootropic, peer-reviewed articles on this subject often equivocate over the ethical and pragmatic implications for the use of smart drugs. Researchers anticipate the future development of more of these types of compounds.[129] Widespread abuse of nootropics, such as Adderall and Ritalin, is already pervasive on college campuses.[130] As these "smart drugs" enhance cognitive function, researchers anticipate the development of stronger and more effective compounds in the future.[131] Compounding the development of performance-enhancing drugs, pharmaceutical companies engage in strong, legal, direct-to-consumer marketing. Given their legal pharmaceutical status, current drug prohibition efforts make controlling illicit pharmaceutical use a daunting challenge that will only become more difficult as new pharmaceutical drugs enter the market.

b. Digital Currency

Digital currency refers to electronic currency that operates in a manner similar to physical currency, such as the Euro or the U.S. dollar. Using this form of currency, transactions are instantaneous. Historically, government-run currency had a monopoly

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[129] Cakic, *Smart Drugs for Cognitive Enhancement*, 611.

[130] Christine T. Sweeney et al., "Nonmedical Use of Prescription ADHD Stimulants and Preexisting Patterns of Drug Abuse," *Journal of Addictive Diseases* 32, no. 1 (2013): 1, doi:10.1080/10550887.2012.759858.

[131] Cakic, *Smart Drugs for Cognitive Enhancement*, 611.

over traditional money because there was not a reliable alternative.[132] In 2017, there are countless alternative virtual currencies. Cryptocurrencies, like Bitcoin, are a form of digital currency that use cryptography to secure transactions.[133] Bitcoin is partially anonymous and decentralized instead of having backing from a government or similar state actor.[134] Digital currencies, relying on peer-to-peer networking, are often vulnerable to fluctuating volatility in worth.[135]

3. Radical Variables

Lastly, radical variables describe fringe technologies that are extreme yet plausible. Although these technologies are still under development, they signal future possibilities.

a. Artificial Intelligence

AI refers to intelligence demonstrated by machines, often mimicking cognitive functions of humans like learning and reasoning. Technological advances employing deep neural networks already allow artificial intelligence to solve such complex pattern detection problems as speech recognition and word prediction.[136] Experts predict that AI will most likely reach general human capability before the year 2050.[137] Surpassing human abilities, the development of *superintelligence* refers to cognitive performance beyond human potential.[138] Highly functioning AI poses an existential threat to humanity

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[132] Nikolei Kaplanov, "Nerdy Money: Bitcoin, the Private Digital Currency, and the Case against Its Regulation," *Loyola Consumer Law Review* 25, no.1 (2012): 111–174.

[133] William J. Luther, "Cryptocurrencies, Network Effects, and Switching Costs," *Contemporary Economic Policy* 34, no. 3 (2016): 553–571.

[134] Reuben Grinberg, "Bitcoin: An Innovative Alternative Digital Currency," *Hastings Science and Technology Law Journal* 4 (2012): 159.

[135] Nicole D. Swartz, "Bursting the Bitcoin Bubble: The Case to Regulate Digital Currency as a Security or Commodity," *Tulane Journal of Technology and Intellectual Property* 17 (2014): 319.

[136] Zoubin Ghahramani, "Probabilistic Machine Learning and Artificial Intelligence," *Nature* 521, no. 7553 (2015): 453, doi: 10.1038/nature14541.

[137] Vincent C. Müller and Nick Bostrom, "Future Progress in Artificial Intelligence: A Survey of Expert Opinion," in *Fundamental Issues of Artificial Intelligence*, ed. Vincent C. Müller (Synthese Library; Berlin: Springer International Publishing, 2016), 567.

[138] Nick Bostrom, *Superintelligence: Paths, Dangers, Strategies* (Oxford: Oxford University Press, 2014), 26.

as described by *technological singularity*. This hypothesis posits that accelerating growth in disruptive technologies may trigger an unfathomable phase that will radically change human civilization.[139] Looming anticipation surrounds potential future usage of AI. Law enforcement officers anticipate the use of AI to investigate criminals and drug dealers. The pharmaceutical industry anticipates the use of deep learning to accelerate the discovery and development of future drugs. At the same time, AI could provide the ability to develop formulations for new illicit drugs or even to sell them.[140]

b. Brain-Computer and Neural Interfaces

Brain-computer interface (BCI) refers to direct communication between a brain and an external device such as a computer. Using internal implants or external wires, researchers typically use this technology to research and map brain functions so as to augment or rehabilitate cognitive functions.[141] BCIs are a conduit for scientists to interact innovatively with the nervous system. For example, BCI research has produced neuroprosthetics applications to help restore impaired senses through cochlear or retinal implants. Motor neuroprosthetics restore movement in individuals with paralysis and deep brain stimulator implants assist individuals with Parkinson's. This technology is still evolving, but in the future, BCIs will integrate with the body seamlessly, limited only by the brain's plasticity.[142] BCI may have potential use as a component of drug addiction treatment as it can provide a neurofeedback mechanism.[143]

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[139] Amnon H. Eden et al., "Singularity Hypotheses: An Overview," in *Singularity Hypotheses: A Scientific and Philosophical Assessment*, ed. Amnon H. Eden et al. (Berlin: Springer-Verlag, 2012), 1. Disruptive technologies include artificial intelligence, robotics, genetic engineering, and nanotechnology, among others.

[140] Goodman, *Future Crimes*, 398, 413.

[141] Max O. Krucoff et al., "Enhancing Nervous System Recovery through Neurobiotics, Neural Interface Training, and Neurorehabilitation," *Frontiers in Neuroscience* 10, no. 584 (2016): 2, doi: 10.3389/fnins.2016.00584.

[142] Eric D. Chan, "The FDA and the Future of the Brain-Computer Interface: Adapting FDA Device Law to the Challenges of Human-Machine Enhancement," *John Marshall Journal of Computer and Information Law* 25, no. 4 (2007): 118.

[143] Brent J. Lance et al., "Brain-Computer Interface Technologies in the Coming Decades," *Proceedings of the IEEE* 100, Special Centennial Issue (May 2012): 1588.

Within the next two decades, experts anticipate BCI technology will allow computing fueled by brain signals, rather than a person having to say or touch a device.[144] While this will increase the ease of computing, BCI also opens the door for hackers to detect or even manipulate the thoughts of others without their knowledge. This presents a noticeable security threat, as narcotrafficking organizations may have the ability to decipher the thoughts of enemies and/or hack the computer interface strategic plans and network of law enforcement.

E. CONCLUSION

Reality is infinitely complex, but forecasting possible future scenarios provides support in laying the foundation for present action. There is currently a gap in the use of futures methodologies in the field of homeland security. The value of the thesis is not only the content itself but in the adaptation of future studies for homeland security. Adaptability requires an intellectual flexibility to reconcile probable futures with irreducible uncertainty. The following two chapters present scenarios illustrating how trajectories of megatrends and the specific technological variables outlined above could intersect. These scenarios are not predictions; they merely present narratives of alternative environments that intentionally feel unnatural. This method captures relevant uncertainties and dynamic factors related to the contextual landscape of illicit drug use. In doing so, this thesis highlights risks as well as opportunities for consideration in strategizing future drug policy.

[144] Harish Shah, "The New Security Threats in the Age of the Brain Computer Interface," *Futurista* [blog], February 10, 2014, http://futuristablog.com/new-security-threats-age-brain-computer-interface/.

III. SCENARIO 1: CHEMICALLY ENHANCED

> Amid growing availability of high quality recreational drugs coming from Mexico and Canada, in this world, Americans legally regulate and augment their own cognitive functioning.

In 2018, the United States federal government strictly cracks down on all state-level recreational and medical marijuana legislation. Around the same time, international regulations and treaties on drugs collapse following the decisions from both Canada and Mexico to legalize recreational use of marijuana in 2017 and 2018, respectively. Following the economic success of marijuana legalization, in 2022, Canada decides to further decriminalize all recreational drugs. The decision by the United States to militarize the border and strictly enforce the nation's CSA creates distinctive repercussions at a time when drugs from both border countries seep as through osmosis into the United States.

In 2030, the United States finds itself beleaguered by a confusing, inconsistent drug policy, coupled with a rising prevalence of illicit drugs. On the other hand, use of legal nootropics—drugs for enhancing brain cognition—is ubiquitous. Despite America's new isolationist stance and increased law enforcement efforts, recreational drugs from Mexico and Canada continue to appear throughout the United States. Following IBM Watson's success in the medical field, the Pharmaceutical Research and Manufacturers of America trade group collaborate with IBM Watson Group to create artificially intelligent Wendy, a deep learning sister system focused exclusively on research and development in the pharmaceutical industry.[145] This partnership proves lucrative, ushering in an era of enhanced human cognition with the help of legal pills. In this world, Americans sleep better, are more productive at work, and experience general emotional well-being. Widespread use of nootropics is seen as miraculous and imperative, the key to advancing humanity.

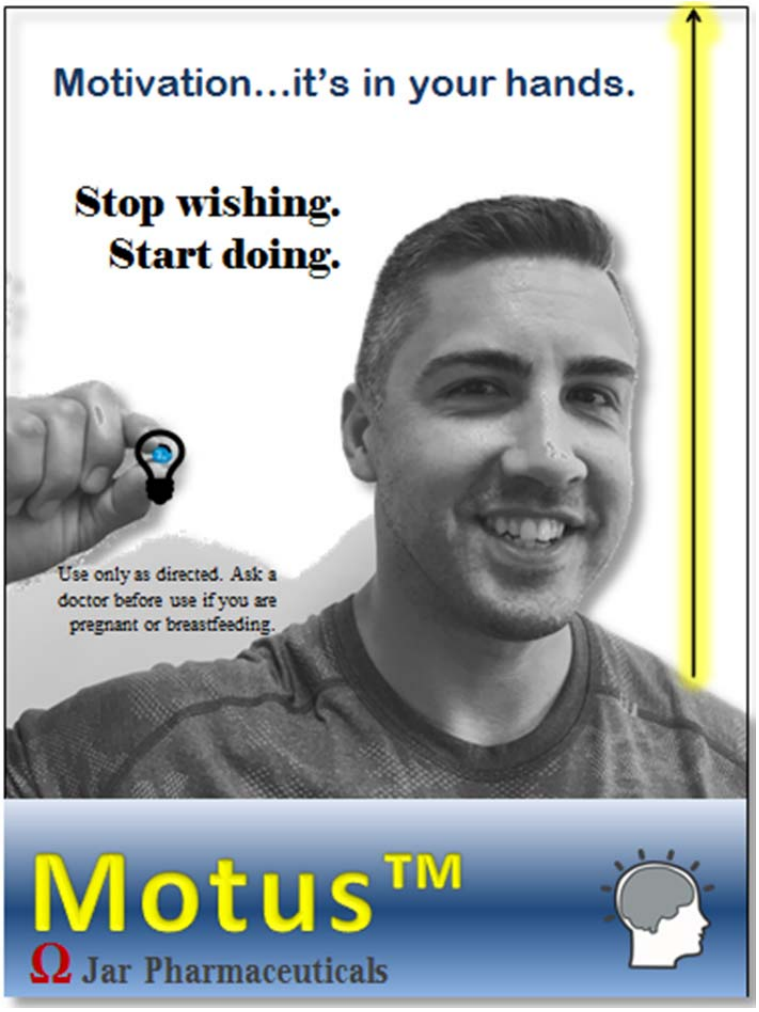
[145] Deep learning refers to a process of applying artificial neural networks to learning tasks.

A. THE WORLD: 2030

Americans live in a world of increasingly enigmatic drug policy. On one hand, Americans view nootropics as acceptable legal substances, no different from taking daily vitamins with breakfast in previous decades. On the other hand, recreational drugs legalized in Canada and Mexico increasingly appear on the black market, despite their illegal status in the United States. Although the federal government continues to spend more on border enforcement and security, illegal drugs such as marijuana and psychedelics are increasingly flooding the country.

Pharmaceutical assistance improves almost any physical or mental ailment. Students take Memovirium for superior memory and focus, derisively remembering how people used to search for Adderall or Ritalin from friends lucky enough to get a prescription. Attorneys, politicians, and corporate businesspersons take Execumol for higher executive brain functioning. Permitted to by the International Olympic Committee, athletes take ViperEx for enhanced speed and muscle performance. Artists, musicians, and those who are creatively inclined take Partum for heightened creativity. As depicted in Figure 7, more than one-third of adults with full time occupations take Motus for boosted motivation and flexibility. The cognitive augmentation benefits from these substances appear limitless, enriching myriad facets of human life for those who can afford it.

Figure 7. Advertisement for Motus



Nootropics are for adults and children alike. Due to widespread use of Attentax among schoolchildren, the United States has risen to sixth among the world's leading education systems. Harvard, Stanford, and the Massachusetts Institute of Technology have all pioneered new doctoral programs in neuroscience optimization.

The landscape of competitive sports looks distorted.[146] Athletes throw further, run faster, and lift heavier than at any other time in history. Athletes augment themselves

146 Ryan M. Rodenberg and John T. Holden, "Cognition Enhancing Drugs ('Nootropics'): Time to Include Coaches and Team Executives in Doping Tests?," *British Journal of Sports Medicine* 51, no. 18 (2016), doi: 10.1136/bjsports-2015-095474.

through powerful and potent nootropics, replacing the use of steroids, supplements, and other doping techniques of previous years. The field of competitive sports has yet to conclude how to regulate the use of these intense new drugs. The National Collegiate Athletic Association is in the midst of a highly controversial lawsuit for failing to drug test athletes for nootropics. Proponents of the lawsuit claim that the drugs are prohibitively expensive and give students the means to having an unfair advantage over their competitors. Critics of the lawsuit call it quixotic, claiming that nootropics are legal substances and point to the use and normalization of other legal nootropics like caffeine.

Computer programmers and software engineers view the creation of IBM Watson as the breakthrough point for highlighting the societal benefits of using AI. Wendy, IBM Watson's sister program, assists the pharmaceutical industry in researching and developing new cognitive enhancement drugs. In the same vein, Walter helps the agriculture industry by creating genetically modified organisms and synthetic substances. Similarly, Wiley analyzes biometric data and sorts through aggregate databases to help law enforcement jurisdictions prosecute crimes. Despite their specialized uses, all of the artificially intelligent programs exist in one centralized network, connecting the deep learning occurring within each individual system.

The age of nootropics highlights a watershed moment in the field of public health. There are countless nootropics to enhance physical health, leading to a decrease in morbidity and mortality from obesity. Nootropics on pharmacy shelves combat hunger, low energy, and overeating. Other nootropics increase fat burning and even physical performance while exercising. By 2030, most Americans have forgotten the opioid epidemic that engrossed the country during the previous decade. New vendors appear to promote cognitive enhancement drugs every year at annual conferences of the American Public Health Association. Simultaneously, concern rises for an increasing number of people seeking treatment from combining multiple nootropics. While most see nootropics as indispensable, physicians fear a lack of longitudinal data on their safety and worry that

the drugs may deteriorate the brain's delicate balance of neurotransmitter levels.[147] Other critics cite philosophical opposition to the "loss of what it means to be human."

The pharmaceutical drug industry experiences soaring success. Capitalizing on uncertainty proves to be lucrative for the pharmaceutical industry; its aggressive lobbying efforts of the Food and Drug Administration (FDA) paved the way for the classification of nootropics as legal over-the-counter supplements. Successful lobbying has led to a furious rush to create and bring new cognitive enhancement drugs to the market. The federal government, lacking a national biology policy and focused on supporting corporate business interests, has shortened the clinical trial process for testing new drugs. The resulting surge in new drugs ushers in undeniable fiscal improvements to the American economy.

The success of nootropics does not replace the existence of illegal drugs, as highlighted in Figure 8. Increasing numbers of Americans are in prison following incarceration for nonviolent offenses related to drug use. Prohibitive drug policies do not reduce demand.[148] Not surprisingly, underground speakeasies provide access to marijuana and other psychoactive drugs. "Physical rooms" provide comfortable settings for people to relax with illicit drugs, and complex air filtration systems disguise the smell of cannabis to anyone who may be passing near the establishments. Individuals patronizing these establishments refer to 2030 as "Prohibition 2.0" or "the roaring twenties."

147 Ruairidh M. Battleday and Anna Katharine Brem, "Modafinil for Cognitive Neuroenhancement in Healthy Non-sleep-deprived Subjects: A Systematic Review," *European Neuropsychopharmacology* 25, no. 11 (2015): 1865–1881.

148 Angus Bancroft, *Drugs, Intoxication and Society* (Cambridge, UK: Polity Press, 2009), 82.

Figure 8. Newspaper Column: Mirage Scenes and Product Greens

Mirage Scenes and Product Greens

By FRANK ERBEWEATHER
CORRESPONDANT TO THE MERIDIAN DAILY
August 5, 2030

"It is sometimes hard to recall the days, almost a decade ago, when marijuana was mainstream and sold openly in some parts of America. This was a time when people still paid for groceries using cash, the European Union was one entity, and the NASDAQ's "420 index" was thriving. Long before millions of dollars disappeared from the NY Stock Exchange, 24% of Americans had grown accustomed to legal cannabis consumption. It was even permitted in the nation's capital.

We remember the outrage of 2018, when our populist federal government shut down all recreational and medical marijuana programs. In hindsight, it seems asinine that terrorism was the nation's greatest concern.

Today, marijuana lives on in an underground network of speakeasies known as the Mezzerola Highway, or "Mezhi" for short. Anyone can access this network on the dark web using Tor.4. The U.S. Office of National Drug Control Policy claims there were an estimated 317,842 underground establishments in operation throughout 2029.

MONDAY MORNING COFFEE WITH ...

Frank Erbeweather's *weekly column features hipster dives, indie scenes, and PBR beer. Frank lives in Portland, exploring the growing world of speakeasies.*

I find the best underground scenes using "Hydro Buddha," a GPS-enabled app using my iPhone to connect me to the nearest open establishments. "Musician's Cooperative" works best on the Android platform.

Last year, the U.S. Drug Enforcement Administration (DEA) shut down an analogous app known as "Wacky Tobaccy." This landmark case fueled anonymous rogue programmers. Now, apps appear faster than the DEA can shut them down. Although globalization has slowed in the U.S., the newest apps link Americans directly to dealers that have access to the legal drug markets of Mexico and Canada. Some things never change, and an isolationist stance will not stop Americans from accessing the drugs they want.

In 2030, United States drug policy is in a state of pandemonium after withdrawing from the North American Free Trade Agreement. With America moving toward a more isolationist stance and an increase in law enforcement powers, further militarization of security makes illicit drugs harder to come by. In a search for legal (and affordable) alternatives, people welcome the development of nootropics. Their advent is an advertiser's dream. The products sold themselves—at first, local pharmacies even struggled to keep the shelves stocked for customers. The rapid adoption of nootropics is comparable to the electronic cigarette, or "vaping," phenomenon in the United States—

which quickly gained traction among tobacco smokers.[149] From 2011 to 2012, e-cigarette sales in the United States doubled from $250 to $500 million.[150] Sales of nootropics mirror this exponential growth.

Nootropics are domestic disrupters that bring a new type of inequality. The wealthy have access to new designer drugs first and can afford higher quality substances. Highlighted in Figure 9, urbanization accelerates this disparity. The gap between rural and urban populations increases as people living in cities have greater access to drugs and more discretionary income. The resulting social disparities slowly become apparent across multiple contexts, widening the gap between ends of the socioeconomic spectrum. This issue is especially prevalent in school systems and sports, wherein capabilities differ drastically between those who use and those who do not use enhancement substances. Debate over intentional cognitive augmentation creates rancor among politicians regarding the issue of equity.

149 Dominic L. Palazzolo, "Electronic Cigarettes and Vaping: A New Challenge in Clinical Medicine and Public Health. A Literature Review," *Frontiers in Public Health* 1, no. 56 (2013): 1–20.

150 Ibid., 1.

Figure 9. Zoo York Times Book Review

The Zoo York Times
SUNDAY BOOK REVIEW
THE SHORTLIST

Pink Slime
By Kathy Binkelow

To read *Pink Slime* is to immerse your mind in a world of meatpacking, urbanization, and to feel where Binkelow herself spent the past 2 years between 2026 and 2028. Here, in the decaying town of Osceola, Iowa, Binkelow seeks to understand a gripping reality of rural depletion. We meet Reiss Shea, owner of Beef Products Corporation, a meat packing facility infamous for its defamation lawsuit against KSA News. Reiss relays a compelling story of how his facility almost shut down following a sensationalized media portrayal of "pink slime," an additive used to reduce product costs. Submerged in her research, Binkelow takes readers down unexpected twists, revealing that Osceola's population decline is actually from migration to cities, not a meat industry scandal. Tearing apart assumptions, readers learn how, scandals aside, rural America is becoming less relevant. Marvin Screvilevitz, a factory worker at Grateful Cheese Emporium, remembers the day President Trump withdrew from the North American Free Trade Agreement in 2018: "it was, very soon after in the next year, you had to move to a city to provide for your family... that is where the jobs was." As America's population shifts from farms to smart megacities, Binkelow's nonfiction Zoo York Times Bestseller account of rural decline and urban growth will leave you questioning your assumptions.

Karla LuAnn is the founder of Tequila Mockingbird, a society of nonfiction writers, essayists, and cultural champions.

49 Saturday, March 3, 2030

Despite American isolationism, the rest of the world continues to move forward with globalization. In December 2030, 18 countries sign a free trade agreement, radically changing the landscape of international trade and policy. The United States, still recovering from its withdrawal from the North American Free Trade Agreement, does

not participate in the deal. Experts predict a geopolitical crisis as the United States slowly loses its predominance in the world economy.

B. WHERE ARE WE IN 2017?

The previous section presented a plausible scenario for the year 2030. Stories that cannot be rendered impossible through logical reasoning, plausible scenarios present a challenge to deeply held assumptions. The depiction presented a narrative interweaving nootropics, AI, globalization, urbanization, and marijuana legalization in Canada and Mexico. Is this scenario plausible? In 2017, the driving forces behind each of these factors are already self-evident.

1. Nootropics

Humans naturally pursue pleasure; the desire to intentionally augment or enhance one's cognitive functioning is not new. Nootropics are substances taken to augment positively cognitive functioning. These types of substances are omnipresent throughout daily life. As previously states, caffeine is an exemplar and culturally endorsed nootropic. Additionally, nicotine positively affects cognitive processing through improved motor abilities, attention, and memory.[151] The L-theanine found in green and black tea provides relaxation and mental alertness,[152] and theobromine found in chocolate has memory enhancement properties.[153]

Humanity's evolutionary history points to a natural impulse to consume intentionally external substances to augment brain chemistry.[154] For example, ancient Greek athletes consumed various plants and hallucinogens to improve speed and overall

151 Stephen J. Heishman, Bethea A. Kleykamp, and Edward G. Singleton, "Meta-Analysis of the Acute Effects of Nicotine and Smoking on Human Performance," *Psychopharmacology* 210, no. 4 (2010): 453–469.

152 Anna C. Nobre, Anling Rao, and Gail N. Owen, "L-theanine, a Natural Constituent in Tea, and Its Effect on Mental State," *Asia Pacific Journal of Clinical Nutrition* 17, no. S1 (2008): 167–168.

153 Consuelo Lazaro Flores et al., "Beverage Containing Caffeine or Theobromine and Vinpocetine Citrate for Stimulating Cerebral Activity," U.S. Patent 6,290,994, issued September 18, 2001.

154 Nutt, *Drugs without Hot Air*, 132.

Olympic performance as far back as the third century B.C.[155] Similarly, Roman gladiators ingested stimulants to fight fatigue.[156] Nineteenth century Austrian lumberjacks boosted their endurance by consuming significant quantities of arsenic.[157] For thousands of years, Indian Ayurvedic medicine employed forskolin extract, a plant derivative, to boost learning and memory formation.[158] Neuropsychopharmacologist David Nutt highlights the role of drugs in human evolution by explaining, "Deliberately creating altered states of consciousness is one of the human universals."[159] Nootropics are not new, but their prevalence is slowly increasing in the societal consciousness.

Hollywood films capture the prevailing zeitgeist surrounding cultural trends. Recent media framing surrounding nootropics demonstrates increasing acceptance, as popularized by such recent movies as *Limitless* in 2011 and *Lucy* in 2014. *Limitless* provoked scholarly debate over the use of nootropics for human enhancement. The main character in the film takes NZT-48, a fictional nootropic causing perfect memory recall and the ability to cross-correlate large quantities of information at a high speed.[160] Similarly, *Lucy* stimulated dialogue on nootropics following its portrayal of a woman who takes the fictional synthetic drug CPH4, leading to such psychokinetic abilities as telekinesis, enhanced mental capability, and the inability to feel pain.[161] As debate on this topic continues, websites and groups continually move forward to promote smart drugs, as seen in Figure 10, a screenshot from the website smartdrugsmarts.com.[162]

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155 Claudia L. Reardon and Shane Creado, "Drug Abuse in Athletes," *Substance Abuse and Rehabilitation* 5 (2014): 95.

156 Panayiotis J. Papagelopoulos, Andreas F. Mavrogenis, and Panayotis N. Soucacos, "Doping in Ancient and Modern Olympic Games," *Orthopedics* 27, no. 12 (December 2004): 1226–1231.

157 TZ Csáky, "Doping," *Journal of Sports Medicine and Physical Fitness* 12, no.2 (1972): 117–123.

158 Bryan F. Curtin et al., "Forskolin, an Inducer of cAMP, Up-regulates Acetylcholinesterase Expression and Protects against Organophosphate Exposure in Neuro 2A Cells," *Molecular and Cellular Biochemistry* 290, no. 1 (2006): 23–32.

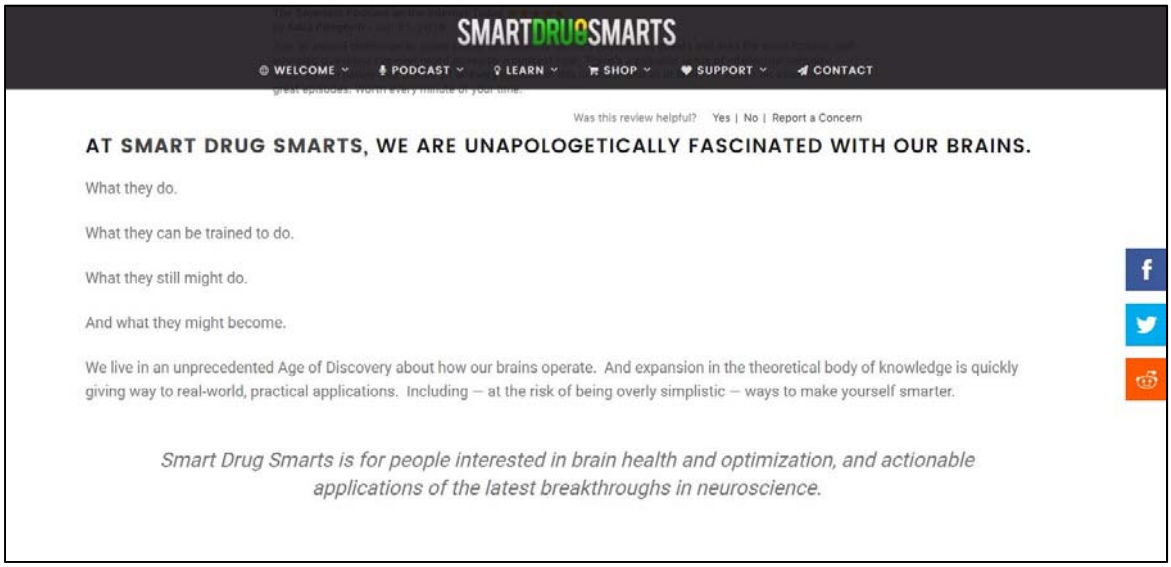
159 Nutt, *Drugs Without Hot Air*, 62.

160 Hub Zwart, "A New Lease on Life: A Lacanian Analysis of Cognitive Enhancement Cinema," in *Handbook Posthumanism in Film and Television*, ed. Michael Hauskeller, Thomas D. Philbeck, and Curtis D. Carbonell (London: Palgrave MacMillan UK, 2015), 214–224.

161 Anna-Katharina Höpflinger and Alexander D. Ornella, "I Sing the Body Electric," *Journal for Religion, Film and Media* 2, no. 1 (2016): 9–14.

162 See for example www.smartdrugsmarts.com. This site provides information and podcasts about such topics as brain health, neuro-tech, nootropics, and future fringe technologies.

Figure 10. Screenshot from SmartDrugSmarts.com[163]



Illegal use of nootropics is common in the United States. According to the National Survey on Drug Use and Health, in 2014, 1.2 percent of young adults ages 18–25 self-reported that they abuse such prescription stimulants as Adderall or Ritalin.[164] One study analyzing abuse prevalence of individuals taking non-prescribed attention-deficit/hyperactivity disorder (ADHD) medications reported abuse rates of 43 percent.[165] Abuse of ADHD medications is popular because the drugs enrich attention, motivation, and focus while decreasing fatigue.[166] Likewise, many athletes abuse steroids, take growth hormones, or use other doping techniques to improve performance.[167] Seeking

[163] "About Us," Smart Drugs Smarts, accessed October 15, 2016, https://smartdrugsmarts.com/about/.

[164] Center for Behavioral Health Statistics and Quality, *Behavioral Health Trends in the United States: Results from the 2014 National Survey on Drug Use and Health* (HHS Publication no. SMA 15-4927(Rockville, MD: Center for Behavioral Health Statistics and Quality, 2015), https://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.pdf, 9.

[165] Claire D. Advokat, Devan Guidry, and Leslie Martino, "Licit and Illicit Use of Medications for Attention-Deficit Hyperactivity Disorder in Undergraduate College Students," *Journal of American College Health* 56, no.6 (2008): 601–606.

[166] Irena P. Ilieva, Cayce J. Hook, and Martha J. Farah, "Prescription Stimulants' Effects on Healthy Inhibitory Control, Working Memory, and Episodic Memory: A Meta-Analysis," *Journal of Cognitive Neuroscience* 27, no. 6 (2015): 1069–1089.

[167] Oliver de Hon, Harm Kuipers, and Maarten van Bottenburg, "Prevalence of Doping Use in Elite Sports: A Review of Numbers," *Sports Medicine* 45, no. 1 (2015): 57–69.

bursts of synthetic clarity, some high performing professionals on Wall Street and in Silicon Valley abuse prescriptions of Provigil (modafinil), a wakefulness agent originally created to treat sleep disorders like narcolepsy.[168] This nootropic drug improves cognitive abilities through concentration, clarity, motivation, and focus, primarily by mediating an increase in adrenaline and dopamine release.[169] Although not approved for sale in the United States, piracetam is a nootropic sold in Europe, Asia, and South America to improve memory as well as learning capacity.[170] There are countless other drugs that people take off-label for nootropic abilities as well.[171]

A considerable market for legal nootropics is also thriving. Backed by independent clinical results, a company known as Onnit sells Alpha BRAIN, a legal cognitive-enhancement drug promising to optimize memory, focus, and mental processing speed.[172] Likewise, Neurohacker Collective sells Qualia, a product to "build a better brain" at the cognitive, psychoaffective, and physiological levels.[173] The company Bulletproof sells Unfair Advantage for a burst of brain-enhancing energy, and KetoPrime for clarity via potent doses of the neuroprotective agent oxaloacetate. The marketing success of NeuroBrands provides evidence of demand for a culture of neural self-augmentation.[174] Seeking legal and natural products to enhance mental stimulation, some

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168 Julia L. Chapman et al., "Modafinil/armodafinil in Obstructive Sleep Apnoea: A Systematic Review and Meta-analysis," *European Respiratory Journal* 50, no. 5 (2016): ERJ-01509. doi: 10.1183/13993003.01509-2015.

169 Jacob S. Ballon and David Feifel, "A Systematic Review of Modafinil: Potential Clinical Uses and Mechanisms of Action," *Journal of Clinical Psychiatry* 67, no. 4 (2006): 554–566.

170 Stuart J. Dimond and E. Y. M. Brouwers, "Increase in the Power of Human Memory in Normal Man through the Use of Drugs," *Psychopharmacology* 49, no. 3 (1976): 307–309.

171 Geraldine Dowling et al., "Outsmarted by Nootropics? An Investigation into the Thermal Degradation of Modafinil, Modafinic Acid, Adrafinil, CRL-40,940 and CRL-40,941 in the GC Injector: Formation of 1, 1, 2, 2-tetraphenylethane and its Tetra Fluoro Analog," *Drug Testing and Analysis* 9, no. 3 (2017): 518–528.

172 Todd M. Solomon et al., "A Randomized, Double-blind, Placebo Controlled, Parallel Group, Efficacy Study of Alpha BRAIN® Administered Orally," *Human Psychopharmacology: Clinical and Experimental* 31, no. 2 (2016): 135–143.

173 To learn more, see for example, http://neurohacker.com/qualia/.

174 "Neuro Bliss and Neuro Codeine," *Neurocritic* [blog], July 23, 2011, http://neurocritic.blogspot.co.uk/2011/07/neuro-bliss-and-neuro-codeine.html.

individuals snort raw cacao powder. A company called Legal Lean even sells a snorting powder called Coco Loko comprising cacao, gingko biloba, taurine, and guarana.

In what might sound like radical pop science, Americans are also taking initiative to combine genetic testing with nootropics.[175] Individuals first obtain DNA analysis using saliva through a company like 23andMe.[176] The kits are available online and through Best Buy, CVS, or Target for $100–$200. Next, several online companies like Nutrahacker or Promethease mine the individual's genetic data and provide recommendations about supplements and nootropics that can enhance the mind and body.[177] In case the list of recommendations is confusing, the site Nootropedia provides comprehensive information on every category of nootropics for self-optimization.[178] The trend of hyper-personalized body hacking will likely continue to present a challenge to drug regulation.

Compelling research on the medical utility of certain illicit drugs continues to challenge the CSA. The American Academy of Neurology published a report in 2014 supporting the use of oral cannabis extract for such neurological conditions as muscle spasticity, pain, and urinary dysfunction.[179] In 2013, researchers published longitudinal data demonstrating the lasting efficacy of using 3,4-methylenedioxymethamphetamine (ecstasy) within a clinical setting to treat patients suffering from chronic post-traumatic stress disorder.[180] While some individuals report taking LSD as a nootropic for

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[175] Kaleigh Rogers, "The Nootropics Community Is Using 23andMe to Match Smart Drugs to Their DNA," *Motherboard*, October 25, 2017, motherboard.vice.com/en_us/article/9kqywy/the-nootropics-community-is-using-23andme-genetic-testing-to-match-smart-drugs-to-their-dna-optimized-quantified-self.

[176] See www.23andme.com for more information on this genetic testing service.

[177] Sites like Nutrahacker (www.nutrahacker.com) or Promethease (www.promethease.com) analyze genetic data for the purpose of providing DNA-based supplement recommendations.

[178] See, for example, www.nootropedia.com.

179 Barbara S. Koppel et al., "Systematic Review: Efficacy and Safety of Medical Marijuana in Selected Neurologic Disorders Report of the Guideline Development Subcommittee of the American Academy of Neurology," *Neurology* 82, no. 17 (2014): 1556–1563.

180 Michael C. Mithoefer et al., "Durability of Improvement in Post-traumatic Stress Disorder Symptoms and Absence of Harmful Effects or Drug Dependency after 3, 4-Methylenedioxymethamphetamine-Assisted Psychotherapy: A Prospective Long-Term Follow-up Study," *Journal of Psychopharmacology* 27, no. 1 (2013): 28–39.

enhancing creativity and empathy, scientists are exploring the use of LSD and/or psilocybin (mushrooms) to treat cluster headaches.[181]

Humans have a long history with nootropics—and one displaying a propensity to creatively adapt plant products to alter brain functioning. The pervasive and increasing promulgation of nootropics indicates that humans naturally desire the ability to biohack their brains for improved performance. Biohacking refers to the process of exploiting or tinkering with genetic material of existing organisms.[182] Nootropics are everywhere, and experts anticipate their use will only increase in the future.[183] The timeless search for new means of cognitive enhancement presents an ethical issue regarding the types of nootropics that society aims to develop and how Americans intend to use them.

2. Artificial Intelligence

The hypothetical scenario of 2030 incorporated a brand extension from IBM's deep learning computer system Watson for specialized uses in particular industries. Wendy assisted the pharmaceutical industry in creating new drugs, Walter aided the agriculture industry, and Wiley combed through aggregated data for law enforcement. Anchored in events already taking place in 2017, this scenario is plausible.

IBM's Watson already has an AI sister named Lucy working in Africa to tackle large-scale development projects across the continent.[184] IBM also pitches this cognitive supercomputer to businesses wanting to utilize aggregate data to enhance marketing capabilities. Lucy specializes in marketing by researching extraordinarily large structured and unstructured data in fractions of a second. Like Watson, Lucy understands natural language processing, and after digesting over 250,000 articles a day, she has the capacity to provide insights and plan the next course of action.[185]

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181 R. Andrew Sewell, John H. Halpern, and Harrison G. Pope, "Response of Cluster Headache to Psilocybin and LSD," *Neurology* 66, no. 12 (2006): 1920–1922.

182 David B. Nash, "Beware Biohacking?," *Biotechnology Healthcare* 7, no. 1 (2010): 7.

183 Cakic, *Smart Drugs for Cognitive Enhancement*, 614.

184 "Lucy-Marketing's Cognitive Companion," IBM, accessed June 17, 2017, https://www.ibm.com/us-en/marketplace/7857.

185 Ibid.

Aside from marketing, IBM has developed numerous applications for using AI in targeted industries.[186] For instance, Watson Education is a global alliance to bring Watson's cognitive abilities to bear to help educate citizens around the world. Additionally, Watson Talent assists human resource departments by aiding recruitment, providing talent insights, career coaching, and improving human resource operations, and Watson Financial Services assists the financial sector on a broad range of issues including customer demographics, risk management, regulatory compliance, and profit enhancement.

In the scenario of 2030, Wendy is a supercomputer that helps pharmaceutical companies rapidly develop new cognitive enhancement drugs. In 2017, Watson for Drug Discovery uses the AI's cognitive capabilities to help researchers identify novel drug targets and different uses for drugs already on the market. For example, Watson for Drug Discovery presently assists researchers at the Barrow Neurological Institute in their mission to discover new drug targets for treating amyotrophic lateral sclerosis In September 2017, over 250 AI and pharmaceutical representatives from leading biotech companies attended a London-based conference on the use of AI in drug development.[187] The company TwoXAR uses AI for drug discovery.[188] Similarly, a startup company in San Francisco called AtomWise uses AI to scan over a million compounds in 24 hours, a process that typically requires months using traditional methodologies.[189] The future use of AI across different business sectors and industries is not only possible...it is already happening.

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186 IBM's website provides information on all of the company's current projects related to Watson: https://www.ibm.com/watson/.

187 "Artificial Intelligence in Drug Development Congress," Oxford Global, accessed April 29, 2017, http://www.artificialintelligence-congress.com/.

188 For example, see www.twoxar.com for more information about artificial intelligence-driven drug discovery.

189 Izhar Wallach, Michael Dzamba, and Abraham Heifets, *AtomNet: A Deep Convolutional Neural Network for Bioactivity Prediction in Structure-Based Drug Discovery* (Ithaca, NY: Cornell University Library, 2015), ArXiv Preprint ArXiv:1510.02855, 11.

3. Marijuana Legalization

The scenario presented in this section involves the decision by Mexico and Canada to legalize marijuana and potentially other recreational drugs. In this scenario, Canada decided to decriminalize all drugs in 2022. The response by the United States is to enforce strictly the CSA, which drives the marijuana industry underground. This scenario highlights the unmaintainable discrepancy between federal and state marijuana laws.

Following campaign promises, in March 2017, Prime Minister Justin Trudeau's Liberal Party voted to legalize marijuana across Canada. By July 2018, infrastructure will be in place for legal marijuana sales across the country. This legislative decision ultimately affects Canadian diplomacy and the country's involvement in international drug control treaties. As of 2017, Canada is a signatory of the United Nation's 1961 Single Convention on Narcotic Drugs, the 1971 Convention on Psychotropic Substances, and the 1988 Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances.[190] The geopolitical ramifications of deciding to break international law through marijuana legalization have yet to be determined.

On the southern border of the United States, Mexican President Enrique Peña Nieto signed a law to legalize medical usage of marijuana in Mexico in June 2017.[191] Mexico's Ministry of Health leads the implementation of regulating the medical use of cannabis and oversees a research program to study the impact of the drug policy. Given the shift from conservative drug laws to medical marijuana legalization, it is not improbable to anticipate full cannabis legalization in Mexico by 2030.

The fictionalized decision by Canada to decriminalize all drugs in 2022 is both conceivable and grounded in a global momentum toward a more liberal drug policy. In

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190 Tom Porter, "How is Canada Legalizing Marijuana? And What Will the Impact Be on Health, Policing and Crime," *Newsweek*, June 24, 2017, http://www.newsweek.com/canada-marijuana-legalization-627909.

191 Enrique Peña Nieto, "Decreto por el Que Se Reforman y Adicionan Disposiciones de la Ley General de Salud y del Código Penal Federal [Decree by Which Various Provisions of the General Health Law and the Federal Penal Code Are Amended and Added]" Diario Oficial de la Federación, June 19, 2017, http://www.dof.gob.mx/nota_detalle.php?codigo=5487335&fecha=19/06/2017. Amendment to articles 237, 245, 290, and 235.

July 2001, Portugal decriminalized possession and use of all drugs for personal use.[192] Portugal's Law 30/2000 decriminalized the use, possession, and acquisition of all drugs for personal use, defined as a 10-day supply.[193] While it removed penal sanctions for drug crimes, this policy did not make drug use legal in Portugal. Rather, Portugal now treats drug use as an administrative violation that has the potential to receive punishment by either fines or community service.

As of 2017, Mexico and Canada have taken the stance that the criminalization of drug use has been a failure and that society needs to approach drug use from a public health lens. The countries are just beginning to move forward in regulating the legal use of marijuana and creating the infrastructure to support this shift. This period of transition leaves the United States in a quagmire at a time when marijuana already is in a regulatory grey area.

As Canada and Mexico scramble to set up infrastructure to regulate a new business industry, the United States is at a crossroads between action and the status quo. U.S. public policy surrounding marijuana is rife with inherent contradiction. The decisions by Mexico and Canada to legalize marijuana at various levels will have a profound impact on the United States. By maintaining the status quo in the United States, marijuana remains suspended in a paradoxical predicament, as any state legalizing marijuana in any form is inherently breaking federal law, yet 29 states and the District of Columbia have done so. Alternately, the United States could follow suit with sweeping decriminalization or move to enforce the CSA strictly. In the hypothetical scenario of 2030, the U.S. federal government decided to strictly enforce the CSA's zero tolerance policy toward marijuana, which eventually drove the relatively new marijuana industry underground, evoking a tribute to the popularity of speakeasies in the early 1920s and 30s.

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192 Arthur Domoslawski and Hanna Siemaszko, *Drug Policy in Portugal: The Benefits of Decriminalizing Drug Use* (New York: Open Society Foundations, 2011).

193 Caitlin Elizabeth Hughes and Alex Stevens, *The Effects of Decriminalization of Drug Use in Portugal* (Oxford: Beckley Foundation Drug Policy Programme, 2007), 1.

In 2017, there is no indication that the U.S. federal government intends to reschedule marijuana within the CSA or decriminalize its use. In February 2017, the White House warned the marijuana industry that "greater enforcement" of federal drug laws would be taking place.[194] Strict enforcement of federal drug laws would upend an industry that had over $6.7 billion in marijuana sales in 2016.[195] An environment of legal uncertainty is unsustainable. Legislative ambiguity impedes the full potential of the marijuana industry.[196] Former Mexican President Vincente Fox cautioned that the decisions by Canada and Mexico to sell marijuana in various forms would lead to stiff competition for marijuana entrepreneurs in the United States. Both border countries aim to export marijuana to the United States; Fox claimed that Mexico intends to integrate cannabis into the North American Free Trade Agreement.[197]

Strict enforcement of the CSA might lead to a shutdown of state and local marijuana dispensaries, cultivation centers, and all associated business industry. The criminal justice system might boost its effort to prosecute personal marijuana use, including all owners, state regulators, and law enforcement officers complicit in their involvement. Although this decision would be extreme, it is not without precedent. In 2013, former Deputy Attorney General James Cole distributed a memorandum notoriously warning states that the Justice Department intended to enforce federal drug laws banning marijuana.[198] The memo included a caveat that the department would likely overlook states with well-run programs, but it warned of federal intervention in states

194 John Wagner and Matt Zapotosky, "Spicer: Feds Could Step up Enforcement Against Marijuana Use in States," *Washington Post*, February 23, 2017, https://www.washingtonpost.com/news/post-politics/wp/2017/02/23/spicer-feds-could-step-up-anti-pot-enforcement-in-states-where-recreational-marijuana-is-legal/?utm_term=.42163b79a473.

195 Debra Borchardt, "Marijuana Sales Totaled $6.7 Billion in 2016," *Forbes*, January 3, 2017, https://www.forbes.com/sites/debraborchardt/2017/01/03/marijuana-sales-totaled-6-7-billion-in-2016/#30ffea4875e3.

196 Kimberly Taylor et al., "An Analysis of the Accounting and Financial Effects of Inconsistent State and Federal Laws in the Recreational Marijuana Industry," *Journal of Legal, Ethical and Regulatory Issues* 19, no. 2 (2016): 11.

197 Claire Atkinson, "Former Mexican President 'Want to be the R. J. Reynolds of Marijuana,'" *New York Post*, August 6, 2017, http://nypost.com/2017/08/06/former-mexican-president-wants-to-be-the-r-j-reynolds-of-marijuana/.

198 James M. Cole, *Memorandum for all United States Attorneys Guidance Regarding Marijuana Enforcement* (Washington, DC: U.S. Department of Justice, 2013), https://www.justice.gov/iso/opa/resources/3052013829132756857467.pdf.

lacking robust regulatory frameworks to control usage. Mounting friction between federal and state marijuana laws will eventually lead to a strategy of either prohibition or a move toward legalization.

4. Globalization and Urbanization

> Innovation and globalization have created opportunity the likes of which has never before existed.[199]

Across the literature on megatrends research, globalization, and urbanization are two of the most prominently reiterated movements. In the scenario presented in this chapter, the United States responds to globalization by moving to an isolationist stance after the country withdraws from the North American Free Trade Agreement. In 2030, 18 countries sign a free trade deal without involvement from the United States. These changes lead to an amplification of border security control measures. At the same time, citizens continue the momentum of relocating to cities in search of employment. This scenario is plausible and highlights some of the issues occurring within the discursive framing surrounding transnational drug policy.

Globalization is a megatrend describing the dynamic movement of increasing connectedness across the globe and among nations. This phenomenon has existed for decades and occurs through multiple complex processes rather than via a singular linear progression.[200] Cultural and social trends strongly influence norms surrounding drug use. The decisions of Canada and Mexico to permit the recreational and medical use of marijuana reflect a cultural trend happening around the world.[201] Currently, more than 25 countries have shifted toward removing criminal sanctions for personal use of illicit drugs.[202] For example, the Netherlands, Uruguay, and certain states within Australia have

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199 Ross, *Industries of the Future*, 249.

200 Hay and Marsh, eds., *Demystifying Globalization*, 3.

201 Jose De Cordoba, "Latin American Panel Calls U.S. Drug War a Failure," *Wall Street Journal*, February 12, 2009, https://www.wsj.com/articles/SB123439889394275215.

202 Niamh Eastwood, Edward Fox, and Ari Rosmarin, *A Quiet Revolution: Drug Decriminalisation across the Globe*, Drugs, the Law, and Human Rights Series (London: Release Publications, 2016), https://www.citywide.ie/download/pdf/a_quiet_revolution_decriminalisation_across_the_globe.pdf, 3.

removed criminal sanctions for the recreational use of marijuana.[203] Moreover, social attitudes in the United States currently favor deregulation and widely call for reform of draconian drug policy at the national level.[204] In 2011, the Global Commission on Drug Policy concluded that the United States should spend less on law enforcement and more on prevention, education, and treatment.[205]

In the midst of globalization, a swelling anti-globalization current is rising to push back the megatrend of international connectedness. Fueled by populist movements and anti-terrorism rhetoric, some countries are taking steps to becoming closed systems. For example in 2016, the United Kingdom decided to withdrawal from the European Union. Within this contextual landscape, it is plausible to imagine a scenario wherein the United States transforms itself into a more isolationist state dealing exclusively in bilateral negotiations. In 2017, the United States withdrew from the Trans-Pacific Partnership held among 12 countries. The federal administration in place in 2017 also intends to renegotiate or withdrawal from the North American Free Trade Agreement with Canada and Mexico.[206] In 2017, the United States withdrew itself from the list of 195 signatories of the Paris Agreement on climate change.[207] This same year, Japan and the European Union signed a free trade agreement encompassing approximately one-third of the global economy and 40 percent of international trade.[208]

Around the world, urbanization is transforming the landscape of population density maps. Economic and social opportunities accompany the migration from rural regions to cities. Concurrently, urbanization taxes infrastructure and drains local

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203 Peter H. Reuter, *Marijuana Legalization: What Can Be Learned from Other Countries?* (Santa Monica, CA: RAND Drug Policy Research Center, 2010), 1.

204 Mahmoud A. ElSohly et al., "Changes in Cannabis Potency Over the Last 2 Decades (1995–2014): Analysis of Current Data in the United States," *Biological Psychiatry* 79, no. 7 (2016): 613–619.

205 Global Commission on Drug Policy, *War on Drugs*.

206 Lylah Alphonse, "Trudeau Urges Caution in Renegotiating NAFTA," *U.S. News*, July 14, 2017, https://www.usnews.com/news/best-states/articles/2017-07-14/justin-trudeau-urges-caution-in-renegotiating-nafta-tells-us-governors.

207 White House, "Statement by President Trump on the Paris Climate Accord" (speech, Washington, DC, June 1, 2017).

208 European Commission, "EU and Japan Conclude 18th Round of Trade Talks," European Commission News Archive, April 10, 2017, http://trade.ec.europa.eu/doclib/press/index.cfm?id=1649.

resources. In the backdrop of a city, availability of illicit drugs permeates and conceals criminal enterprises. The correlation between drug abuse and urban living should inform U.S. strategy for regulating controlled substances. How can the Substance Abuse and Mental Health Services Administration effectively promote prevention of illicit drug use in an urban environment that enables an easy transfer of drugs?

The future is transnational. Globalization and urbanization may increase ramifications to the stability of United States drug policy. Globalization helps drive an underground drug trade between countries. Thus, interdiction and prosecution by law enforcement will continue be challenging. In a highly interconnected global system, fluctuations in one region can inspire unanticipated volatility in another region.[209] Subsequently, the new marijuana policies of Canada and Mexico affect the United States and its place in a burgeoning North American marketplace of marijuana. Furthermore, the movement of many countries to decriminalize drugs will continue to challenge the existence and role of international drug treaties. Futurologist Alec Ross encapsulates that to flourish amid globalization, "a society must be open to exchange new ideas, conduct research free from political interference, and pursue creative projects."[210] The world is increasingly connected, and people are congregating in densely populated metropolises. The United States needs to determine its role among this momentum. The 2030 scenario may not come to fruition in the future, but nonetheless its plausibility should agitate greater questions about the utility and dexterity of the CSA within a rapidly changing world.

C. INFLUENCING UNITED STATES DRUG POLICY

This thesis asks how megatrends and emergent technologies may affect future United States drug policy. This first scenario described for 2030 underscores larger issues of strategic significance. The scenario highlights issues relating to neuroethics, the feasibility of regulating nootropics, marijuana policy failures, and the ethics of AI.

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209 Dobbs, *No Ordinary Disruption*, 72.

210 Ross, *Industries of the Future*, 204.

1. Neuroethics

The drug landscape of the hypothetical 2030 highlights an underlying ethical challenge in framing national drug discourse. An examination of the rising prominence of nootropics elicits the following question: is there something intrinsically wrong with pharmacologically augmenting one's own brain?[211] In the early 1990s, psychologist Peter Kramer envisioned a medical realm of "cosmetic psychopharmacology" entailing the use of medications by healthy people to promote socially desirable personality traits.[212] Since then, more and more people have sought to strengthen their neuroplasticity by biohacking their own minds.

In the scenario, the ubiquity of cognitive enhancement substances raised conflict. This notion incites a discussion on social equality and how the government should regulate the use of nootropics, especially in such realms as schools and sports. Psychologist Vince Cakic likens the use of nootropics in schools to the use of illegal drugs in competitive sports.[213] Cakic points out that prohibiting nootropics in any realm does not level the playing field because inequality is already omnipresent in the United States. From this perspective, a decision to fight educational inequality by banning cognitive enhancement drugs should be consistent and accompany a ban of private tutors or other items for which distribution of access is not equal among all students. Could intelligence augmentation lead to identity-based conflict or civil conflict based on transhumanist advantage? Highlighting the potential for alterity conflict, futurist Rodrigo Nieto-Gómez points to the current dissonance between those supporting transhumanist advantage and those maintaining a bioconservative ethic.[214]

Analyzing the applied ethical issues arising from advancements in neuroscience is beyond the scope of this thesis. The intention of this scenario is to stimulate critical

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211 Françoise Baylis et al., *Health Care Ethics in Canada*, 3rd ed. (Toronto, Ontario: Nelson Education, 2012), 521.

212 Peter D. Kramer, *Listening to Prozac: The Landmark Book about Antidepressants and the Remaking of the Self* (New York: Penguin Group, 1997), 224.

213 Cakic, *Smart Drugs for Cognitive Enhancement*, 612.

214 Rodrigo Nieto-Gómez, "This is Your Brain on Code: Embodied Intelligence Augmentation and Conflict," unpublished paper, 2017.

discussions about how an emerging science of intentional cognitive amplification might affect current drug policy. In 2004, neurologist Anjan Chatterjee coined the term "cosmetic neurology" in reference to the idea of neurocognitive enhancement.[215] Chatterjee claims that humanity is now facing a historical inflection point as it hovers on the brink of a neuro-enhancement revolution.[216] On the other side of this inflection point, the cognitive abilities of healthy individuals will be augmented using brain-enhancing drugs.[217]

The intellectual movement of transhumanism embraces the use of new technologies to improve the human condition. With a limited mechanistic understanding of how the human brain functions, the incorporation of neuroethical discussions into National dialogue is imperative as newer onto-epistemological developments arise. For instance, in a capitalist society of naïve consumerism, what is the role of government in regulating direct-to-consumer marketing for cognitive enhancement drugs? Will employers one day require employees to consume certain substances for enhanced job performance? Will bioethical constructs within the neuroscience of free will change when it is conventional to alter one's consciousness intentionally?

2. Is Nootropic Regulation Possible?

The 2030 scenario highlights the futility of regulating nootropics. The federal government modifies the CSA regularly to include newly discovered drugs. In 2017, the lag time between drug discovery and legislative change already borders on unattainable. The process for rescheduling the legal classification of drugs necessitates an intricate legal process involving either Congressional or administrative executive action. It is easy to classify certain drugs, such as marijuana or cocaine, but how might the federal government regulate substances like the Indian water plant *bacopa monnieri*, which

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[215] Anjan Chatterjee, "Cosmetic Neurology: The Controversy over Enhancing Movement, Mentation, and Mood," *Neurology* 63, no. 6 (2004): 968–974.

[216] Anjan Chatterjee and Oshin Vartanian, "Neuroaesthetics," *Trends in Cognitive Sciences* 18, no. 7 (2014): 370–375.

[217] Jacob M. Appel, "When the Boss Turns Pusher: A Proposal for Employee Protections in the Age of Cosmetic Neurology," *Journal of Medical Ethics* 34, no. 8 (2008): 616–618.

relieves stress and improves memory?[218] At some point, regulators draw a line between illicit drugs and unregulated vitamins or supplements. Further confounding this issue, medical utility is one of the primary factors used to classify where to schedule illegal drugs. This presents a challenge when cognitive enhancement substances accompany solid evidence demonstrating their biological and/or medicinal value. How might the government regulate products like the snorting powder Coco Loko when all of the primary ingredients are available over the counter and occurring frequently in energy drinks?

In this chapter's scenario, the FDA shortens the clinical trial process to promote the proliferation of new drugs and its resulting fiscal boost to the economy. This idea is not outside the realm of possibility; research supports the notion that machine learning outperforms humans in drug design.[219] Researchers studying translational paradigms in drug discovery claim that decisions in the field of pharmacology are increasingly based on aggregated, digitized groupthink in what has become a "positive-herding" phenomenon focused more on outcomes and less on the safety process.[220] The cost of producing a new FDA-approved pharmacological drug is high and continues to rise. Eroom's law states that the price of creating a new pharmaceutical drug doubles every nine years.[221] In 2015, the FDA released a white paper regarding the administration's aim to accelerate the development of new pharmaceutical therapies.[222] To counter declining efficiency in research and development, the use of programs like IBM Watson could assist rapid succession in the discovery of new nootropics. As these new drugs enter the

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218 Matthew P. Pase et al., "The Cognitive-Enhancing Effects of Bacopa Monnieri: A Systematic Review of Randomized, Controlled Human Clinical Trials," *The Journal of Alternative and Complementary Medicine* 18, no. 7 (2012): 647–652.

219 Robert Burbidge et al., "Drug Design by Machine Learning: Support Vector Machines for Pharmaceutical Data Analysis," *Computers and Chemistry* 26, no. 1 (2001): 5–14.

220 Kevin Mullane, Raymond J. Winquist, and Michael Williams, "Translational Paradigms in Pharmacology and Drug Discovery," *Biochemical Pharmacology* 87, no. 1 (2014): 189–210.

221 Jack W. Scannell et al., "Diagnosing the Decline in Pharmaceutical R&D Efficiency," *Nature Reviews Drug Discovery* 11, no. 3 (2012): 191–200.

222 U.S. Food and Drug Administration, *FDA and Accelerating the Development of New Pharmaceutical Therapies* (Washington, DC: U.S. Food and Drug Administration, 2015), https://www.fda.gov/aboutfda/reportsmanualsforms/reports/ucm439082.htm.

market in unconscionable proportion, trying to regulate all new substances adequately becomes an unsustainable game of whack-a-mole.

3. Marijuana Policy Failures

The scenario presented in this chapter draws attention to the challenge of managing the impact of marijuana legalization in the border countries of Canada and Mexico. In a landscape of globalization and a burgeoning movement to decriminalize drugs in certain countries, it is reasonable to forecast increasing recreational drugs becoming legal in Mexico and Canada. Borders are porous. Moreover, a decision by Canada or Mexico to follow Portugal's model to decriminalize all drugs would have widespread implications for the United States. Regulation would be subject to the usual vicissitudes of drug control efforts on the border—but on a substantially larger scale.

In considering other recreational drugs, can the United States avoid the pitfalls and policy mistakes of marijuana regulation? In 2017, marijuana remains in a legal purgatory hovering between federal prohibition and asynchronous state laws that allow the drug in certain forms in certain contexts. A trend by Mexico, Canada, or other countries to legalize psychoactive substances beyond marijuana could further obfuscate the already complicated enforcement capability of United States drug policy. Escalating globalization further befuddles domestic drug control efforts amid international integration in the free movement of people and goods.

In considering the ability of the United States to keep marijuana illegal despite widespread availability in its border countries, it is helpful to revisit the efficacy of alcohol prohibition during the early part of the nineteenth century. American-Mexican relations were altered following the prohibition of alcohol production and consumption in accordance with the 1919 Volstead Act.[223] Literature on drug policy implementation supports the notion that enforcement does not reduce availability.[224] Rather, zero tolerance policies merely drive illicit drug markets underground as the United States

[223] Gabriela Recio, "Drugs and Alcohol: U.S. Prohibition and the Origins of the Drug trade in Mexico, 1910–1930," *Journal of Latin American Studies* 34, no. 1 (2002): 25.

224 Shawn D. Bushway and Peter Reuter, "Deterrence, Economics, and the Context of Drug Markets," *Criminology and Public Policy* 10, no. 1 (2011): 183–194.

experienced during Prohibition.[225] During this period, Tijuana, as well as other Mexican cities, blossomed as havens for alcohol. Additionally, alcohol prohibition in the United States led to the formation of lucrative black markets. Mexico's bootlegging role in 1910 established drug trafficking routes that are still in existence in 2017.[226]

While marijuana legalization has yet to go into effect in Mexico and Canada, the domestic policy environment is facing rapid change. In July 2017, Oregon presented House Bill 2355, legislation decriminalizing cocaine, heroin, ecstasy, and methamphetamine for residents without previous felony convictions or more than two previous drug arrests.[227] Marijuana legalization in both border countries will further agitate domestic drug enforcement policies with a significant change.

4. Ethics of Artificial Intelligence

In the scenario outlined in this chapter, in 2030, the pharmaceutical industry capitalizes on AI to help create new cognitive enhancement drugs. At a time when autonomous robots are already performing soft-tissue surgery, the use of AI for drug discovery is underway and thus highly relevant.[228] The scenario highlights the need to assess developing technologies proactively as society moves toward an increasingly symbiotic relationship between human and machine.

Artificially intelligent robots are already in use in such fields as medicine, the military, transportation, and other industries. In October 2017, the first robot in the world was recognized with a nationality when Saudi Arabia official granted citizenship to

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225 Peter J. Boettke, Christopher J. Coyne, and Abigail R. Hall-Blanco, "Keep Off the Grass: The Economics of Prohibition and U.S. Drug Policy," *Oregon Law Review* 91, no.1 (2013): 1069–1095.

226 Recio, *Drugs and Alcohol*, 22, 26.

227 Kristina Edmunson, "Statement from AG Rosenblum on Her 2017 Oregon Legislative Session Priorities and Accomplishments," press release, Oregon Department of Justice, July 7, 2017, http://www.doj.state.or.us/releases/Pages/2017/rel070717.aspx.

228 Meera Senthilingham, "Would You Let a Robot Perform your Surgery by Itself?," *CNN*, Mary 12, 2016, http://www.cnn.com/2016/05/12/health/robot-surgeon-bowel-operation/.

Sophia, an intelligent humanoid robot.[229] Despite this progress, the field is still nascent and growing; we can anticipate that AI and machine learning will play a more comprehensive role in biomedical research in the future.[230] Moore's law stipulates that the number of transistors per square inch on integrated circuit boards will double every year.[231] One consequence of this type of exponential growth is that technology simultaneously becomes cheaper and more advanced. Applying this theory to AI, what happens when AI and programs like IBM Watson are affordable for anyone? Could drug syndicates hack AI units to develop new illicit drugs or even use their cognitive abilities to sell drugs?[232]

Technological singularity refers to the ability of AI to improve itself autonomously, ultimately surpassing human control or grasp. As of 2017, many experts predict that AI technology will reach human capability before the year 2045; some experts predict singularity will even occur before 2030.[233] Pushing for regulation in July of 2017, Elon Musk warned the National Governors Association about the existential risk posed by AI.[234] What happens to U.S. national drug policy when AI comes to the life sciences in a more mainstream capacity? The United States currently lacks a national biology policy. This is concerning, as the future of cyber-crime will likely be exponential, automated, and three-dimensional.[235] The United States needs a proactive policy

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229 Natasha Salmon, "Robot Granted Citizenship in Saudi Arabia has 'More Rights than Saudi Woman,'" *The Times of India*, October 31, 2017, https://timesofindia.indiatimes.com/world/middle-east/robot-granted-citizenship-in-saudi-arabia-has-more-rights-than-saudi-woman/articleshow/61359381.cms.

230 Wlodzislaw Duch, Karthikeyan Swaminathan, and Jaroslaw Meller, "Artificial Intelligence Approaches for Rational Drug Design and Discovery," *Current Pharmaceutical Design* 13, no. 14 (2007): 1497–1508.

231 Robert R. Schaller, "Moore's Law: Past, Present, and Future," *IEEE Spectrum* 34, no. 6 (1997): 52–59.

232 Goodman, *Future Crimes*, 413.

233 Bogdan Nicolescu, "The Dark Side of Technological Singularity: New Barbarism," *Cybernetics and Human Knowing* 23, no. 4 (2016): 77–83.

234 Camila Domonoske, "Elon Musk Warns Governors: Artificial Intelligence Poses 'Existential Risk,'" *The Two Way, NPR*, July 17, 2017, http://www.npr.org/2017/07/17/537686649/elon-musk-warns-governors-artificial-intelligence-poses-existential-risk.

235 Goodman, *Future Crimes*, 506.

infrastructure that can anticipate how future developments in emerging technologies could affect the nation.

5. A Path Forward

When it comes to American drug policy, are policymakers asking the right questions? National drug policy should reflect a deliberate system of doctrines leading to the intended outcome of reducing morbidity and mortality caused by drug use. Antidepressants, anesthetics, and plastic surgery were all initially considered fringe and bizarre bodily modifications before becoming ordinary.[236] Absent an unpredictable wildcard event, linear extrapolation of current trends indicate that emerging technologies will undoubtedly affect the future landscape of drug use in America. It is important to assess not only what United States drug policy aims to accomplish, but also how it intends to do so. Does the CSA effectively realize this goal or does the country have a catawampus collective of unsustainable policy directives ready to be undermined by digital convergence?

236 Webb, *Signals are Talking*, 128.

IV. SCENARIO 2: WEARABLE ENHANCEMENT

In this scenario, biohackers have discovered ways to trigger pleasure areas of the body to stimulate the brain via neural interface technology. In the hyper-connected world of 2030, Americans combine neural stimulation with illicit synthetic drugs and other technologies. Ubiquitous digital currency and exponential technological growth challenge interdiction efforts.

Over 35 billion devices comprise the worldwide IoT. Mired in the inertia of exponential technological growth, digital disruption improves the quality of life for most Americans. Stores are fully automated using RFID technology.[237] Robotic digital assistants assiduously take care of mundane tasks, challenging the orthodoxy of the 40-hour work week. Banking systems use cloud-based digital currency with biometric scanning to verify identities. Due to the IoT and its interconnecting richness, the United States exists as a hyper-connected society. Human ingenuity produces a variegated mix of IoT-based toys and devices with a prevalent, if erroneous, belief that these new technologies are largely impervious to hacking.

The year 2030 is a world full of newfangled gadgets altering perception through cybernetics—the scientific study of the synthesis between humans, animals, and machines through frames of information, control, and communication.[238] Through amalgamating the organic and the mechanical, people have ascertained ways to use neural interface devices for recreational drug use. An array of neural stimulation devices appear on the market for public consumption. Many of the devices mimic illicit drugs in the human brain, despite their lack of a physical biochemical structure. Should United States drug policy concern itself with the development of non-biochemical devices that alter consciousness?

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[237] Radio-frequency identification n (RFID) uses electromagnetic fields to identify automatically and track tags attached to objects.

[238] Katherine N. Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 2008), 8.

A. THE WORLD: 2030

Americans live in a socio-technical world of human ingenuity and digital disruption. In this environment, there is greater tolerance for ambiguity. Digitized cities exist collectively on one national smart grid. Robust infrastructure improvements make the United States highly efficient, although critics point out how the unified grid essentially organizes the country into potential national instability. Over 99.5 percent of Americans are online and hyper-connected in a ubiquitous web of networked computing.

With countless new technologies on the market, Americans generally possess a sanguine view of exponential technological growth. Subject to frequent topics of discussion in the news, biohackers discover innovative ways to stimulate the brain to release specific neurotransmitters through neural interfaces. With direct neural stimulation, individuals can subversively hack their own neurotransmitters to release natural opioids or specific neurotransmitters like dopamine without having to ingest noxious chemicals physically. Lacking a regulatory framework to oversee many of these products, the U.S. Patent and Trademark Office reported a 460 percent increase in the number of patents filed during the last fiscal year.

A Japanese company called HaiRave sells neon, rainbow-colored hair wigs that cause hallucinations by the individual wearing the wig. The wigs operate by dramatically elevating dopamine levels in the brain. After appearing in a viral music video, the wigs became a staple feature at raves and music festivals. This year, the wigs were for sale by multiple vendors at Coachella.[239] Carrying only beers and smart phones, festival-goers paid for the wigs seamlessly using ZaBux digital currency with the touch of their finger on the screen. Outside of the United States, the wigs are also popular across Europe and in parts of China and Japan. The theatrical antics of people wearing HaiRave wigs at music festivals belie the severity of the notion that humans are slowly merging with machines.

[239] The Coachella Valley Music and Arts Festival is an annual music and arts festival held in California.

The landscape of competitive sports looks warped as new products, such as Vitaglass, spark heated debate. Vitaglass Products is a company producing neural stimulating eyeglasses for athletes. The glasses contain a transmitting node near the back of the ear to stimulate norepinephrine release to produce energy surges mimicking a fight-or-flight response. The company anticipates the release of a contact lens version of their product within the next five years. The glasses are especially prominent in sports, like sprinting, which require type II fast-twitch muscle fibers.[240] Athletes wearing Vitaglass consistently outperform, at statistically significant levels, when compared with athletes not wearing the eyeglasses. Proponents of Vitaglass point to the fact that sports associations do not ban the wearing of eyeglasses. Moreover, the sheer variety of frames produced by Vitaglass Products makes it nearly impossible to determine who is wearing Vitaglass as opposed to ordinary eyeglasses. Critics of Vitaglass claim the wearables give athletes an unfair advantage over their opponents. Physicians and scientists are concerned with the unknown and potential long-term risks associated with manipulating norepinephrine levels in the brain. Already, abuse of Vitaglass is associated with causing a flat affect, an apathetic mindset, and general fatigue. A recent article in *The Atlantic* profiles four professional athletes known for openly using Vitaglass. The exposé highlights the danger of this new technology as all four athletes reported miserable feelings of anxiousness, hyperactivity, and hypervigilance in the 24-hour period following a major sporting event in which Vitaglass technology was used repeatedly. In spite of this negative news coverage, Vitaglass Products reported a steep increase in sales of glasses in the quarter following the article's publication.

The utility of neural interface products extends beyond therapeutic use. Mellow Melon is a helmet stimulating serotonin receptors of the brain's inhibitory system and a release of gamma-Aminobutyric acid. Wearing the device produces a gentle warming sensation and feelings of relaxation. This innovative technology galvanizes a potentially dangerous paradox; many individuals report using Mellow Melon in lieu of taking

[240] Scientists classify muscle fibers by type I ("slow-twitch") or type II ("fast-twitch"). High force, power, and speed production, but low endurance characterize type II muscle fibers. William J. Evans and Jan Lexell, "Human Aging, Muscle Mass, and Fiber Type Composition," *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 50, no. Special Issue (1995): 11–16.

medications for anxiety or depression. Others report using the helmet as a replacement for smoking marijuana or consuming opioids.

Advertised on the QVC, Shed Head is a weight loss headband stimulating the release of epinephrine, a hormone essential to metabolism. Excess use of this product is associated with sleep problems, anxiety, and attention disorders. Nevertheless, the side effects fail to hinder sales of the headband; users report feeling mentally alert and focused while wearing it. Scientist Karla Kienlen, creator of Shed Head, claims empirical studies provide evidence that the headband successfully inhibits insulin excretion and raises levels of fatty acids in the blood. Double-blind placebo studies demonstrate that participants with a body mass index above 25 typically lose at least one pound per week while using Shed Head.[241]

The pharmaceutical industry faces a need to pivot their business strategy, as neural interfacing technologies slowly eliminate the need to ingest biochemical substances. Last year, the FDA approved Ceresulin, a hair cap to control type II diabetes. Placed on the head, the cap directs the brain to stimulate the pancreas to release more insulin, a peptide hormone involved in the regulation of metabolism. Ceresulin replaces the need for an arsenal of injections and diabetes prescriptions—the number of minutes spent wearing the cap replaces the need for rapid release, short-acting, and long-acting insulin regulation drugs. Biofeedback technology links a patient's insulin vitals directly to their smartphone in real-time with a medical consent option to give physicians access to insulin monitoring. A built-in safety feature turns the cap off if a patient's insulin levels approach dangerously high levels.

Combining neural stimulation devices with other substances and technologies amplifies their potential side effects. In 2030, synthetic drugs are highly prevalent with approximately 200 new substances arriving on the street each year. On college campuses across America, students experiment by combining neural stimulation devices like

[241] Body mass index (BMI) is a score based on an individual's height and weight; it is used to categorize persons as underweight (<18.5), normal (18.5-24.9), overweight (25-29.9), or obese (>30). Mariel M. Finucane et al., "National, Regional, and Global Trends in Body-Mass Index Since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 960 Country-Years and 9.1 Million Participants," *The Lancet* 377, no. 9765 (2011): 557–567.

HaiRave with synthetic drugs, as highlighted in Figure 11. Athletes test the limits of their physical endurance by coalescing Vitaglass eyeglasses and traditional forms of doping like steroids.

Figure 11. GNN: Collegiate Drug Use in a Digital Age

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August 6, 2030

Collegiate Drug Use in a Digital Age
by Virginia Shea, GNN 10:19 AM ET

COMMENTS **(add comment)**

(GNN) — On college campuses across America, students are experimenting by combining neural stimulation devices like the popular HaiRave with synthetic drugs.

As reported in a GNN exclusive last week, the National Pan-Hellenic Campus issued warnings to 26 sorority organizations as transports to local emergency departments continue to escalate. Today, the Office of National Drug Control Policy released a statement encouraging universities to educate students about the dangers associated with synthetic drugs, especially in combination with neural stimulation devices.

From January to August of 2029, a reported 2,346 college students were transported to hospitals following combined use of drugs and neural stimulation devices. Authorities are especially concerned about abuse of the devices during Greek life hazing rituals. At the University of Florida, use of Vitaglass eyeglasses by the college's football team has stirred controversy, as reported last week by Florida Today.

For more on this topic, click **here**.

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In the healthcare field writ large, physicians worry about the potential for long-term brain damage from excessive exposure to various neural stimulation devices. Underscoring their concern is a void in longitudinal data on the topic. On one hand, bio-hackers creating neural interface devices are tinkering with brain chemistry in the same manner as a biochemist would. On the other, the interaction effect from combining multiple neural interfacing devices remains unknown. Pharmacists argue that as an increasing number of neural interfacing devices appear on the market, it is important that the various FDA-approved healthcare devices are able to integrate their platforms to avoid the effects of drug interactions. At the last annual meetings of the American

Pharmacists Association and the American Medical Association, multiple pharmacists and neurosurgeons led forum discussions on the possible brain damage and lasting medical implications that could arise as Americans continue to experiment with various neural interface devices on the market.

However, not all physicians are against the use of neural interface technology. In the field of behavioral health, psychiatrists treating substance use disorders promote the use of interface technology as a replacement therapy for other biochemical recreational drugs, as illustrated in Figure 12. The use of interface replacement therapy is especially effective in treating patients addicted to such hallucinogenic drugs as ecstasy, psilocybin ("magic mushrooms"), LSD (or "acid"), and phencyclidine (PCP or "Angel Dust"). A clinic in San Francisco operates a clinical trial for substitution therapy wherein HaiRave technology works as a replacement for popular hallucinogenic club drugs. Behavioral health advocates and addiction counselors applaud this form of substitution therapy as an effective harm reduction approach.[242] Preliminary data from a large pilot study reveals a 30 percent improvement in the success of substitution therapy for treating addiction when compared with standard detox and outpatient treatment.

[242] As an approach, harm reduction seeks to utilize a broad set of strategies to meet individuals where they are, rather than aiming for strict abstinence from illicit drug use. This approach tolerates treatment goals as directed by consumers. An example of a harm reduction strategy in treating substance use disorders is the distribution of clean needles for injection drug users. Alan G. Marlatt, Arthur W. Blume, and George A. Park, "Integrating Harm Reduction Therapy and Traditional Substance Abuse Treatment," *Journal of Psychoactive Drugs* 33, no. 1 (2001): 13–21.

Figure 12. HaiRave Rehab Advertisement

This age of exponential technological growth and hyper-connectivity highlights the danger of trusting neural interface devices. When the IoT links everything, everything is vulnerable. Illustrated in Figure 13, the U.S. Department of Homeland Security (DHS) and the Federal Bureau of Investigation (FBI) publish bulletins alerting state fusion centers about the possibility that neural interface devices could be hacked. Operatives within the intelligence community regard neural interface technology with trepidation, especially in light of the cavalier attitudes of Americans as most citizens lack awareness of how this same technology has utility for nefarious purposes. Just last year, a lawmaker in Germany had his Ceresulin cap hacked on the morning of voting for a highly controversial piece of legislation. An unknown source was able to access the Ceresulin cap and order it to release excessive levels of insulin, bypassing the automatic shutoff safety feature and causing the lawmaker to fall unconscious.

Figure 13. FBI/DHS Joint Intelligence Memo

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Intelligence Bulletin
Joint FBI-DHS Bulletin No. 349

(U//FOUO) Diabetic Ceresulin Hacking

Friday April 13, 2029

***(U) Handling Notice**: Recipients are reminded that FBI and DHS intelligence bulletins contain sensitive information on terrorism and criminal investigation meant for use primarily within the law enforcement and homeland security communities. Such bulletins shall not be released in either written or oral form to the media, the general public, or other personnel who do not have a valid need-to-know without prior approval from an authorized FBI or DHS official.*

(U) Prepared by the FBI's Counterterrorism Division / Directorate of Intelligence, Counterterrorism Analysis Section and the DHS/I&A Domestic Threat Analysis Division in support of activities of the Department. The Intragency Threat Assessment and Coordination Group has reviewed this product from the perspective of our non-federal partners.

(U) Scope

(U//FOUO) This product is intended to provide perspective and understanding of the nature and scope of potentially emergent threats and to assist federal, state, local, and tribal government agencies and authorities, the private sector, and other entities to develop priorities for protective and support measures relating to an existing or emerging threat to homeland security.

(U) Key Findings

(U/FOUO) According to a confidential informant and open source reporting, German Finance Minister Hans-Peter Scholz was hospitalized following the hacking of his FDA-approved Ceresulin hair cap for controlling Type II diabetes. The hacks appear intended to keep Scholz from voting on highly controversial legislation related to bank bailouts. Initial reporting indicates Scholz appears to be the only individual affected by this targeted bio-hack. The FBI and DHS are unaware of any bio-hacking incidents of this type within the United States.

- (U//FOUO) An unknown source was able to access Scholz's Ceresulin cap and ordered the device to release excessive levels of insulin, bypassing automatic shutoff safety features.
- (U//FOUO) According to initial FBI investigation, Scholz fell unconscious at 07:43 and was stabilized at Alexianer St. Hedwig-Krankenhaus Hospital at 13:04.
- (U//FOUO) Given potential consequences of brain—computer interface vulnerability, this incident is being investigated in collaboration with the Department of Homeland Security. Hyper-connectivity enhances the danger of trusting neural stimulation and interfacing devices. This type of incident could occur in the United States. Investigation into the bio-hack is ongoing.

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Critics of neural stimulation devices call for strict regulatory oversight. In response, advocates point to the fact that BCI devices are merely computers. How might the government create the regulatory infrastructure to govern their use—should the government even aim to do so?

B. WHERE ARE WE IN 2017?

The previous section presented a plausible scenario for the year 2030. The fictional narrative highlighted the structural inter-relationships of the driving forces of neural stimulation, BCI, the IoT, a hyper-connected society, and exponential technological growth. In 2017, the fundamental driving forces that could make this scenario come to fruition are largely already in existence.

1. Neural Stimulation and BCIs

> That psychiatrists can use both drugs and electricity to battle illness testifies to the fact that the brain is both a chemical and an electrical organ.[243]

The concept of stimulating an individual's nerves for therapeutic reasons is not new. In 46 A.D. Rome, a court physician to Emperor Claudius used electric rays to relieve headache pain.[244] In the 1700s, Italian anatomist Luigi Galvani discovered that applying an electrical current to the muscles of dead frogs caused their limbs to twitch.[245] Nearly a century later, German physicians Fritsch and Hitzig laid the groundwork for understanding the motor cortex through their realization that by stimulating various parts of the brains of live dogs, they could produce predictable limb movements.[246] Since the eighteenth century, the understanding of neural interfaces continues to evolve.

A BCI allows an individual to communicate with a device using only the brain's electrical conductivity.[247] Previous research demonstrates BCI technology can already

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[243] Samuel K. Moore, "Psychiatry's Shocking New Tools: Electronic Implants and Electromagnetic Pulses Are Picking Up Where Psychoactive Drugs Have Failed," *IEEE Spectrum*, February 28, 2006, https://spectrum.ieee.org/biomedical/diagnostics/psychiatrys-shocking-new-tools.

[244] Jack E. Jensen et al., "The Use of Transcutaneous Neural Stimulation and Isokinetic Testing in Arthroscopic Knee Surgery," *The American Journal of Sports Medicine* 13, no. 1 (1985): 27–33

[245] André Parent, "Giovanni Aldini: From Animal Electricity to Human Brain Stimulation," *Canadian Journal of Neurological Sciences* 31, no. 4 (2004): 576–584.

[246] Charles G. Gross, "The Discovery of Motor Cortex and its Background," *Journal of the History of the Neurosciences* 16, no. 3 (2007): 320–331.

[247] Jonathan R. Wolpaw et al., "Brain-Computer Interfaces for Communication and Control," *Clinical Neurophysiology* 113, no. 6 (2002): 767–791.

detect, noninvasively, whether an individual is thinking "yes" or "no."[248] A company called BrainGate aims to turn thoughts literally into action by developing neural interfacing technology.[249] In March 2017, this technology allowed a man with quadriplegia to gain mobility in his limbs following implantation of a brain-recording, muscle-stimulating device.[250] Clinical trials for the BrainGate2 Neural Interface System are underway to allow individuals with tetraplegia to operate communications software by simply imagining the movement of their hands.[251]

By using neural interfaces, scientists aim to connect an individual's nervous system with the outside world. In this scenario, neural stimulation devices serve multiple functions and purposes to stimulate one's brain to release specific neurotransmitters. In 2017, physicians use neural stimulation technology to treat such neurological conditions as spinal cord injuries, neurological disorders, and sensory disorders.[252] To stimulate human nerves, physicians already use electrical, mechanical, and/or light stimulation devices.[253] Because of this technological innovation, individuals with sensory loss can use cochlear implants, retinal implants, and spinal cord stimulators to restore hearing, sight, and relieve pain, respectively.[254] This technology supports cardiac pacemakers, implantable defibrillators, and even has potential for treating arthritis.[255] The Bion microstimulator is a miniature wireless device that physicians inject into the body;

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[248] Eric W. Sellers and Emanuel Donchin, "A P300-Based Brain-Computer Interface: Initial Tests by ALS Patients," *Clinical Neurophysiology* 117, no. 3 (2006): 538–548.

[249] Ming Yin et al., "Wireless Neurosensor for Full-Spectrum Electrophysiology Recordings during Free Behavior," *Neuron* 84, no. 6 (2014): 1170–1182.

[250] Susan Fitzgerald, "Novel Brain-Controlled Technology Allows Paralyzed Man to Use His Arm and Hand," *Neurology Today* 17, no. 9 (2017): 1–20.

[251] Jörn Vogel et al., "Continuous Control of the DLR Light-Weight Robot iii by a Human with Tetraplegia using the Braingate2 Neural Interface System," in *Experimental Robotics: The 12th International Symposium on Experimental Robotics*, ed. Oussama Khatib, Vijay Kumar, and Gaurav Sukhatme (Berlin: Springer, 2014), 125–136.

[252] Stuart F. Cogan, "Neural Stimulation and Recording Electrodes," *Annual Review of Biomedical Engineering* 10 (2008): 275–309.

[253] Jinn-Rung Kuo et al., "Deep Brain Light Stimulation Effects on Glutamate and Dopamine Concentration," *Biomedical Optics Express* 6, no.1 (2015): 23–31.

[254] Kristoffer Famm et al., "Drug Discovery: A Jump-Start for Electroceuticals," *Nature* 496, no.7444 (2013): 159–161.

[255] Colin Reardon, "Neuro-Immune Interactions in the Cholinergic Anti-Inflammatory Reflex," *Immunology Letters* 178 (2016): 92–96.

clinical trials are currently underway to appraise the utility of this device for treating a wide range of neurological conditions from urinary incontinence to sleep apnea or headaches.[256] Neural stimulation is also a key component of BCI technology.

Research on implantable "neural dust" shows promise for the future of brain monitoring. Neural dust refers to a technology involving thousands of free-floating, independent sensor nodes in the brain the size of dust particles.[257] The particles identify extracellular electrophysiological data and communicate that information to a subcranial interrogator device.[258] During in vivo testing led by the Defense Advanced Research Projects Agency (DARPA) in 2016, ultrasound wirelessly powered and communicated with tiny devices implanted into muscles and nerves.[259] The use of ultrasound allows for the placement of tiny sensors deep within human bodies without interrupting the ability of the sensors to read neural signals. In the future, scientists aim to shrink neural dust to half the width of a single strand of human hair.[260]

Most neural interface research focuses on outputs, but input research is slowly evolving. Input research allows scientists to record neural signals, an area where BCI technology is critical. For instance, by recording brain signals, researchers could decipher how individuals with paralysis intend to move their limbs. With a solid mapping of brain circuitry, researchers can understand neural coding, plasticity, disease origins, and the relationship between the brain and behavior.[261] Understanding this foundational knowledge of the brain opens countless new avenues for utilizing neural stimulation.

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[256] Todd K. Whitehurst et al., "The Bion® Microstimulator and Its Clinical Applications," in *Implantable Neural Prostheses 1: Devices and Applications*, ed. David D. Zhou and Elias Greenbaum (New York: Springer, 2009), 253–273.

[257] Dongjin Seo et al., *Neural Dust: An Ultrasonic, Low Power Solution for Chronic Brain-Machine Interfaces* (Ithaca, NY: Cornell University, 2013), https://arxiv.org/pdf/1307.2196.pdf.

[258] Ibid., 1.

[259] "Implantable 'Neural Dust' Enables Precise Wireless Recording of Nerve Activity," Defense Advanced Research Projects Agency, August 3, 2016, https://www.darpa.mil/news-events/2016-08-03.

[260] Gregory Mone, "Sensors on the Brain," *Communications of the ACM* 60, no. 4 (2017): 14, doi: 10.1145/3048380.

[261] Nicholas G. Hatsopoulos and John P. Donoghue, "The Science of Neural Interface Systems," *Annual Review of Neuroscience* 32 (July 2009): 249–266.

The jump from invasive neural stimulation to wearable devices is not inconceivable. The products featured in this scenario profiled a hallucination-causing wig, norepinephrine-releasing sports eyeglasses, a relaxation-inducing helmet, a weight loss headband, and a hair cap for treating type II diabetes. Already in existence and sold in over 170 countries, people purchase HairMax, a wearable headband laser device to stimulate hair growth.[262] In 2017, groundbreaking research is underway for using vagus nerve stimulation (VNS) to treat epilepsy and depression.[263] Historically, treating severe depression using VNS has been invasive and involved neurosurgery to implant a stimulator device into the patient's brain.[264] In 2016, researchers successfully developed a noninvasive form of VNS for treating severe depression by merely clipping electrodes to a patient's ear.[265]

People already use electrical signals from their brains to interact with and influence their environments.[266] This technology is in use in robotic devices, in visual spelling apparatuses, in prostheses, in certain wheelchairs, and in the disabled community.[267] Some pacemaker devices interface with the Internet for remote cardiac monitoring.[268] Wearable fitness trackers, such as Nike's Fitbit, track body movement, heart rate, sleep, and calories. User data transmits in real time to a computer, tablet, or smartphone app.[269] Doppel is a wearable technology that uses rhythmic pulses to induce

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[262] See, for example: www.hairmax.com.

[263] Jared Pisapia and Gordon Baltuch, "Vagus Nerve Stimulation," in *Neuromodulation in Psychiatry*, ed. Clement Hamani et al. (Chichester, UK: John Wiley and Sons, 2016), 325–334.

[264] Jiliang Fang et al., "Transcutaneous Vagus Nerve Stimulation Modulates Default Mode Network in Major Depressive Disorder," *Biological Psychiatry* 79, no. 4 (2016): 266–273.

[265] Ibid., 266.

[266] Jerry J. Shih, Dean J. Krusienski, and Jonathan R. Wolpaw, "Brain-Computer Interfaces in Medicine," *Mayo Clinic Proceedings* 87, no. 3 (2012): 268–279.

[267] Ulrich Hoffmann et al., "An Efficient P300-Based Brain-Computer Interface for Disabled Subjects," *Journal of Neuroscience Methods* 167, no. 1 (2008): 115–125.

[268] Paul Boulos et al., "Pacemakers: A Survey on Development History, Cyber-Security Threats and Countermeasures," *International Journal of Innovative Studies in Sciences and Engineering Technology* 2, no. 8 (2016): 21–25.

[269] Rocky Termanini, *The Cognitive Early Warning Predictive System Using the Smart Vaccine: The New Digital Paradigm for Smart Cities and Critical Infrastructure* (Boca Raton, FL: CRC Press, 2016), 267.

calmness and focus.[270] Placed on the base of a user's neck, Thync uses neurostimulation to lower stress and anxiety.[271]

Emerging research also grounds the idea of using wearable neural stimulation for drug delivery, medical treatments, and health monitoring. Like the Ceresulin hair cap for treating diabetes in the scenario, evolving medical device research highlights how neural stimulation has value for drug delivery. For instance, a patent filed in 2001 outlines the use of neural stimulation devices to deliver drugs to patients in the treatment of cardiovascular disorders.[272] In 2014, Google submitted a patent for digital multisensing contact lens that could help individuals with diabetes by monitoring glucose levels in their tears.[273] Collaborating on this initiative, Novartis aims to link Google's smart lens to smartphones or tablets to help diabetic patients monitor their blood glucose levels using real-time data from the contacts.[274]

Also targeting the eyes, Sensimed is a Swiss startup developing FDA-approved contact lens for treating glaucoma by embedding microsensors for monitoring intraocular pressure into silicone lens.[275] In collaboration with the Gates Foundation, Fuse Project is developing Kernel of Life, a diagnostic medical device necklace using cloud technology for health monitoring and diagnosis.[276] Biosensing pads test blood, saliva, urine, and breath; results transmit by Bluetooth to mobile apps.[277] The rapid adoption of wearable

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[270] For more information, see www.doppel.london.

[271] Isy Goldwasser et al., "Wearable Transdermal Electrical Stimulation Devices and Methods of Using Them," U.S. Patent 8,903,494, issued December 2, 2014.

[272] Robert S. Kieval, "Drug Delivery Neural Stimulation Device for Treatment of Cardiovascular Disorders," U.S. Patent 6178349B1, issued January 23, 2001.

[273] "Digital Contact Lenses Can Transform Diabetes Care," Medical Futurist, accessed October 15, 2017, http://medicalfuturist.com/googles-amazing-digital-contact-lens-can-transform-diabetes-care/.

[274] Jonah Comstock, "Novartis CEO Comments, New Patent Shed Light on Google's Contact Lens Project," *Mobile Health News*, September 8, 2015, www.mobihealthnews.com/46600/novartis-ceo-comments-new-patent-shed-light-on-googles-contact-lens-projects.

[275] Michael Sawh, "Triggerfish Smart Contact Lens All Set to Tackle Glaucoma," Wareable, March 8, 2016, www.wareable.com/health-and-wellbeing/smart-contact-lens-glaucoma-2419.

[276] For more information, see https://fuseproject.com/work/kernel/diagnostic-amulet/?focus=overview.

[277] Ibid.

fitness trackers provides evidence that wearable neural stimulation devices could be similarly embraced in the future.

Not all innovative neural stimulation devices target medical conditions. In her book, *Bonk: The Curious Coupling of Science and Sex*, Mary Roach describes how neural stimulation can assist individuals in achieving orgasm.[278] For instance, FertiCare creates a transcutaneous mechanical nerve stimulation device to help males with spinal cord injuries achieve orgasm.[279] Separately, Dr. Stuart Meloy created the "Orgasmatron," a modified spinal cord stimulator device wired to an individual's spine to emit pleasure signals directly to the spinal cord.[280] At Oxford University, researchers discovered that stimulating the orbitofrontal cortex produces pleasure; their goal is to create a "sex chip" using deep brain stimulation to target this area of the brain.[281] In 2017, individuals heighten experiences by taking illicit drugs while experiencing virtual reality.[282] Capitalizing on the potential for combining technology with pleasure, other companies have built virtual reality pornography sites.[283] Challenging the limits of how technology can impact human sexuality, sexual education expert Dr. Laura Berman argues that the future will include sex with robots, virtual reality, and the use of drugs.[284]

Outside of the private sector, BCI research is also taking place through government-sponsored initiatives. With a budget of over $100 million, DARPA is

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[278] Mary Roach, *Bonk: The Curious Coupling of Science and Sex* (New York: WW Norton and Company, 2008), 223.

[279] Nancy L. Brackett et al., "An Analysis of 653 Trials of Penile Vibratory Stimulation in Men with Spinal Cord Injury," *The Journal of Urology* 159, no. 6 (1998): 1931–1934.

[280] Richard Glover, "Can't Buy a Thrill: Substantive Due Process, Equal Protection, and Criminalizing Sex Toys," *The Journal of Criminal Law and Criminology* (2010): 563.

[281] "Bionic 'Sex Chip' that Stimulates Pleasure Centre in Brain Developed by Scientists," *Daily Mail*, last modified December 22, 2008, www.dailymail.co.uk/sciencetech/article-1099722/Bionic-sex-chip-stimulates-pleasure-centre-brain-developed-scientists.html#.

[282] Hugh Langley, "What It's Like to Take Drugs in Virtual Reality," Tech Radar, April 6, 2016, www.techradar.com/news/wearables/what-it-s-like-to-take-drugs-with-virtual-reality-1318460.

[283] Matthew Wood, Gavin Wood, and Madeline Balaam, "They're Just Tixel Pits, Man: Disputing the 'Reality' of Virtual Reality Pornography through the Story Completion Method," in *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, 5439–5451 (Denver, CO: ACM, 2017).

[284] "The Future of Sex: Robots and Virtual Reality," *Wall Street Journal*, April 26, 2015, www.wsj.com/video/the-future-of-sex-robots-and-virtual-reality/C402159C-7950-45BF-A56F-7DEC50AD1122.html.

working to develop an implantable neural interface through the BRAIN initiative.[285] Announced by the Obama Administration in 2013, the Brain Research through Advanced Innovative Neurotechnologies (BRAIN) project is a collaborative, public-private research enterprise.[286] The project's goal is to develop innovative technologies to provide insight into how the brain works as well as applications to enhance brain functioning.[287] The creator of GPS and the Internet, DARPA has also created a new Biological Technologies Office in 2014 to "harness the power of biological systems."[288] The BRAIN initiative is only one of many ongoing projects within this office.

Other projects underway in the Biological Technologies Office include memory improvement and human-machine symbiosis. One way DARPA is assisting with the BRAIN initiative is through its Electrical Prescriptions program. The goal of this effort is to "help the human body heal itself through neuromodulation of organ functions using ultraminiaturized devices, approximately the size of individual nerve fibers, which could be delivered through minimally invasive injection."[289] Its Hand Proprioception and Touch Interfaces and its Neural Engineering System Design programs are developing implantable devices that communicate with the brain directly and wirelessly with external modules.[290] Another program, the Systems-Based Neurotechnology for Emerging Therapies program aims to create an implantable device for diagnosis and treatment of neuropsychological illnesses.[291] These are only a few of the projects DARPA is focusing on as part of its role in the empirical BRAIN initiative.

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[285] "Bridging the Bio-Electronic Divide: New Effort Aims for Fully Implantable Devices Able to Connect with Up to One Million Neurons," Defense Advanced Research Projects Agency, January 19, 2016, https://www.darpa.mil/news-events/2015-01-19.

[286] "Fact Sheet: BRAIN Initiative," White House, Office of the Press Secretary, April 2, 2013, https://obamawhitehouse.archives.gov/the-press-office/2013/04/02/fact-sheet-brain-initiative.

[287] For more information, visit www.braininitiative.org.

[288] "Biological Technologies Office (BTO)," Defense Advanced Research Projects Agency, accessed August 2, 2017, https://www.darpa.mil/about-us/offices/bto.

[289] "DARPA and the Brain Initiative," Defense Advanced Research Projects Agency, accessed August 2, 2017, https://www.darpa.mil/program/our-research/darpa-and-the-brain-initiative.

[290] Ibid.

[291] Ibid.

At a time when the Pentagon is funding BCI research, private companies are also pouring funding into projects using the same technology. For example, Disney has created its own accelerator program to build a network of companies that "dream for the future" using technological innovation.[292] The accelerator sponsors an annual portfolio of companies to merge the entertainment industry with such technologies as robotics, virtual reality, and mind control. Emotiv, a 2015 Disney accelerator finalist, produces electroencephalography headsets that noninvasively record brain activity and produce three-dimensional visualizations.[293] Releasing new forms of "brainwear," the company aims to measure brain fitness and harness this ability to control video games, among other activities.[294] In 2016, the online payment company Braintree invested $100 million into Kernel, a startup company aiming to build a flexible platform for recording and stimulating neurons.[295] This technology also has promise for treating Alzheimer's or other diseases.

With approximately two billion users, Facebook is working on the creation of "optical neuro-imaging systems" to allow users to type words from their brain directly into the Facebook platform. In pursuit of this lofty goal, Facebook spent $2 billion in 2014 to acquire the virtual reality company Oculus.[296] The company's experimental technology division known as Building 8 claims that the goal of this telepathy is for users to type 100 words per minute, which is five times as fast as manual typing on a smartphone. Within seconds, people will be able to transcribe whole thoughts into texts or email without manual input. If successful, this consensual telepathy would remove language barriers.

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[292] See for example https://disneyaccelerator.com.

[293] See for example www.emotiv.com.

[294] Nicholas A. Badcock et al., "Validation of the Emotiv EPOC® EEG Gaming System for Measuring Research Quality Auditory ERPs," *PeerJ* 1 (2013): e38, doi: 10.7717/peerj.38.

[295] John Mannes, "Bryan Johnson Invests $100 Million in Kernel to Unlock the Power of the Human Brain," Tech Crunch, October 20, 2016, https://techcrunch.com/2016/10/20/bryan-johnson-invests-100-million-in-kernel-to-unlock-the-power-of-the-human-brain/.

[296] Josh Constine, "Facebook's $2 Billion Acquisition of Oculus Closes, Now Official," Tech Crunch, July 21, 2014, https://techcrunch.com/2014/07/21/facebooks-acquisition-of-oculus-closes-now-official/.

In the future, electrical impulses may stimulate neurons for countless medical and recreational purposes. The field of healthcare could one day revolve around the use of neural stimulation targeting specific nerve fibers or areas in the brain.[297] With a full map of the brain's circuitry, physicians could intentionally target specific neural impulses to achieve a desired medical response, like controlling inflammation. Beyond medical uses, it is plausible that future iterations of this technology could allow people to bypass the consumption of biochemical drugs as society knows them today and directly stimulate targeted areas in the brain to achieve specific forms of altered consciousness.

As of 2017, Americans have already merged with their phones, computers, and apps. Ambitious BCI technologies are not far from realization. It is now in the middle of an underdeveloped neurotechnology space that Americans should discuss the implications of BCI technology *before* intelligent dust particles can invade human brains. Inexorably, the existence of high performance BCI technologies places the onus on the government to decide how to regulate these devices. Is society willing to strike a Faustian bargain in its pursuit to augment human abilities?

2. The Internet of Things

Technology pioneer Kevin Ashton coined the term "Internet of things" in 1999 in reference to the growing web of Internet-connected devices.[298] In 2017, devices as simple as coffee makers have now become "smart" and joined the IoT by connecting to the Internet; connecting to the IoT expands the device's ability to produce coffee through remote activation or to analyze coffee consumption data.[299] As the number of devices connected to the IoT continues to grow, the way that society operates will continue to transform. For example, as the online network of people and devices continues to grow, the job of collecting, organizing, and interpreting data will shift to machines, which have greater computing power in comparison to human capabilities. The accelerating speed of

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[297] Famm, *Drug Discovery*, 159.

[298] William E. Eggers, *Delivering on Digital: The Innovations and Technologies that are Transforming Government* (New York: Rosetta Books, 2016), Kindle ed., location 344.

[299] Hans-W Gellersen, Michael Beigl, and Holger Krull, "The MediaCup: Awareness Technology Embedded in an Everyday Object," in *Handheld and Ubiquitous Computing*, ed. Hans-W Gellersen (Berlin/Heidelberg: Springer, 1999), 308.

development in the realms of information and communications technology propels the IoT forward.[300] Expanded Internet access to rural and developing countries will further this acceleration toward connectivity. In 2017, the goal of Google's Project Loon is build a network of balloons to send to the stratosphere; the project aims to extend Internet access across the globe with its aerial wireless network.[301]

The IoT connects people to one another, people to machines, and machines to other machines. In the next evolution of connectedness, researchers believe that human brains could ultimately connect with one another on this same Internet-enabled web. In 2012, an Israeli student connected his brain to a surrogate robotic avatar located 1,250 miles away using a camera and functional magnetic resonance imaging.[302] In 2013, scientists at Harvard University succeeded in noninvasively interfacing the brains of a human and a rat using brain-to-brain interface (BBI), an advancement beyond BCI technology.[303] Connected by the BBI, human participants could control the rat's tail through thought alone. As this technology continues to progress, it is conceivable that a BBI could exist between humans, allowing for the bidirectional transference of complex ideas.[304] Furthering this research, neuroscientists at Duke University are creating a Brainet, networking multiple animal brains together into one super-brain, allowing for synchronous brain connection during activities.[305] In the future, these preliminary archetypes could evolve into full brain-computer and BBI paradigms.

Neural lace technology may be the next step in the progression to a human Brainet. Neural lace is a piece of ultra-thin mesh implanted in the skull to allow the brain

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[300] Friedemann Mattern and Christian Floerkemier, "From the Internet of Computers to the Internet of Things," in *From Active Data Management to Event-Based Systems and More*, ed. Kai Sachs, Ilia Petrov, and Pablo Guerrero (Berlin/Heidelberg: Springer, 2010), 246.

[301] See, for example, www.x.company/loon.com.

[302] Sebastian Anthony, "Real-Life Avatar: The First Mind-Controlled Robot Surrogate," Extreme Tech, July 6, 2012, https://www.extremetech.com/extreme/132389-real-life-avatar-the-first-mind-controlled-robot-surrogate.

[303] Seung-Schik Yoo et al., "Non-Invasive Brain-to-Brain Interface (BBI): Establishing Functional Links between Two Brains," *PloS one* 8, no. 4 (2013): e60410.

[304] Ibid., e60410.

[305] Robert Saracco, "Brainet: The First Brains Network," *EIT Digital* [blog], August 4, 2015, www.eitdigital.eu/newsroom/blog/article/brainet-the-first-brains-network/.

to connect to a machine.[306] Once implanted, the wireless mesh molds to the brain. Scientists anticipate that neural lace will ultimately allow human brains to communicate bidirectionally with computers.

With over $27 million in startup funding, Elon Musk created a project known as Neuralink that aims to advance humanity by essentially creating the equivalent of a human Brainet.[307] In its simplest description, Musk is attempting to build an Internet-of-brains, wherein human brains and the Internet coexist on one large networked web.[308] Intending to advance past neural lace, the project focuses on connecting human brains to the Internet and to one another, thus allowing for telepathy, among other changes, which could one day make language itself obsolete.[309] If materialized, this technology would become intrinsically part of individuals, allowing mindless thought connection to cloud computing. Musk asserts that Neuralink is necessary to protect humanity from existential vulnerability in the face of AI.[310] If the blueprint of whole-brain interface comes to fruition, society will need to usher in a new realm of brain security. Salient repercussions present themselves when criminals are able to access the biological core of human cognition.

In 2017, more than 8.4 billion devices already comprise the IoT; that number continues to increase rapidly.[311] Beyond robust connectivity, developments in digital connectedness provide a platform for the advancement of innovation. The growing IoT and emerging brain-computer research may one day converge to form the Neuralink as Elon Musk envisions. If neural stimulation devices like the ones depicted in this scenario come to fruition, it is likely they would follow the established path of technological

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[306] Christina Mercer, "What is Neural Lace?," Tech World, September 14, 2017, www.techworld.com/data/what-is-neural-lace-3657074/.

[307] For example, see www.neuralink.com/.

[308] Tim Urban, "Neuralink and the Brain's Magical Future," *Wait but Why* [blog], April 20, 2017, http://waitbutwhy.com/2017/04/neuralink.html.

[309] Dana Hull, "Elon Musk's Neuralink Gets $27 Million to Build Brain Computers," *Bloomberg Technology*, August 25, 2017, www.bloomberg.com/news/articles/2017-08-25/elon-musk-s-neuralink-gets-27-million-to-build-brain-computers.

[310] Domonoske, *Elon Musk Warns Governors.*

[311] "Gartner Says 8.4 Billion Connected 'Things' Will Be in Use in 2017, Up 31 Percent from 2016," press release, *Gartner*, February 7, 2017, www.gartner.com/newsroom/id/3598917.

progression and join the IoT. As the United States continues to move toward an environment of ubiquitous digital technology—enhancing collective vulnerability—the need to secure this network grows.

3. A Hyper-Connected Society and Exponential Technological Growth

The existence of almost all Americans and their devices on one connected IoT creates a hyper-connected society. In a hyper-connected world, people live embedded in a landscape of invisible, networked computing, without which is nearly impossible to function. A hyper-connected digital society challenges such fundamental rights as freedom of expression and the notion of privacy. For instance, what might privacy of thought look like in a world immersing everyone in one connected digital labyrinth?

Technology is growing exponentially, as described in several laws of exponential growth. In accordance with Moore's law, technology is becoming smaller and more efficient as its cost decreases.[312] Butters's law of photonics claims that the cost for transmitting via optical fiber halves every nine months.[313] This degree of technological advancement means that engineers can manufacture small, mobile devices that have the same performance capabilities of desktop computers. The laws of Reed and Metcalfe highlight how large networks, like social networks, scale exponentially with the number of people or devices in the network.[314] In the realm of computation, Rose's law for quantum computing describes exponential growth in computing power, a development that may allow people to solve humanity's most complex problems.[315] Together, these laws and others illustrate how the rapid pace of technological growth that the United States witnessed in the previous few decades will likely continue to grow exponentially.

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[312] Thomas N. Theis and H-S. Philip Wong, "The End of Moore's Law: A New Beginning for Information Technology," *Computing in Science & Engineering* 19, no. 2 (2017): 41–50.

[313] Thomas Butter, "Privacy-Preserving Framework for Context-Aware Mobile Applications" (PhD diss., Universität Mannheim, 2009), 9.

[314] Susan P. Crawford, "Who's in Charge of Who I Am: Identity and Law Online," *New York Law School Law Review* 49 (2004): 224.

[315] Matthew Griffin, "Quantum Computing Rose's Law is Moore's Law on Steroids," *Global Futurist Magazine*, August 31, 2016, www.fanaticalfuturist.com/2016/08/quantum-computing-roses-law-is-moores-law-on-steroids/.

Assessing the future of technology and innovation, the United Kingdom's Government Office for Science succinctly described the implications for the interactions of emergent technologies and driving forces, "The greatest future opportunities lie in enabling existing and emerging technologies to interact with each other."[316] Underscoring this notion is the idea that trends do not evolve in a vacuum. Rather, the convergence of technological innovation, interacting with other trends, combine together to affect profound change in the rapidly evolving future.

One area highlighting the intersection of exponential technological growth and hyper-connectedness is in the realm of digital currency. Cryptocurrencies present a digital disruption to the standard notion of banking. The network of cryptocurrency known as bitcoin first came into existence in 2009.[317] Bitcoin operates on a decentralized database known as block chain that records digital asset transfers in a distributed ledger.[318] Although bitcoin was the first cryptocurrency to achieve widespread adoption, there are several other operational alternative digital currencies, like Ethereum.[319] Beyond currency, a hyper-connected society of exponential technological growth presents a litany of implications in the domain of drug policy. In October 2017, the peer-to-peer payment app Venmo announced its expansion to allow users to purchase items from two million online merchants.[320] In pursuit of creating a modern digital wallet, Venmo ultimately aims to allow users to use the app in physical stores to pay for purchases.[321]

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[316] UK Government Office for Science, *Technology and Innovation Futures 2017* (London: Government Office for Science, 2017), www.gov.uk/government/uploads/system/uploads/attachment_data/file/584219/ technology-innovation-futures-2017.pdf, 7.

[317] Satoshi Nakamoto, "Bitcoin v0.1 Released," *The Mail Archive*, January 9, 2009, www.mail-archive.com/cryptography@metzdowd.com/msg10142.html.

[318] Arvind Narayanan et al., *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction* (Princeton, NJ: Princeton University Press, 2016), 28.

[319] See, for example: www.ethereum.org.

[320] Sarah Perez, "Venmo Users Can Now Shop Online Anywhere PayPal is Accepted in the U.S.," Tech Crunch, October 17, 2017, https://techcrunch.com/2017/10/17/venmo-users-can-now-shop-online-anywhere-paypal-is-accepted-in-the-u-s/.

[321] Ethan Wolff-Mann, "Venmo is One Step Closer to Being a Full-Service Digital Wallet," *Yahoo Finance*, October 17, 2017, https://finance.yahoo.com/news/venmo-one-step-closer-full-service-digital-wallet-202915047.html.

4. Drug Substitution Therapy

In the field of drug addiction, medication-assisted treatment therapy (MAT) is a central component used in treating certain substance use disorders.[322] MAT helps people transition from substance use addiction to sobriety in a step-down fashion that avoids life-threatening responses associated with sudden withdrawal. One popular example of MAT is the use of methadone for treating addiction to opioids like heroin or Oxycotin.[323] Patients on methadone typically visit a private or public methadone clinic daily for their dose of methadone and periodic counseling. Contingent on state laws, patients may receive a few days' worth of methadone to take home, especially over the weekend.[324] Depending on the severity of addiction, patients may be on methadone for years or for their remainder of their life. Beyond methadone, a catalogue of other drugs also treat opioid addiction: buprenorphine, naltrexone, disulfiram, and others.

In use since the 1960s, a large body of research provides evidence that methadone is effective in the treatment of opioid dependence.[325] Notwithstanding its efficacy, this form of pharmacotherapy presents its own set of barriers and challenges. One significant barrier for patients is the fact that most methadone maintenance programs require patients to visit their MAT clinic daily for dosing.[326] This presents an obvious hardship for patients as it logistically limits their ability to travel far from their dosing clinic. In response, pharmaceutical companies developed Vivitrol (naltrexone), a drug administered

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[322] Paul M. Roman, Amanda J. Abraham, and Hannah K. Knudsen, "Using Medication-Assisted Treatment for Substance Use Disorders: Evidence of Barriers and Facilitators of Implementation," *Addictive Behaviors* 36, no. 6 (2011): 584–589.

[323] Substance Abuse and Mental Health Services Administration, *Federal Guidelines for Opioid Treatment Programs* (HHS Publication No. (SMA) PEP15-FEDGUIDEOTP) (Rockville, MD: Substance Abuse and Mental Health Services Administration, 2015), 22, 49.

[324] Pier Paolo Pani, Roberto Pirastu, Antonia Ricci, and Gian Luigi Gessa, "Prohibition of Take-Home Dosages: Negative Consequences on Methadone Maintenance Treatment," *Drug and Alcohol Dependence* 41, no. 1 (1996): 81–84.

[325] Martin Connock et al., "Methadone and Buprenorphine for the Management of Opioid Dependence: A Systematic Review and Economic Evaluation," *Health Technology Assessment* 11, no. 9 (2007): 1–6.

[326] Lindsey Richardson et al., "Addiction Treatment-Related Employment Barriers: The Impact of Methadone Maintenance," *Journal of Substance Abuse Treatment* 43, no. 3 (2012): 276–284.

intramuscularly once a month to improve treatment adherence.[327] Vivitrol is approximately 10 times more expensive than methadone and is not appropriate for treating all types of opioid addiction.[328]

Another challenge of MAT is that the pharmacotherapies are drugs themselves, creating an opportunity for diversion as well as abuse potential. For instance, methadone is an opioid drug; one major criticism of this treatment is that many patients move from an addiction to drugs like heroin to an addiction to methadone.[329] A booming underground market exists for buying and selling MAT drugs.[330] Aside from addiction potential, many MAT pharmacotherapies present a list of side effects for patients to deal with. For instance, common side effects, among others, of methadone include anxiety, insomnia, impotence, constipation, vomiting, and dry mouth.[331]

Beyond the treatment of opioid addiction, other forms of substitution therapy show promise in treating addiction. MAT is the most popular and conventional form of replacement therapy used in treating substance use disorders. However, in 2017, emerging research draws attention to the use of marijuana as another form of substitution therapy. Along with state-level policy initiatives to legalize the medical and/or recreational use of cannabis during the past two decades, there is a growing social

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[327] Yahiya Y. Syed and Gillian M. Keating, "Extended-Release Intramuscular Naltrexone (VIVITROL®): A Review of Its Use in the Prevention of Relapse to Opioid Dependence in Detoxified Patients," *CNS Drugs* 27, no. 10 (2013): 851–861.

[328] Vivitrol typically costs $1000 per month, while one month of methadone and counseling at a methadone clinic typically costs approximately $100 per month. Barbara Andraka-Christou, "American Needs the TREAT Act: Expanding Access to Effective Medication for Treating Addiction," *Health Matrix: The Journal of Law Medicine* 26, no.1 (2016): 309–362.

[329] Sheng-Chang Wang et al., "Functional Genetic Polymorphisms in CYP2C19 Gene in Relation to Cardiac Side Effects and Treatment Dose in a Methadone Maintenance Cohort," *Omics: A Journal of Integrative Biology* 17, no. 10 (2013): 519–526.

[330] Shannin Gwin Mitchell et al., "Uses of Diverted Methadone and Buprenorphine by Opioid-Addicted Individuals in Baltimore, Maryland," *The American Journal on Addictions* 18, no. 5 (2009): 346–355.

[331] Laxmaiah Manchikanti, Kavita N. Manchikanti, Vidyasagar Pampati, and Kimberly A. Cash, "Prevalence of Side Effects of Prolonged Low or Moderate Dose Opioid Therapy with Concomitant Benzodiazepine and/or Antidepressant Therapy in Chronic Non-Cancer Pain," *Pain Physician* 12, no. 1 (2009): 259–267.

acceptance of its use.[332] According to the Center for Behavioral Health Statistics and Quality in, 2015 roughly 22.2 million Americans over the age of 12 self-reported marijuana use within the past month.[333] Experimentation with cannabis also extends to physicians, whose patterns of drug prescriptions is decreased in states that legalized marijuana.[334]

Although state-level medical marijuana regulations is in a legal purgatory outside of the federal CSA, people are self-administering cannabis to treat pain, anxiety, and other conditions.[335] In May 2017, researchers in the state of Washington published evidence demonstrating that people are using marijuana as a substitute for prescription drugs.[336] Another prospective study shed light on the use of cannabis to reduce opioid use for individuals with chronic pain.[337] Promoting a harm reduction framework to reduce negative outcomes, Dr. Amanda Reiman promotes the use of marijuana as a form of substitution therapy for alcohol and other drugs.[338] In the near future, marijuana could become a standard component of substitution therapy. While the use of marijuana for this purpose has utility for decreasing the negative consequences of more harmful drugs, cannabis itself is still a drug.

In the more distant future, physicians may use neural stimulation technology as a form of substitution therapy for treating substance use disorder. Methadone and other

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[332] National Academies of Sciences, Engineering, and Medicine, *The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research* (Washington, DC: National Academies Press, 2017), 73.

[333] Center for Behavioral Health Statistics and Quality, *Results from the 2015 National Survey on Drug Use and Health: Detailed Tables Prevalence Estimates, Standard Errors, P Values, and Sample Sizes* (Rockville, MD: Center for Behavioral Health Statistics and Quality, 2015).

[334] Ashley C. Bradford and W. David Bradford, "Medical Marijuana Laws Reduce Prescription Medication Use in Medicare Part D," *Health Affairs* 35, no. 7 (2016): 1230–1236.

[335] Philippe Lucas et al., "Substituting Cannabis for Prescription Drugs, Alcohol and Other Substances among Medical Cannabis Patients: The Impact of Contextual Factors," *Drug and Alcohol Review* 35, no. 3 (2016): 326–333.

[336] James M. Corroon Jr, Laurie K. Mischley, and Michelle Sexton, "Cannabis as a Substitute for Prescription Drugs–A Cross-Sectional Study," *Journal of Pain Research* 10 (2017): 989.

[337] Simon Haroutounian et al. "The Effect of Medicinal Cannabis on Pain and Quality-of-Life Outcomes in Chronic Pain: A Prospective Open-label Study," *The Clinical Journal of Pain* 32, no. 12 (2016): 1036–1043.

[338] Amanda Reiman, "Cannabis as a Substitute for Alcohol and Other Drugs," *Harm Reduction Journal* 6, no. 1 (2009): 35, https://doi.org/10.1186/1477-7517-6-35.

opioid analgesics treat addiction to such opiates as heroin, prescription painkillers, and morphine. In the future, marijuana could eventually become part of the standard protocol for treating other conditions and addictions. Complicating the field of addiction treatment is the fact that more and more novel synthetic drugs continue to appear on the streets, as discussed in the first scenario. For most of these novel drugs, substitution pharmacotherapy treatment options do not exist. With a more comprehensive understanding of brain circuitry and the capabilities of interfacing technology, could neural stimulation one day replace most forms of substitution therapy in treating the disease of addiction?

5. A Cultural Context for Drug Use

To reduce the harms associated with illicit drugs, society must understand both natural human impulses as well as the contemporary cultural context for taking drugs.[339] Abundant evidence establishes the human impulse to augment one's reality; the history of humanity is full of examples of drug use for various purposes. This desire explains the decision by some people to deprive their bodies of oxygen during sex or to hack existing technologies in an effort to alter reality.[340] One reason people attend raves is to heighten the experience of a drug through loud music and flashing lights.[341] The contemporary cultural context of drug use in 2030 will most likely look different than it does in 2017. Technological influence and ubiquitous connectedness will likely change the landscape of drug use and the options for altering mental status.

In 2017, one cultural context for illicit drug use revolves around the use of synthetic drugs. Synthetic drugs are a relatively new class of designer drugs promising potency, affordability, accessibility, and an inability for detection by drug screening.[342]

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[339] Nutt, *Drugs without Hot Air*, 68.

[340] Mark D. Griffiths, "A Brief Review of Self-Asphyxial Risk-Taking Behaviour in Adolescents," *Education and Health* 33, no. 3 (2015): 59–61.

[341] Andrew C. Parrott and Lucy Young, "Saturday Night Fever in Ecstasy/MDMA Dance Clubbers: Heightened Body Temperature and Associated Psychobiological Changes," *Temperature* 1, no. 3 (2014): 214–219.

[342] Liana Fattore and Walter Fratta, "Beyond THC: The New Generation of Cannabinoid Designer Drugs," *Frontiers in Behavioral Neuroscience* 5, no.60 (2011): 1–12.

In 2017, there is already a strong demand for synthetic drugs. One reason these drugs are so popular is because of their perception as a "legal high." For example, toxicologists point out that *Salvia divinorum* (salvia) and *Mitragyna speciosa* (kratom) are growing in reputation not only because of their hallucinogenic and morphine-like effects but also because the substances are unscheduled.[343] As "legal" substances, they are available for purchase in convenience stores under a guise of such innocuous products as incense, bath salts, plant food, or potpourri. This emerging trend for legal highs is gaining traction; the dubious legality of these drugs allows them to evade toxicological monitoring.[344] The American Association of Poison Control Centers illuminated an 80 percent increase in calls about synthetic cannabinoids from 2010 to 2012.[345] Additionally, the DEA published a report revealing that in 2011, the number of emergency department admissions for this class of drugs had more than doubled.[346] In 2017, the United States is combating an epidemic of heroin, pain relievers, and synthetic opiates such as fentanyl, a synthetic opioid analgesic 50–100 times more potent than morphine.[347]

In 2017, the federal government is struggling to regulate synthetic cannabinoids. This class of drugs presents an oversight challenge due to a lack of standardization for testing as well as the seemingly endless number of variations. In 2010, the DEA passed an emergency one-year ban on five common synthetic cannabinoids, classifying them temporarily as Schedule 1 drugs.[348] In 2012, President Obama signed the Synthetic Drug

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[343] Kavita M. Babu, Christopher R. McCurdy, and Edward W. Boyer, "Opioid Receptors and Legal Highs: Salvia Divinorum and Kratom," *Clinical Toxicology* 46, no. 2 (2008): 146–152.

[344] Kathryn A. Seely et al., "Spice Drugs Are More than Harmless Herbal Blends: A Review of the Pharmacology and Toxicology of Synthetic Cannabinoids," *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 39, no. 2 (2012): 234–243.

[345] United Nations Office on Drugs and Crime, *Global Synthetic Drugs Assessment: Amphetamine-Type Stimulants and New Pyschoactive Substances* (New York: United Nations, 2014), 54, https://www.unodc.org/documents/scientific/2014_Global_Synthetic_Drugs_Assessment_web.pdf.

[346] Lisa N. Sacco and Kristin Finklea, *Synthetic Drugs: Overview and Issues for Congress* (CRS Report No. R42066) (Washington, DC: Congressional Research Service, 2016), https://fas.org/sgp/crs/misc/R42066.pdf, 7.

[347] Donna A. Volpe et al., "Uniform Assessment and Ranking of Opioid Mu Receptor Binding Constants for Selected Opioid Drugs," *Regulatory Toxicology and Pharmacology* 59, no. 3 (2011): 385–390, doi:10.1016/j.yrtph.2010.12.007.

[348] U.S. Drug Enforcement Administration, *Synthetic Cannabinoids and Synthetic Cathinones Reported in NFLIS, 2009–2010* (Washington, DC: U.S. Drug Enforcement Administration, 2011), https://www.deadiversion.usdoj.gov/nflis/2010rx_synth.pdf, 1.

Abuse Prevention Act of 2012, a law banning a non-exhaustive list of 15 chemical precursors found across many synthetic drug formulations.[349] In 2013, former Attorney General Eric Holder permanently classified the psychoactive stimulant methylone as a Schedule 1 drug.[350] Are these new laws effective in reducing supply, or are they merely pallid renditions of old bans for such substances as marijuana, cocaine, and heroin?

Unfortunately, these laws often become obsolete almost immediately, and the list of chemicals used to create synthetics is ostensibly endless. Sentiment beclouds objective action, and too often, deviant innovation outpaces bureaucracy's propensity for reactionary policy. Evading prohibitions of specific precursor chemicals, drug chemists easily recombine molecular structures to create even more potent drug strains. In the United States alone, the DEA identified approximately 300 new and discrete synthetic drugs between 2009 and 2014.[351] Not surprisingly, there is little consistency in the range of reactions to various synthetic drugs—violence, hallucinations, death, paranoia, delirium, paralysis, psychosis, and irrational behavior are all reported side effects.[352] The idea of banning analogues of existing controlled substances is a failed policy.[353]

While most synthetic drugs in the United States originate in laboratories in China and Southeast Asia, the notion of homemade drug production is also conceivable.[354] A quick YouTube search for "how to make drugs at home" generates over seven million videos; the same entry into Google reveals 28 million search results. In the future, lab-on-a-chip (LOC) technology could make it even easier to synthesize drugs at home. LOC is an appliance that can integrate multiple laboratory functions into a single small chip to

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[349] Synthetic Drug Abuse Prevention Act of 2012, 21 CFR 1308 (2012).

[350] Schedules of Controlled Substances: Placement of Methylone into Schedule I, 21 CFR Part 1308 (2013).

[351] "DEA News: Huge Synthetic Drug Takedown," news release, Drug Enforcement Administration, May 7, 2014, https://www.dea.gov/divisions/hq/2014/hq050714.shtml.

[352] Carrie Arnold, "The New Danger of Synthetic Drugs," *The Lancet* 382, no. 9886 (2013): 15–16.

[353] Nutt, *Drugs without Hot Air*, 121.

[354] Joe Sheffer, "New Frontier of Designer Synthetic Drugs," *Pharmacy Today* 20, no. 1 (January 2014): 50.

automate high-quality screening or detection.[355] In 2017, researchers have begun to study the use of LOC technology for toxicity screening.[356] Furthermore, law enforcement agencies are in the process of developing mobile LOC devices to screen saliva for the presence of a wide range of intoxicants.[357]

In 2017, LOC technology has permeated multiple disciplines. In particular, LOC devices hold promise for use in the field of global health. Tiny portable lab chips provide a means for mobile testing without a laboratory, a significant benefit for disease screening in resource-challenged countries. Moreover, LOCs are especially attractive because of low manufacturing costs.[358] Many researchers view LOC technology as the solution to future diagnostic testing.[359] Aside from testing, current research indicates an intention to use the technology for drug discovery.[360]

In 2005, the United Kingdom's Government Office for Science assessed how future scientific advances could ultimately affect illicit drug use. Its analysis hypothesized that in the future, LOC technology could be used to "produce one's own drugs, or to download online instructions for synthesizing them from common raw materials straight onto a chip."[361] What happens when LOC technology moves from a nascent device to a low-cost, widely available item—will anyone be able to use these devices to create designer drugs at home?

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[355] Lisa R. Volpatti and Ali K. Yetisen, "Commercialization of Microfluidic Devices," *Trends in Biology* 32, no. 7 (2014): 347–350.

[356] Eric E. Esch, Anthony Bahinski, and Dongeun Huh, "Organs-On-Chips at the Frontiers of Drug Discovery," *Nature Reviews Drug Discovery* 14, no. 4 (2015): 248–260.

[357] Nauman Khalid, Isao Kobayashi, and Mitsutoshi Nakajima, "Recent Lab-on-chip Developments for Novel Drug Discovery," *Wiley Interdisciplinary Reviews: Systems Biology and Medicine* 9, no.4 (2017): e1381, doi: 10.1002/wsbm.1381.

[358] Ryan S. Pawell et al., "Manufacturing and Wetting Low-Cost Microfluidic Cell Separation Devices," *Biomicrofluidics* 7, no. 5 (2013): 056501-8.

[359] Paul Yager et al., "Microfluidic Diagnostic Technologies for Global Public Health," *Nature* 442 (July 2006): 412–418, doi: 10.1038/nature05064.

[360] Khalid, *Recent Lab-on-Chip Developments*, e1381.

[361] UK Government Office for Science, "Drugs Futures 2025," July 13, 2005, www.gov.uk/government/publications/drugs-futures-2025, 32.

C. POLICY IMPLICATIONS

As the U.S. policymakers consider neural interfaces, what policy implications arise from its recreational use? Would this technology fit into the realm of drug policy concerned with controlling illicit biochemical substances? The scenario presented in this chapter highlights the regulatory challenges associated with this form of technology, as well as the dangerous human bias to trust technology instinctively. Furthermore, recreational use of neural stimulation in a world of hyper-connectivity challenges interdiction efforts. Finally, emergent technologies and global megatrends could inadvertently lead to the creation of digital and transhumanist divides.

1. Regulating Neural Stimulation

The crux of this scenario revolves around the issue of whether drug policy should be concerned about the development of non-biochemical devices that alter consciousness. Although it regulates U.S. drug policy at the federal level, the CSA does not govern technological devices. Although they could one day stimulate the release of specific neurotransmitters to mimic illicit biochemical drugs, neural interface devices are essentially nothing more than computers. This presents a challenge in trying to regulate a motherboard and its associated computer parts rather than specific chemical molecules, like methamphetamine. This regulatory challenge elicits a discussion on whether the government should try to govern the use of technological devices for brain stimulation.

At its basic level, the purpose of U.S. drug policy is to protect citizens. If scientific advancements lead to the creation of a way to create pleasure in the brain noninvasively, society would possess a drug that could be very difficult to constrain. Lab studies provide evidence that animals can become compulsively addicted to neural stimulation. For example, in 1954, Olds and Milner discovered how rats would learn to work impulsively for direct electrical brain stimulation by pressing a lever.[362] As neurological understanding of addiction progressed, scientists later discovered that monkeys would also compulsively self-administer pleasurable stimulants to the point of

[362] James Olds and Peter Milner, "Positive Reinforcement Produced by Electrical Stimulation of Septal Area and Other Regions of Rat Brain," *Journal of Comparative and Physiological Psychology* 47, no. 6 (1954): 419.

sickness or death.[363] Beyond evolving collective understanding of the science of addiction, these studies ground concern regarding the potential for humans to become addicted to neural stimulation devices.

Knowing the addictive potential of neural stimulation devices, the government may not even have the option to govern these devices. What are the implications for the public once more advanced BCI technology comes to maturity? If the present is any indication of the future, it is likely that people will find ways to hack neural interface technology before commercial applications are even made available for purchase. Unlike FDA-tested drugs, recreational street drugs are not pure in quality. Individuals buying and selling illegal drugs generally chose to accept the risk accompanying an imprecise substance, even if that means the drugs could cause dangerous secondary effects. Rather than targeting a specific disease or condition, recreational drugs are illegal and largely operate as wide spectrum drugs. Applying this insight to neural stimulation, it is plausible that these same notions will hold true. Seeking an altered mental state, individuals may shrug at the notion that the technology is unsafe or not fully developed as long as it is effective in producing a high.

If neural stimulation devices become a common form of technology, would the United States regulate them as it does medical devices through the FDA? A 2015 study by Harvard University demonstrated that FDA approval for innovative medical devices took, on average, 7.2 months longer than drug approvals.[364] This difference in approval time means that the FDA could stifle innovation by blocking new disruptive technology from appearing on the market. On a pragmatic level, it will not be hard for individuals to avoid the FDA approval process once this technology is pervasive. Like the 2017 marketing of synthetic drugs as potpourri or bath salts, neural stimulation manufacturers could attach similar packaging labels to indicate that the devices are not for medical use.

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[363] E. T. Rolls, M. J. Burton, and F. Mora, "Neurophysiological Analysis of Brain-Stimulation Reward in the Monkey," *Brain Research* 194, no. 2 (1980): 339–357.

[364] Gina Shaw, "Too Slow or Too Sloppy? Medical Devices Want Faster FDA Approval," *The Washington Diplomat*, August 27, 2015,http://www.washdiplomat.com/index.php?option=com_ content&view= article&id =12344:too-slow-or-too-sloppy-medical-devices-want-faster-fda-approval&catid=1535&Itemid=428.

The regulatory challenges highlighted in this section largely focus on the recreational use of neural stimulation on the level of individual consumption. Considering this topic at large provokes a larger discussion of the implications for geopolitics, gangs, cartels, and militias.

2. Digital Insecurity: In Technology We Trust

Exponential technological growth positions the United States in an environment of staggering complexity, wherein accelerating change is networking everyday life through ephemeralization. In 2010, the chief executive officer of Google showed how every 48 hours, society generates as much information as it did from the beginning of humanity until 2003.[365] As an increasing number of objects connect to the IoT, society generates even more data, allowing for complex analytics that produce new levels of efficiency. At the same time, this degree of connectedness means almost all things are becoming hackable. The country experienced this threat firsthand in 2013 when hackers stole personal and financial information from approximately 110 million customers of the retailer Target.[366] The hackers were able to access this confidential information through poor security protocols of a third party heating, ventilation, and air conditioning contractor.[367] As manufacturers attach sensors to more and more devices to allow them to communicate with one another, it is important to understand the data they generate. Risk increases as Americans entangle themselves further in the web of dependent connectedness: "when everything is connected, everyone is vulnerable."[368]

Research on "trust in screens" informs insight on how society may respond to neural stimulation and brain-computer devices of the future. For instance, abundant research establishes the human propensity to trust automated decision-making systems

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[365] MG Siegler, "Eric Schmidt: Every 2 Days We Create as Much Information as We Did up to 2003," *Tech Crunch, August* 2, 2010, https://techcrunch.com/2010/08/04/schmidt-data/.

[366] U.S. Senate Committee on Commerce, Science, and Transportation, *A "Kill Chain" Analysis of the 2013 Target Data Breach* (Washington, DC: U.S. Senate, 2014), https://www.commerce.senate.gov/public/_cache/files/24d3c229-4f2f-405d-b8db-a3a67f183883/23E30AA955B5C00FE57CFD709621592C.2014-0325-target-kill-chain-analysis.pdf.

[367] Ibid., 4.

[368] Goodman, *Future Crimes*, 53.

over their own cognitive knowledge, a concept referred to as automation bias.[369] Because of automation bias, there are countless examples of people ignoring their intuition and driving their vehicles into ponds and lakes as directed by GPS technology.[370] When programmers design new technologies, they program ethics and decision making into the operating systems. Decisions arising from big data analytics are prone to reinforce negative biases.[371] Consumers are generally unaware of which calculations go into programming ethics and black-box algorithms. For instance, programmers developing self-driving cars must program calculated ethics into the operation system of the cars. In confronting an unavoidable collision, should the car aim to save as many human lives as possible, or should it primarily protect the passengers in its vehicle?[372] These examples demonstrate the fallacy of math neutrality and the danger of placing full trust in screens.

Applied to neural stimulation and BCI devices, trust in screens may one day extend to trust in neural devices. Connected to the Internet, implanted and/or external technology becomes vulnerable to hacking. In 2016, National Public Radio profiled "body hacking," a movement among individuals who experiment with intentionally augmenting themselves with technology to enhance the human body.[373] As society grapples with the implications of the IoT, policymakers must also take into consideration

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[369] Mary L. Cummings, "Automation Bias in Intelligent Time Critical Decision Support Systems," in *AIAA 1st Intelligent Systems Technical Conference*, vol. 2 (Chicago: AIAA, 2004): 557–562.

[370] Nahila Bonfiglio, "Area Man Puts Too Much Faith in GPS, Drives into Lake," *The Daily Dot*, June 29, 2017, www.dailydot.com/unclick/man-drives-into-lake-gps-fail/.

[371] Ross, *Industries of the Future*, 184.

[372] The ethics of this dilemma arise from the "trolley problem," a widely discussed thought experiment studied in the field of moral psychology. The general premise of the scenario describes a runaway trolley zooming down a set of railroad tracks. Five people are tied up and immobile further down the track, and the trolley is heading directly toward them. An observer stands off in the distance near a lever that, if pulled, will switch the trolley to a different set of tracks. However, the observer sees that there is one person standing on the second set of tracks. Which action by the observer is more ethical—to do nothing and allow the trolley to kill the five people, or to divert the trolley to the other set of tracks by pulling the lever (and thus killing one person)? As companies work to develop autonomous vehicles, programmers find themselves facing problems analogous to the trolley conundrum. During a potential crash, the autonomous vehicle's software will have to decide how to respond. Philippa Foot, "The Problem of Abortion and the Doctrine of Double Effect," *Oxford Review* no. 5 (1967): 5–15.

[373] Eyder Peralta, "'Body Hacking' Movement Rises Ahead of Moral Answers," *All Things Considered, NPR*, March 10, 2016, www.npr.org/sections/alltechconsidered/2016/03/10/468556420/body-hacking-movement-rises-ahead-of-moral-answers.

possible future threats emanating from accelerated digital convergence. In an age of deep digital insecurity, it may one day be possible to hijack someone's mind.

Is it possible to hack neural stimulation devices? In 2017, hacker culture refers to a subculture of people who intentionally conquer software limitations.[374] The cultural movement has led to the formation of more specific subgroups, such as black hat hackers (people who hack for malicious purposes) and white hat hackers (those who hack for good). The biohacker movement challenges the status quo by championing the open democratization of science. The hacker ethic generally promotes societal improvement, open sharing, and decentralized technology.[375] While the hacker ethic of 2017 is generally positive, nefarious actors still present a threat to the security of the country. For instance, China hires a large number of fulltime hackers to target the United States, among other actors.[376] As growing connectedness enhances society's collective vulnerability, the government must implement strategic cybersecurity prophylaxis before brain-computer devices come to fruition.

3. Challenging Interdiction

The ubiquity of neural and BCI technology could bring a sea change to how the government prosecutes a new realm of drug crimes. How might the government enforce interdiction efforts against a computer?

A shift toward the use of neural stimulation in place of illicit drugs could have profound geopolitical ramifications. Drug trafficking is one of the most ubiquitous forms

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[374] "Hacking" refers to the act of engaging in activities (like programming) in a spirit of playfulness and exploration. Verna V. Gehring, *The Internet in Public Life* (Lanham, MD: Rowman and Littlefield Publishers, 2004), 43–56.

[375] Steven Levy, *Hackers: Heroes of the Computer Revolution*, Vol. 14 (Garden City, NY: Anchor Press/Doubleday, 1984).

[376] Edward Wong, "Hackers Find China is Land of Opportunity," *New York Times*, May 22, 2013, http://www.nytimes.com/2013/05/23/world/asia/in-china-hacking-has-widespread-acceptance.html?mcubz=3; David E. Sanger, David Barboza, and Nicole Perlroth, "Chinese Army Unit Is Seen as Tied to Hacking against U.S.," *New York Times*, February 18, 2013, http://www.nytimes.com/2013/02/19/technology/chinas-army-is-seen-as-tied-to-hacking-against-us.html?pagewanted=all&_r=0.

of transnational crime across the world.[377] Trafficking illicit drugs comprises five parts: cultivation, production, trafficking, distribution, and consumption.[378] The use of neural stimulation devices in lieu of biochemical drugs would upend this global system of supply and distribution. Manufacturers could produce neural stimulation devices in the United States (cultivation, production, trafficking) and sell the gadgets in retail markets (distribution) for consumers to purchase (consumption).

Global connectedness also presents a challenge in the ability to track drug crimes. In a hyper-connected society, it is difficult to track communication. As an example, the Telegram Messenger is a messaging platform that allows anyone to communicate anonymously with high speed and security encryption. Largely owing to this security, Telegram is the messaging app of choice of the Islamic State of Iraq and the Levant and its affiliates.[379]

Beyond messaging, Internet-based monetary platforms present a further host of regulatory challenges in the effort to prosecute drug crimes. Digital cryptocurrencies, like bitcoin, are decentralized and pose competition to central bank fiat currency.[380] Cryptocurrencies face issues of price volatility, hacking, theft, and the avoidance of government taxation. Nevertheless, their sovereign nature and anonymous platforms allow individuals to obfuscate their transaction histories. This benefit essentially creates a black market currency providing full amnesty—an issue with obvious implications in the realm of drug interdiction.[381]

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[377] Matthew S. Jenner, "Drug Trafficking as a Transnational Crime," in *Handbook of Transnational Crime and Justice*, 2nd ed., ed. Philip Reichel and Jay Albanese (Thousand Oaks, CA: SAGE Publications, 2014), 65–85.

[378] Ibid., 65.

[379] Ahmet S. Yayla and Anne Speckhard, *Telegram: The Mighty Application that ISIS Loves* (Washington, DC: International Center for the Study of Violent Extremism, 2017), www.icsve.org/brief-reports/telegram-the-mighty-application-that-isis-loves/.

[380] Max Raskin and David Yermack, *Digital Currencies, Decentralized Ledgers, and the Future of Central Banking* (Report No. w22238) (Cambridge, MA: National Bureau of Economic Research, 2016), http://www.nber.org/papers/w22238.

[381] The dark web site Silk Road was once the world's largest purveyor of contraband; dealers sold illicit drugs and other illegal products directly to consumers. The interdiction challenges associated with prosecuting Silk Road highlight issues surrounding the use of digital black market currency. Goodman, *Future Crimes*, 257.

The digital underground of the dark web further complicates the notion of drug interdiction. In 2013, the Federal Bureau of Investigation shut down the Silk Road, the largest international purveyor of contraband.[382] Bypassing geopolitical borders and challenging prosecution, this site connected drug dealers anywhere directly with individuals on a quest to purchase drugs.[383] The site operated as a Tor hidden service, allowing consumers to use browse and shop with anonymity.[384] Tor is a protocol for asynchronous, loosely federated overlay network designed to anonymize major Internet applications.[385] One month after the Federal Bureau of Investigation terminated Silk Road, a substitution site, Silk Road 2.0, was already operational.[386] Although Silk Road 2.0 also shut down, countless other equivalent sites have opened. The massive economic success and global dimension of the original Silk Road indicates that illicit drug vendors are content with buyer demand.[387] Cyber drug marketers are innovative in finding avenues for creating an online retail market for illicit products.[388] Should law enforcement agencies continue to shut down an endless string of online clandestine marketplaces, or is this endeavor a failing game of whack-a-mole?

The U.S. government is aware of the prevalence of synthetic drugs as well as the challenges inherent in regulating these substances. In 2016, the Congressional Research Service released a report providing an overview of synthetic drugs in the United States as well as related issues for Congress.[389] The report provides a synopsis of the increasing

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[382] Goodman, *Future Crimes*, 245–246.

[383] Nicole Lee, "Anonymity is Dead and other Lessons from the Silk Road Trial," Engadget, February 8, 2015, www.engadget.com/2015/02/08/silk-road-trial-lessons/.

[384] Nicolas Christin, "Traveling the Silk Road: A Measurement Analysis of a Large Anonymous Online Marketplace," in *Proceedings of the 22nd International Conference on World Wide Web* (Rio: Association for Computing Machinery, 2013), 213–224.

[385] Roger Dingledine, Nick Mathewson, and Paul Syverson, *Tor: The Second-Generation Onion Router* (Washington, DC: U.S. Naval Research Lab, 2004), www.dtic.mil/docs/citations/ADA465464.

[386] Joe Van Buskirk et al., "The Closure of the Silk Road: What Has This Meant for Online Drug Trading?" *Addiction* 109, no. 4 (2014): 517–518.

[387] Marie Claire Van Hout and Tim Bingham, "Responsible Vendors, Intelligent Consumers: Silk Road, the Online Revolution in Drug Trading," *International Journal of Drug Policy* 25, no. 2 (2014): 183–189.

[388] Alasdair J. M. Forsyth, "Virtually a Drug Scare: Mephedrone and the Impact of the Internet on Drug News Transmission," *International Journal of Drug Policy* 23, no. 3 (2012): 198–209.

[389] Sacco and Finklea, *Synthetic Drugs*, 1.

prevalence of synthetic drugs as well as the resulting encumbrance on the nation's public health system. The report further presents a list of issues for Congress to consider, including but not limited to: implications on the criminal justice system when scheduling synthetic drugs within the CSA, hindering future medical research by enumerating additional synthetic drugs as Schedule 1, and the idea of amending the CSA to facilitate easier enforcement against synthetic drugs. Articulating its role in scheduling drugs, the FDA testified before the Senate Committee on the Judiciary in 2016, cautioning, "New illicit synthetic drugs are flooding the U.S. market, and many pose significant health risks."

The issue of how to regulate synthetic drugs overlaps with the issue of how to regulate do-it-yourself biology (DIYbio). DIYbio is an emerging global phenomenon of transversal collaborations promoting an open source ethos and access to resources for tinkering with biology.[390] This movement of more than tens of thousands of amateur biologists challenges institutionalized biology, promising cheaper and simpler solutions.[391] Although global governance of this movement is complicated, the DIYbio community has created its own safety and ethical framework of guidelines. Sophia Roosth, a cultural anthropologist with expertise in DIYbio, claimed, "Hobbyist tinkering and industrialized manufacture are two modes of production that are not dialectically opposed in the twinned cultures of synthetic biology and DIY biology."[392] Does this mentality of accepting the coexistence of divergent epistemic profiles have any utility in how policymakers view designer drugs?

Synthetic drugs create unique interdiction challenges due to a lack of means of drug testing, an endless catalogue of potential chemical configurations, pervasive availability for purchase online, and the ability to synthesize new drugs at home. Drug

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[390] Ana Delgado, "DIYBio: Making Things and Making Futures," *Futures* 48 (April 2013): 65–73.

[391] Thomas Landrain et al., "Do-It-Yourself Biology: Challenges and Promises for an Open Science and Technology Movement," *Systems and Synthetic Biology* 7, no. 3 (2013): 115–126.

[392] Hannah Sophia Roosth, "Crafting Life: A Sensory Ethnography of Fabricated Biologies" (PhD diss., Massachusetts Institute of Technology, 2010).

markets are perpetually resilient in the face of environmental changes.[393] U.S. drug policy must be similarly adaptable so as to stay relevant in a changing world.

4. Digital and Transhumanist Divides

Serendipity fades with everything we hand over to algorithms.[394]

What does it mean to be human in a hyper-connected world? The IoT's capacity to affect the country profoundly is genuine and should not be underestimated.[395] As Americans accumulate vast quantities of personal data, the ability of an individual to control their own data continually decreases. For example, an individual may choose not to create accounts on any social media platforms. Nonetheless, that individual will likely appear in pictures uploaded by friends, family, and colleagues—even if only peripherally. With the advent of biometric scanning and facial recognition software, sites like Facebook have the ability to compile a catalogue of images of that individual, despite the fact that she or he is not a registered user on the site. This level of deep-rooted connectivity raises policy implications regarding privacy, security, and human autonomy.

The acceptable limit of hyper-connectivity is a societal—rather than personal—philosophy. With the rate of objects joining the IoT and the exponential growth of technology, Americans may not have freedom of choice in their participation in a hyper-connected society. In the 1970s, social psychologist Henri Tajfel and John Turner theorized about the social selves of humans through their formation of social identity theory.[396] Focusing on intergroup behaviors, Tajfel described one's social identity as the piece of a person's self-concept originating from perceived membership in various social groupings.[397] For example, a person may identify herself as a woman, sister, daughter,

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[393] David A. Bright and Alison Ritter, "Retail Price as an Outcome Measure for the Effectiveness of Drug Law Enforcement," *International Journal of Drug Policy* 21, no. 5 (2010): 359–363.

[394] Ross, *Industries of the Future*, 180.

[395] Kyle Ebersold and Richard Glass, "The Internet of Things: A Cause for Ethical Concern," *Issues in Information Systems* 17, no. 4 (2016): 145–151.

[396] Henri Tajfel and John C. Turner, "An Integrative Theory of Intergroup Conflict," *The Social Psychology of Intergroup Relations* 33, no. 47 (1979): 33–47.

[397] Henri Tajfel, "Social Psychology of Intergroup Relations," *Annual Review of Psychology* 33, no.1 (1982): 24, 31.

graduate student, professional, personal trainer, and crayon enthusiast. Within each of these self-selected categorizations, there are different sets of norms and behaviors that define the in-group.[398] Social identity theory arose in a time before the Internet. As society becomes more connected, people may experience increased multidimensional framing of their social identity as digital privacy fades away.

Besides privacy implications, a hyper-connected digital society elicits ethical discussions on issues related to fairness, access, and equality. Because of exponential technological growth, the price of new technology decreases over time, as innovative disruption refines and challenges existing prototypes. Nevertheless, the rate of technological growth is striking. In 2007, Apple released the first iPhone, a revolutionary smart phone.[399] Rivalling Blackberry, the first iPhone was a groundbreaking touchscreen handset fusing a mobile phone with Internet access, a camera, a calendar, email, and music/video streaming capabilities.[400] Only a decade later, Apple has released the iPhoneX, featuring an intelligent personal assistant, augmented reality, a bionic chip, facial recognition technology, and two high-definition cameras.[401]

The phrase "digital divide" refers to "the unequal access and utility of Internet communications technologies and explores how it has the potential to replicate existing social inequalities, as well as create new forms of stratification."[402] In a highly digitized world, those without economic means to access the same technologies are likely to be at a disadvantage. In a world of neural stimulation and BCI technologies, this same digital divide may transfer to a transhumanist divide, creating a deeper divide between those with and without access.

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[398] David Brannan and Anders Strindberg, *A Practitioner's Way Forward: Terrorism Analysis* (Salinas, CA: Agile Press, 2014), 56.

[399] Rob Beschizza, "iPhone Announced," *Wired*, January 9, 2007, www.wired.com/2007/01/iphone_announce/.

[400] Mark Sweney, "Apple Launches iPhone," *The Guardian*, January 9, 2007, www.theguardian.com/technology/2007/jan/09/news.newmedia.

[401] Andy Boxall and Kyle Wiggers, "The All-Screen Apple iPhone X Is Here, and It's the New iPhone You'll Want," Digital Trends, September 28, 2017, www.digitaltrends.com/apple/apple-iphone-x-news/.

[402] Massimo Ragnedda and Glenn W. Muschert, eds. *The Digital Divide: The Internet and Social Inequality in International Perspective*, Vol. 73 (New York: Routledge, 2013).

Merging man with machine is the prospect of using technology to augment human capability positive or negative for humanity? On one hand, a breadth of emerging BCI research promises to improve quality of life and cure medical conditions. Human brains have extraordinary cortical plasticity, the ability to self-reorganize by forming new neural connections in response to mental experiences.[403] Because of this neuroplasticity, brain circuitry reflects individual habits and behaviors. Largely reliant on computers and mobile phones, Americans are already in the process of becoming digitally superhuman. According to writer Tim Urban, "the digital age has made us a dual entity—a physical creature who interacts with its physical environment using its biological parts and a digital creature whose digital devices—whose digital *parts*—allow it to interact with the digital world."[404]

On the other hand, it remains unknown how the use of BCI technologies in people beginning at birth could change the nature of how brains operate. Similarly, it remains unknown what could happen when BCI devices interface with AI. In future iterations, society may decide to employ BCI devices for perpetual health monitoring, and BCIs could transmit hourly biometric data into permanent electronic medical health records.[405] This would revolutionize public health but also usher in privacy concerns regarding data protection. In the future, could BCI technology track or investigate citizens?

Used in the wrong hands, BCI technologies are also vulnerable to weaponization. Neuroethicist James Giordano states, "It's not a question of if non-state actors will use some form of neuroscientific techniques or technologies, but when, and which ones they'll use."[406] DARPA is currently in the process of creating neural implants that can detect and suppress urges in people. The proliferation of this type of device could treat addiction or anxiety, but it also generates a new vulnerability for mental hacking. In the

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[403] Norman Doidge, *The Brain's Way of Healing: Remarkable Discoveries and Recoveries from the Frontiers of Neuroplasticity* (New York: Penguin, 2016), xiii.

[404] Urban, *Neuralink and the Brain's Magical Future*.

[405] Melanie Swan, "The Future of Brain-Computer Interfaces: Blockchaining Your Way into a Cloudmind," *Journal of Evolution and Technology* 26, no. 2 (2016): 60–81.

[406] Tim Requarth, "This is Your Brain. This is Your Brain as a Weapon," *Foreign Policy*, September 14, 2015, http://foreignpolicy.com/2015/09/14/this-is-your-brain-this-is-your-brain-as-a-weapon-darpa-dual-use-neuroscience/.

future, will the United States even need a drug policy, or will neural implants block Americans from temptation to try illicit substances?

5. A Path Forward

Facing growth projections for the IoT and continued exponential technological growth, the United States stands on the early moments of a seismic shift. Society will not see the boundary separating the everyday from hysteresis until past the point where technological progress is irreversible.[407] As a country, the United States must decide whether citizens should be able to purchase objects to alter perception through cybernetics. After this is decided, policymakers must develop adaptable policies that can handle shape-shifting forms of drug use. Dexterous policy execution is critical for allowing the nation's regulatory process to stay abreast in a complex, rapidly-evolving world.

[407] Ramo, *The Age of the Unthinkable*, 173.

V. FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

> Whatever happens, it's important that we begin the conversation about the society we want to create, and the role that drugs will play in that.[408]

A. INTRODUCTION

This thesis asks the question of which megatrends and emerging technologies are influencing the future of U.S. drug policy. Through the presentation of two scenarios, fictional "worlds" established and exposed flaws in the conventional wisdom driving modern day drug policy. Furthermore, the scenarios highlight broader umbrella implication of technological innovation when considering the future of drug regulation.

There is no effective panacea for banning all the other new illicit creations coming onto the street. Continuing along a longitudinal ascendant trend line over the past four decades, the use of recreational drugs has increased.[409] As new technology continues to emerge, manufacturing synthetic drugs will only become easier. Neuropsychopharmacologist David Nutt summarizes the difficulty in regulating novel drugs, stating, "This is the designer drug problem: as fast as government can legislate against known drugs, chemists around the world design new compounds specifically to get around the law."[410]

The value of fictional scenarios is in their creation of heuristic tools to emphasize hypotheses and insights.[411] The future of the United States may not appear as a linear extrapolation of the present. The scenarios described in this thesis are not predictions of how the world will look in the future. Rather, they depict plausible alternative futures. In each of the two scenarios, megatrends and emerging technological variables intersected to highlight how people might use drugs in the future outside of the current regulatory frameworks.

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[408] Nutt, *Drugs without the Hot Air*, 305.

[409] UK Government Office for Science, "Drugs Futures 2025," 23.

[410] Nutt, *Drugs without Hot Air*, 121.

[411] "Introduction," UC Berkeley Center for Long-Term Cybersecurity, accessed October 15, 2017, https://cltc.berkeley.edu/scenario-front-matter/.

B. FINDINGS

> Being willing to change our minds in the light of new evidence is essential to rational policy-making.[412]

All trends represent linear projections of the status quo, but black swan events could change forecasts. Black swan events refer to major, unforeseen events that could disrupt the megatrends discussed in this thesis. For example, nuclear war could have massive implications on Internet usage and/or reliance on technology.

Each scenario presented its own list of policy implications that arose from the fictional narrative. More broadly, patterns in these implications highlight three recurring themes present across all scenarios. First, underscoring each scenario is a challenge for how society decides to define a "drug." Second, each scenario challenged the feasibility of regulating emergent forms of drug use. Finally, the scenarios drew attention to ethical issues resulting from these nascent technologies.

1. What is a Drug?

The word "drug" itself is polysemic in nature.[413] Title 21 §802 of the U.S. Code outlines definitions pertaining to the CSA. In item 12, the legal definition for "drug" references back to §321(g) (1) of the same title, as Title 21 of the U.S. Code governs all food and drugs:

> The term "drug" means (A) articles recognized in the official United States Pharmacopeia, official Homeopathic Pharmacopoeia of the United States, or official National Formulary, or any supplement to any of them; and (B) articles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or animals; and (C) articles (other than food) intended to affect the structure or any function of the body of man or other animals; and (D) articles intended for use as a component of any article specified in clause (A), (B), or (C).[414]

Under this regulatory framework, it is unclear how the federal government might define the products described in the two scenarios presented in this thesis. In light of

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412 Nutt, *Drugs without the Hot Air*, 7.

413 Ibid., 54.

414 21 U.S.C. §321 (g) (1).

various emerging technologies with the potential to alter one's mental status, the federal definition for a drug appears open to interpretation. For instance, the federal government may consider neural stimulation devices as drugs under clause (B), as its use in the context of drug substitution therapy would function in the mitigation and treatment of substance use disorders. Furthermore, neural stimulation also fits into clause (C), as it is a non-food item intended to affect the mental functioning of the body. Inconsistently, coffee and green tea—nootropics altering the mind by stimulating alertness—are not included within this same regulatory framework.

Within the Controlled Substance Act, actual classification schedules are undefined and largely based on the abuse potential for each drug. According to the U.S. DEA, "If a drug does not have a potential for abuse, it cannot be controlled."[415] Paradoxically, by law, U.S. Code does not consider alcohol or tobacco to be controlled substances.[416] While the DEA does not define "potential for abuse," the administration outlines four indicators in its *Drugs of Abuse: A DEA Resource Guide*, 2017 edition:

> (1) There is evidence that individuals are taking the drug or other substance in amounts sufficient to create a hazard to their health or to the safety of other individuals or to the community. (2) There is significant diversion of the drug or other substance from legitimate drug channels. (3) Individuals are taking the drug or other substance on their own initiative rather than on the basis of medical advice from a practitioner. (4) The drug is a new drug so related in its action to a drug or other substance already listed as having a potential for abuse to make it likely that the drug will have the same potential for abuse as such drugs, thus making it reasonable to assume that there may be significant diversions from legitimate channels, significant use contrary to or without medical advice, or that it has a substantial capability of creating hazards to the health of the user or to the safety of the community. Of course, evidence of actual abuse of a substance is indicative that a drug has a potential for abuse.[417]

Using the abuse potential criteria outlined above, it is not clear how the DEA might consider the use of emerging technologies to augment mental functioning. The

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[415] U.S. Drug Enforcement Administration, *Drugs of Abuse: A DEA Resource Guide 2017* (Washington, DC: U.S. Department of Justice, 2017) www.dea.gov/pr/multimedia-library/publications/drug_of_abuse.pdf, 8.

[416] 21 U.S.C. §802 (6).

[417] U.S. Drug Enforcement Administration, *Drugs of Abuse*, 8–9.

FDA does not regulate vitamins or supplements. Would a recreational pharmaceutical like the fictional Motus, described in scenario one, fall under the vitamin/supplement category, or would the federal government determine that it should fall within the CSA due to its potential for abuse? Neuroprosthetics, like retinal implants, supplant or supplement the nervous system's inputs and outputs.[418] What happens when it becomes effortless to use these same devices to hack one's own nervous system, especially for recreational purposes? As new intelligence augmentation devices continue to amplify human cognitive abilities, it will become increasingly difficult to discern what qualifies as a "drug," and where to draw the line in ascribing abuse potential.

2. Regulatory Challenges

If the federal government does decide to regulate emerging technologies as drugs—pursuant to the regulations outlined above—regulation provides the next logistical challenge. The history of illicit drug use in the United States is one of resilient adaptation and deviant innovation. In 2017, traffickers are already bypassing federal drug laws by creating novel synthetic drugs and using packaging with labels indicating that products are not for human consumption. The United States is losing its whack-a-mole effort to control synthetics as producers rapidly innovate using new chemical formulations to create drugs outside of the law as written. This same approach may continue into the future with new mind-altering technologies. For example, a manufacturer might produce a neural stimulating sleep aid with the publicized knowledge that individuals could easily reconfigure the device to produce feelings of sedation akin to taking opiates. Can the government pragmatically regulate technology misappropriation?

Developing technologies may ultimately make drug regulation feasibly impossible as it is known today. In 2017, the CSA describes drugs in the context of such distinct biochemical substances as marijuana, heroin, or amphetamines. Law enforcement

[418] Eric C. Leuthardt, Jarod L. Roland, and Wilson Z. Ray, "Neuroprosthetics: Linking the Human Nervous System to Computers is Providing Unprecedented Control of Artificial Limbs and Restoring Lost Sensory Function," *The Scientist*, November 1, 2014, www.the-scientist.com/?articles.view/articleNo/41324/title/Neuroprosthetics/.

officers can test substances to ascertain their chemical composition, definitively categorizing whether a white pill is ecstasy, oxycodone, or simply acetaminophen. On the other hand, a BCI is essentially a piece of hardware containing computer code. Individuals can hack 3D printers to produce drugs, but the physical device itself is merely a modern day printer.

Further compounding the feasibility of drug regulation, global connectedness makes interdiction more taxing. For instance, the decisions by Canada and Mexico to legalize marijuana will exacerbate interdiction efforts in the United States. As of 2017, the federal-state chasm in marijuana regulation continues to grow as new states legalize the drug in certain forms. In addition, globalization continues to make the world more connected than ever before. Digital currency, the rapidly growing IoT, and the ability to create drugs in one's own home make drug prosecution efforts even more complicated. Perpetual shifting toward a dynamic socio-technical system presents vulnerabilities in this high level of connectedness.[419] According to technology policy expert Alec Ross, "The layout of the Internet scrambles the traditional idea that both sovereign countries and warfare are tied to geography and physical place."[420] Unless the legislative or executive branches drastically modify the CSA to take into account new technologies for altering mental status, prosecutors will eventually face the limitation of outdated drug laws.

When it comes to drug policy, is society asking the right questions? Policymakers focusing only on the implementation of regulations pertaining to the present will find themselves unprepared for the rapidly evolving future. Testing drivers for marijuana intoxication provides an example of this notion. As states legalize the use of marijuana in defiance of federal law, they suddenly find themselves faced with the need to regulate its use. Without the technology to test for marijuana intoxication, for instance, policymakers must decide how to enforce policies for driving while under the influence. As lawmakers scramble to govern marijuana use, and researchers rush to engineer a breathalyzer for

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[419] William J. Toth, "Complex Socio-Technical System Disasters, Crises, Crimes, and Tragedies: A Study of Cause from a Systemic Wholeness Perspective" (PhD diss., Saybrook University, 2016), 40, 241.

[420] Ross, *Industries of the Future*, 143.

cannabis to detect driving while under the influence, the advent of autonomous vehicles looms in the near future. Decades of research establish evidence that the war on drugs is an ongoing policy failure; the addition of new technologies for altering the mind will only exacerbate this defeat.[421]

3. Ethical Considerations

Beyond regulatory implications, emerging technologies and global megatrends may intersect to create a future of digital and/or transhumanist divides. The scenarios highlighted this idea in the context of such realms as the neuroethics of intentional cognitive enhancement and through digital insecurity. As humanity slowly merges with technology, society will continue to wrestle with what it means to be human.

One major realm in the field of biotechnical ethics pertains to the creation of economic divides. For instance, if nootropics become ubiquitous, it will create a monetary rift between individuals who can afford them and individuals who cannot.[422] Novel forms of cognitive amplification and a progressive embodiment of augmentation technologies could lead to identity-based conflict.[423] If humans stop sharing a common *umwelt*—a shared way of experiencing the world—the resulting alterity conflict could result in civil conflict based on transhumanist advantage.[424]

C. CONCLUSIONS

This thesis distills a broad arsenal of concepts and research pertaining to global megatrends, emerging technologies, and illicit drug use. Fictional scenarios underscore the challenges in defining a drug, governing its use, and incorporating ethical considerations into regulatory frameworks. The "Where Are We in 2017?" sections marshaled evidence to demonstrate plausibility. From these scenarios and ensuing

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[421] Dan Werb et al., "The Temporal Relationship between Drug Supply Indicators: An Audit of International Government Surveillance Systems," *BMJ Open* 3, no. 9 (2013): e003077. 10.1136/bmjopen-2013-003077.

[422] Nutt, *Drugs without the Hot Air*, 305.

[423] Nieto-Gómez, "This is Your Brain on Code."

[424] Ibid.

findings, three general conclusions emerge: 1) people use drugs, 2) innovation is outpacing drug policy, and 3) the United States must rethink its approach to drug policy.

1. People Use Drugs

Humans are natural pleasure seekers.[425]

Humans have a long history of using drugs to alter their consciousness, physical functioning, and/or mental status. Historians of drug culture highlight how drugs are "an important part of our evolutionary history."[426] Policymakers cannot frame the use and acceptance of these substances through a purely mechanistic way as context and environment are integral components in understanding usage.[427] Drugs already surround most Americans on a daily basis in the socially acceptable forms of coffee, nicotine, ibuprofen, or wine.

It is plausible to assume that humans will continue to use drugs—both legal and illegal—in various forms. This decade's popularity with synthetic and emergent nootropics drugs indicate a societal desire for a legal high, and throughout history, people have tinkered with technologies to produce pleasurable results. It is reasonable, therefore, to presume that individuals will find ways to hack new technologies creatively for enjoyment. As new technologies continue to emerge, their potential for misappropriation only grows exponentially. The fact that scientists have discovered how to engineer baker's yeast into LSD and opiates, for example, means that it likely will not be long before people figure out how to replicate this process in their homes.

Aside from misappropriation, pioneering ingenuity will continue to fuel society with characteristic American moxie. In the future, cultivators may adopt genetic technologies to splice the cannabis genome to produce different strains for different moods like calmness or creativity.[428] Researchers may create a hangover cure in a pill

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[425] Nutt, *Drugs without the Hot Air*, 69.

[426] Ibid., 70.

[427] Ibid., 61.

[428] Maggie Koerth-Baker, "The Future of Getting High," *The Atlantic*, June 2016, www.theatlantic.com/magazine/archive/2016/06/the-future-of-getting-high/480735/.

using dihydromyricetin, derived from certain Asian trees.[429] The hangover-free pleasure drug soma, envisioned in Aldous Huxley's *Brave New World*, may finally come to fruition.[430] In the future, society may no longer view drugs just as molecular combinations of carbon, hydrogen, and other elements on the periodic table. Replaced by interfacing neural stimulation devices, biochemical drugs may be an antediluvian notion. Over time, hidden fringe subcultures will become mainstream with a normalization of experiences once considered taboo.

2. Innovation Is Outpacing Drug Policy

> There really isn't any way to shut down the Silk Road unless multiple governments synchronize a worldwide jam of the entire Internet.[431]

Innovation is slowly making U.S. drug policy irrelevant. Dealers peddling drugs will continue to fuel the supply of illicit drugs, and novel digital technologies will only make sales easier. As the country is already starting to witness in 2017, the CSA will not be able to enumerate a never-ending lineup of newer and more potent synthetic drugs.

The scenarios presented in this thesis highlight countless interdiction challenges as the Internet has revolutionized a lucrative transnational drug trade. The global drug trade is experiencing the same forces that revolutionized other industries: Netflix replaced Blockbuster, Airbnb is supplanting the hotel industry, and Uber is displacing taxis. Sales of drugs on the dark web are already entering the mainstream, with "Cyber Monday" sales offering discounts on drugs, such as 50 percent off of LSD.[432] In a global landscape of hyper-connectivity, it is not feasible to oversee the online sale of illicit drugs in a comprehensive, sustainable way.

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[429] Yi Shen et al., "Dihydromyricetin as a Novel Anti-Alcohol Intoxication Medication," *Journal of Neuroscience* 32, no. 1 (2012): 390–401.

[430] Aldous Huxley, *Brave New World* (New York: HarperCollins, 1932), 54–55.

431 Mike Power, *Drugs Unlimited: The Web Revolution That's Changing How the World Gets High* (New York: Thomas Dunne Books, 2013), 221.

[432] David Gilbert, "50% off LSD and Discount Botox—Cyber Monday Deals Extend to the Dark Web," *International Business Times*, December 1, 2014, www.ibtimes.co.uk/50-off-lsd-discount-botox-cyber-monday-deals-extend-dark-web-1477453.

Whereas the war on drugs represents failed policy, the future of unchanged prohibitionist drug policies will be a futile abomination. The failure of U.S. drug policy was transparent, for example, in the country's effort to ban the stimulant plant khat. Operating under a false premise that banning drugs reduces its use, the federal government banned khat in 1993.[433] Predictably, there were subsequent increases in its price and related criminal activity and no advances in public health.[434] As the United States already learned from Prohibition in the 1930s, this is the tradeoff, the danger in getting drug policy wrong.

The two scenarios presented in this thesis touched on only a few in a long list of emerging technologies. Countless innovations, like 3D printing, also threaten to influence the realm of illicit drug use. The disruptive technology of 3D printing may signal a third industrial revolution in the future, ultimately simplifying supply chain and distribution.[435] Also known as additive manufacturing, 3D printing refers to a computerized process of stacking thin layers of material to create objects. Using a similar process, bioprinting allows scientists to manipulate cell structures and artificially construct living tissue. Layers of living cells are stacked on top of each other systematically to print tissues and organs. In March 2016, the FDA approved Spritam, the first 3D-printed drug for use in the treatment of seizures and epilepsy.[436] 3D printing also has utility for printing guns or opioid pharmaceutical drugs on demand, creating vulnerabilities for this technology to be hacked to print illicit drugs.[437]

According to technology policy expert Alec Ross, "Innovation brings both promise and peril."[438] Radical nascent technologies, like 3D printing, are mixing with drug use to form emergent social phenomena to produce concepts like "chemputers" for

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[433] Schedules of Controlled Substances: Placement of Cathinone and 2,5-Dimethoxy-4-ethylamphetamine Intro Schedule 1, 21 C.F.R. §1308 (1993), https://www.deadiversion.usdoj.gov/21cfr/cfr/1308/1308_11.htm.

[434] Nutt, *Drugs without the Hot Air*, 128.

[435] Jeremy Rifkin, *The Third Industrial Revolution: How Lateral Power is Transforming Energy, the Economy, and the World* (New York: Palgrave Macmillan, 2011), 117.

[436] See, for example: www.spritam.com for more information.

[437] Goodman, *Future Crimes*, 430.

[438] Ross, *Industries of the Future*, 6.

printing drugs.[439] In 2017, self-proclaimed "psychonauts" are tripping on hallucinogenic drugs while experiencing full immersion in virtual reality.[440] How will the government protect citizens when drug regulation is obsolete? The United States is living through an era of exponential technological growth. The speed at which neoteric technologies emerge is unprecedented and beyond the ability of regulators to govern under current policy frameworks.

3. The United States Must Rethink its Approach to Drug Policy

> The biggest wins from technology will go to the societies and firms that don't just double down on the past but that can adapt and direct their citizens toward industries that are growing.[441]

The United States needs a new social framework for conceptualizing drug policy. A zero-tolerance policy approach of prohibition is not only myopic but soon to be unenforceable as well. A drug policy framework for the twenty-first century should actively incorporate ethics and new technological innovation. Instead of clinging to a failed policy agenda, the United States should take a clearheaded look at where the country is heading. The United States must have a drug policy grounded in solid evidence rather than a product of radical subjectivity and bitter partisanship.

The mission of the U.S. Office of National Drug Control Policy is to "lead the Nation's counternarcotics efforts by developing policies and coordinating, promoting, and implementing initiatives to successfully reduce the supply, the use, and the social acceptance of Drugs in the United States."[442] With flexibility of purpose, the federal government can up-frame this mission statement to make it more relevant to current and emerging societal norms. For instance, a sociotechinical systems approach to drug policy

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[439] Tim Adams, "The 'Chemputer' That Could Print Out Any Drug," *The Guardian*, July 21, 2012, www.theguardian.com/science/2012/jul/21/chemputer-that-prints-out-drugs.

[440] Meghan Neal, "Real Drugs, Virtual Reality: Meet the Psychonauts Tripping in the Rift," *Motherboard*, November 23, 2015, https://motherboard.vice.com/en_us/article/4xayxm/real-drugs-virtual-reality-meet-the-psychonauts-tripping-in-the-rift.

[441] Ross, *Industries of the Future*, 43.

[442] "Office of National Drug Control Policy Mission," White House Archives, accessed October 15, 2016, https://clintonwhitehouse1.archives.gov/White_House/EOP/ondcp/html/mission-plain.html.

would recognize the interaction between human behavior, drugs, and technology.[443] Moreover, the cultural context of an illicit drug influences perceptions of how dangerous it is.[444] Regulatory drug policy structures should be antifragile—not only resilient to shocks but also strengthened by them.[445]

An evolution in thinking requires adaptability in this face-paced world. With the creation of augmented reality applications and other novel approaches, the field of healthcare is already embracing emergent technologies.[446] This type of intellectual flexibility requires lawmakers to challenge the status quo before it is too late. An adaptive mindset means being willing to accept that the federalist approach to drug enforcement may not be the most effective. In a global economy, transforming drug policy requires international support to discuss multijurisdictional interdiction responsibility. How countries adapt in the digital era will directly impact how competitive and stable they are in the future.[447] The United States cannot afford to lack urgency or succumb to bureaucratic paralysis in this realm.

D. RECOMMENDATIONS

> Our Nation cannot arrest its way out of the drug problem…the Administration has made it a priority to identify and expand promising, evidence-based practices that increase public safety, promote public health, and correct injustice.[448]

What does the United States imagine for its preferred future? The country currently has an ineffective drug policy not based on evidence, thus producing no real benefit to Americans. As an example, there is a strong correlation between large anti-

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[443] Gordon Baxter and Ian Sommerville, "Socio-Technical Systems: From Design Methods to Systems Engineering," *Interacting with Computers* 23, no. 1 (2011): 4–17.

[444] Nutt, *Drugs without the Hot Air*, 261.

[445] Tetlock and Gardner, *Superforecasting*, 244.

[446] Gloria Rothenberg, "10 Augmented Reality Apps for Healthcare: Medicine is Already on Board with Emerging Technology," MedPage Today, July 14, 2016, www.medpagetoday.com/practicemanagement/informationtechnology/59072.

[447] Ross, *Industries of the Future*, 43.

[448] Office of National Drug Control Policy, U.S. Executive Office of the President, *National Drug Control Strategy* (Washington, DC: Executive Office of the President, 2016), 32.

drug promotions—like "this is your brain on drugs"—and increases in first-time drug use, as youth actually become more curious about drugs.[449] Nevertheless, the same ineffective mass messaging campaigns continue to dominate prevention efforts.[450] Before the United States makes decisions about reforming its drug policy framework, it needs to decide on the purpose of drug policy reform. Is our intention to treat or punish those addicted to illicit drugs?

What might the preferred future of this country look like? Policymakers should proactively envision a drug policy for the twenty-first century, rather than retrospectively looking back to the nineteenth. In contextualizing a modern drug policy framework, regulators must manage a balance between exploration (obtaining new knowledge about emergent drug use) and exploitation (using that knowledge to improve policy frameworks).[451] A balance between these two behaviors will produce an optimal result for framing the future of U.S. drug policy.

The burden of illicit drug use is a real and significant policy problem. As the United States continues to increase spending on drug control programs, it is important to continually monitor and evaluate what policies are working and which are failing. It is imperative to analyze the issue of illicit drug use within a contextual framework assessing threats, laws, agencies, governance, culture, emergent trends, and mentality. The following four recommendations discussed below will create a resilient, adaptable drug policy prepared for the future.

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[449] Richard R. Clayton, Anne M. Cattarello, and Bryan M. Johnstone, "The Effectiveness of Drug Abuse Resistance Education (Project DARE): 5-Year Follow-Up Results," *Preventive Medicine* 25, no. 3 (1996): 315.

[450] Martin Fishbein et al., "Avoiding the Boomerang: Testing the Relative Effectiveness of Antidrug Public Service Announcements before a National Campaign," *American Journal of Public Health* 92, no.2 (2002): 238.

[451] Oded Berger-Tal, Jonathan Nathan, Ehud Meron, and David Saltz, "The Exploration-Exploitation Dilemma: A Multidisciplinary Framework," *PloS One* 9, no. 4 (2014): e95693.

1. Decriminalization

> Is criminalization ever an effective or appropriate moral response to drug use?[452]

In public discussions on the topic of drug policy, American politicians frequently take a position of tough on enforcement on laws regarding drugs and crime. In the fields of healthcare, criminal justice, and behavioral health, leaders call for harm reduction approaches that do not penalize addicts for suffering from the disease of addiction. While often portrayed in this juxtaposed way, the two views are not inherently mutually exclusive.[453] It is important to flag the false dichotomy between total drug prohibition and full legalization. It is a tragic paradox when policies designed to make the country safer end up making the world more perilous.[454]

To operate a modern drug policy for this century, the federal government should eliminate the CSA and the war on drugs. This policy recommendation joins an exhaustive collection of decades of research suggesting that the United States is not winning the "war," and it is causing more harm than positive outcomes.[455] This conclusion is not surprising; literature on the field of drug policy repeatedly concludes that as a mechanism, criminalizing drugs fails to deter use.[456]

As of 2017, states want to circumvent federal drug policy, as evidenced by the growing number of state-level marijuana laws. Another domain highlighting the state-directed shift toward drug policy reform is in the use of drug treatment courts. Beginning in the 1990s, some states created drug treatment courts to divert users out of the criminal justice system and into treatment, thus limiting criminal sanctions for personal drug

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[452] Nutt, *Drugs without the Hot Air*, 31.

[453] Ibid., 268.

[454] Ramo, *Age of the Unthinkable*, 9.

[455] Dan Werb, "Post-War Prevention: Emerging Frameworks to Prevent Drug use after the War on Drugs," *International Journal of Drug Policy* (July 2017), https://doi.org/10.1016/j.drugpo.2017.06.012.

[456] Louisa Degenhardt et al., "Towards a Global View of Alcohol, Tobacco, Cannabis, and Cocaine Use: Findings from the WHO World Mental Health Surveys," *PLoS Medicine* 5, no. 7 (2008): 1062, doi: 10.1371/journal.pmed.0050141.

use.[457] The creation of this innovative approach indicated a paradigm shift toward treatment and restoration instead of punishment.[458]

A decriminalization framework should replace the elimination of the failed war on drugs policies. There are various definitions for describing decriminalization; for the purpose of this policy recommendation, the term refers to a policy wherein use of drugs is not a criminal offense.[459] A transnational threat requires a global response via international cooperation. In assessing the efficacy of decriminalization, the United States should look to Portugal.

In July 2001, Portugal decriminalized possession and use of all drugs for personal use.[460] This innovative policy arose following a public health crisis, as morbidity and mortality from illicit drug use was rapidly increasing. Before 2001, Portugal's drug policy, similar to that of the United States, centered on a criminal approach to dealing with illicit drug use.[461] In the late 1990s, the country recognized that its strategy was not working. A drug use report produced by Portugal's Counsel of Ministers in 1999 stated that 95.4 percent of drug addicts undergoing addiction treatment the previous few years were heroin users, of which 11.6 percent tested positive for HIV.[462] At this same time, deaths from overdose and drug-related arrests were steadily increasing; 57.5 percent of arrests at that time were related to illicit drug use.[463] In 1997, drug related convictions

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[457] Mosi Secret, "Outside Box, Federal Judges Offer Addicts a Free Path," *New York Times*, March 2, 2013, http://www.nytimes.com/2013/03/02/nyregion/us-judges-offer-addicts-a-way-to-avoid-prison.html.

[458] John S. Goldkamp, Michael D. White, and Jennifer B. Robinson, "Do Drug Courts Work? Getting Inside the Drug Court Black Box," *Journal of Drug Issues* 31, no. 1 (2001): 29.

[459] Douglas Husak, "Four Points about Drug Decriminalization," *Criminal Justice Ethics* 22, no. 1 (2003): 21–29.

[460] Domoslawski and Siemaszko, *Drug Policy in Portugal*, 17.

[461] Caitlin Elizabeth Hughes and Alex Stevens, "A Resounding Success or a Disastrous Failure: Re-examining the Interpretation of Evidence on the Portuguese Decriminalisation of Illicit Drugs," *Drug and Alcohol Review* 31, no. 1 (2012): 102, doi: 10.1111/j.1465-3362.2011.00383.x.

[462] José Sócrates, *Portugal National Drug Strategy 1999* (Lisbon: European Monitoring Centre for Drugs and Drug Addiction, 1999).

[463] Ibid.

were rising in Portugal, with individual users (52.2 percent) being sentenced more than traffickers (43.6 percent).[464]

Portugal's Law 30/2000 decriminalized the use, possession, and acquisition of all drugs for personal use, defined as possessing up to a 10-day supply.[465] While it removed penal sanctions for drug crimes, this policy did not make drug use legal in Portugal. Rather, Portugal now treats drug use as an administrative violation, and the violator has the potential to receive punishment by either fines or community service. The penalty for citizens rests at the discretion of the Commissions for the Dissuasion of Drug Addiction, a panel comprising health, social work, and legal professionals.[466] Despite the existence of this panel, most individuals do not receive penalties as Portugal aims to have citizens enter into rehabilitation treatment voluntarily.[467] It is important to note that under decriminalization, it is still a criminal offense to traffic and distribute drugs. Even so, Portugal is an ideal case study for assessing total drug decriminalization because 16 years of data help determine whether this policy was a failure or a success.

Contextually before 2001, cultural perceptions of drug use in Portugal favored a harm-reduction mentality in light of the illicit drug use crisis.[468] Grounded in public health theory, harm reduction in this context refers to pragmatic policies, such as syringe exchange programs, intended to reduce the harmful consequences of drug use behaviors.[469] Most Portuguese citizens favored decriminalization in principle, despite concern over how this notion would work in practice.[470] Decriminalization policies accompanied fear that the rates of illicit drug use would sharply increase, that Portugal

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464 Ibid.

465 Hughes and Stevens, *The Effects of Decriminalization*, 1.

466 Domoslawski and Siemaszko, *Drug Policy in Portugal*, 30.

467 Ibid.

468 Alex Kreit, "The Decriminalization Option: Should States Consider Moving from a Criminal to a Civil Drug Court Model?" *University of Chicago Legal Forum* 2010, no. 11 (2010): 329.

469 G. Alan Marlatt, "Harm Reduction: Come as You Are," *Addictive Behaviors* 21, no. 6 (1996): 779, 780, doi: 10.1016/0306-4603(96)00042-1.

470 Mirjam Van Het Loo, Ineke Van Beusekom, and James P. Kahan, "Decriminalization of Drug Use in Portugal: The Development of a Policy," *The Annals of the American Academy of Political and Social Science* 582, no. 1 (2002): 52.

could become a destination for drug tourism, and that a decriminalization policy would connote federal acceptance of drug use.[471] As part of its overarching strategy to decriminalize drug use, Portugal expanded available resources for drug use prevention, treatment, and recovery.[472] In addition, broad social and health reforms played a crucial role in expanding the welfare state for citizens.[473] This is not surprising; previous research has demonstrated how low socioeconomic status positively correlates with morbidity and mortality from drug use.[474]

From a public health standpoint, the policy was a success; incidence of HIV infections, hepatitis B, hepatitis C, and overall drug related deaths decreased.[475] Since 2001, Portugal has one of the lowest prevalence rates of drug overdose deaths in the European Union. Drug use decreased among 15–24 year olds, a group at higher risk for drug experimentation.[476] Moreover, the rate of individuals experimenting with a drug(s) and continuing to use it dropped from approximately 45 percent in 2001 to 28 percent by 2012.[477] Overall, drug use among minors also decreased.[478] At 10 percent, Portugal has a low rate of lifetime marijuana use in individuals over age 15 (the rate is around 39.8 percent in the United States); Americans also surpass the Portuguese in rates of cocaine

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[471] Jordan Blair Woods, "A Decade After Drug Decriminalization: What Can the United States Learn from the Portuguese Model," *University of the District of Columbia Law Review* 15, no. 1 (2011): 11.

[472] Caitlin Elizabeth Hughes and Alex Stevens, "What Can We Learn from the Portuguese Decriminalization of Illicit Drugs?" *British Journal of Criminology* 50, no. 6 (2010): 1016, doi: 10.1093/bjc/azq038.

[473] Alex Stevens, "Portuguese Drug Policy Shows that Decriminalisation Can Work, But Only Alongside Improvements in Health and Social Policies," *European Politics and Policy at LSE* (December 2012): 1.

[474] Jake M. Najman, Ghasem Toloo, and Gail M. Williams, "Increasing Socio-Economic Inequalities in Drug-Induced Deaths in Australia: 1981–2002," *Drugs and Alcohol Review* 27, no. 6 (2008): 615, doi: 1080/09595230801956108.

[475] "Drug Decriminalisation in Portugal: Setting the Record Straight," *Transform* [blog], June 11, 2017, /www.tdpf.org.uk/blog/drug-decriminalisation-portugal-setting-record-straight.

[476] Hughes and Stevens, "A Resounding Success," 103.

[477] "The Success of Portugal's Decriminalisation Policy—In Seven Charts," *Transform* [blog], July 14, 2014, www.tdpf.org.uk/blog/success-portugal%E2%80%99s-decriminalisation-policy-%E2%80%93-seven-charts.

[478] Ibid.

usage.[479] From a criminal justice and law enforcement perspective, the policy was a success as it led to a decrease in crime.[480] Finally, the prevalence of synthetic drug use in Portugal is now lower than in any country possessing reliable data on usage rates. Overall, drug use has decreased, even while usage across most other countries in Europe has continued to rise.[481] According to drug policy expert Alex Kreit, criminal justice system savings following decriminalization in Portugal allowed for an increase in treatment capacity, leading to a 147 percent rise in the number of people seeking treatment from 1999 to 2003.[482] In Portugal, decriminalization also led to a reduction in federal costs.

Portugal's fears accompanying a policy of decriminalization never materialized. Before decriminalization, there was a fear that such a policy would lead to a dramatic rise in illicit drug use, yet this anticipated fear did not come to fruition.[483] Rather, there was a significant increase in the number of individuals seeking treatment for addiction, and the number of individuals on medication-assisted treatment therapy more than doubled following decriminalization.[484] The significant decreases in deaths from drug overdose, coupled with a decrease in transmitted diseases, provide compelling evidence that this policy is a success.

The structure of Portugal's government is as a semi-presidential representative democratic republic, a government structure providing utility for using Portugal for a comparative analysis.[485] Both Portugal and the United States claim to take a public health

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[479] Maia Szalavitz, "Drugs in Portugal: Did Decriminalization Work?" *TIME*, April 26, 2009, http://content.time.com/time/health/article/0,8599,1893946,00.html.

[480] Kellen Russoniello, "The Devil (and Drugs) in the Details: Portugal's Focus on Public Health as a Model for Decriminalization of Drugs in Mexico," *Yale Journal Health Policy Law and Ethics* 12 (2012): 390.

[481] Glenn Greenwald, *Drug Decriminalization in Portugal: Lessons for Creating Fair and Successful Drug Policies* (Washington, DC: Cato Institute, 2009), 22.

[482] Kreit, *The Decriminalization Option*, 328.

[483] "Setting the Record Straight," *Transform*.

[484] Hughes and Stevens, *Effects of Drug Decriminalization*, 2, 5.

[485] Octavio Amorim Neto and Marina Costa Lobo, "Portugal's Semi-Presidentialism (re) Considered: An Assessment of the President's Role in the Policy Process, 1976–2006," *European Journal of Political Research* 48, no. 2 (2009): 234.

rather than criminal approach toward illicit drug use. However, American policies do not reflect a public health approach, or what is referred to as the "public health smoke-screen in drug policy."[486] Rather than actually following a public health approach to drug use, the United States concentrates most effort on law enforcement and incarcerating nonviolent offenders.[487] More than 80 percent of drug arrests are for personal possession, rather than drug distribution.[488] The majority of arrests for personal possession are among nonviolent offenders.[489] Illicit drug use remains highly criminalized with laws such as mandatory minimum sentencing and "three strikes" shifting sentencing power from judges to attorneys.[490] Because of these strict sentencing laws, first time nonviolent offenders can easily receive *de facto* life sentences if the court prosecutes multiple trafficking convictions together.[491] Rather than continuing to promote a façade, the Office of National Drug Control Policy should center the national drug control strategy on public health.

Availability is not the only basis for decisions to use illicit drugs. Rather, cultural and social trends strongly influence norms surrounding use. Portugal's policy shift away from criminalizing drug use reflects a cultural trend happening around the world.[492] Currently, more than 25 countries have shifted toward removing criminal sanctions for personal use of illicit drugs.[493] For example, the Netherlands, Uruguay, and certain states within Australia removed criminal sanctions for the recreational use of marijuana.[494] Joining Portugal, social attitudes in the United States currently favor deregulation, and

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[486] Joanne Csete and Daniel Wolfe, "Seeing through the Public Health Smoke-Screen in Drug Policy," *International Journal of Drug Policy* 43 (May 2017): 91.

[487] Kerlikowske, *Drug Policy Reform in Action*.

[488] Howard Snyder, *Arrests in the United States: 1990–2010* (Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics, 2012).

[489] Jonathan P. Caulkins and Eric L. Sevigny, "How Many People Does the U.S. Imprison for Drug Use, and Who Are They?" *Contemporary Drug Problems* 32, no. 3 (2005): 405.

[490] Loyd, Mitchelson, and Burridge, *Beyond Walls and Cages*, 7.

[491] Nilsen, "Indecent Standards," 538.

[492] De Cordoba, *Latin American Panel Calls U.S. Drug War a Failure*.

[493] Eastwood, *A Quiet Revolution*, 3.

[494] Reuter, *Marijuana Legalization*, 1.

citizens are widely calling for reform of drug policy at the national level. In 2011, the Global Commission on Drug Policy concluded that the United States should spend less on law enforcement and more on prevention, education, and treatment.[495]

Drug decriminalization in Portugal led to a decrease in drug use, decrease in certain diseases, and an upsurge in the number of people pursuing addiction treatment. It is plausible to infer that decriminalization in the United States will likely lead to similar outcomes. Considering Portugal's decriminalization policy in the context of U.S. drug policy would necessitate a full restructuring of existing drug laws. If the United States decides to implement a decriminalization policy akin to the one in place in Portugal, it would need to replace the CSA. The Office of National Drug Control Policy would shift toward a public health-centric mission focused on prevention, treatment, and recovery. From a federal standpoint of drug decriminalization, states and local governments could decide how to operationalize the process of adjudicating administrative penalties.

When assessing its own implementation fidelity, the United States could collaborate with Portugal. RAND Europe created a guide to help other countries implement Portugal's drug strategy. It includes a breakdown of implementation priorities, tasks, and objectives under the realms of prevention, treatment, rehabilitation, harm reduction, prisons, justice, police, and research.[496] In itself, decriminalization is neither a policy nor an action. Rather, within a legal framework of decriminalization, Portugal's drug policy contains a number of overarching policies.

United States drug policy remains unmatched among developed nations due to its scale and the degree of criminal penalties for illicit drug use. According to a comprehensive systemic review of Portugal's decriminalization policy, policymakers in Portugal are "virtually unanimous in their belief that decriminalization has enabled a far more effective approach to managing Portugal's addiction problems and other drug-related afflictions."[497] Portugal provides a 16-year case study for assessing the utility of

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[495] Global Commission on Drug Policy, *War on Drugs*, 10–17.

[496] Ineke Van Beusekom, Mirjam Van Het Loo, and James P. Kahan, *Guidelines for Implementing and Evaluating the Portuguese Drug Strategy* (Report No. MR-1508) (Lisbon: RAND Europe, 2002).

[497] Greenwald, *Drug Decriminalization in Portugal*, 28.

broad drug decriminalization. Analyses of results following Portugal's decriminalization framework depict positive outcomes. In 2001, Portugal decided to fight the disease of addiction instead of addicted individuals themselves. Rather than continuing current outdated and draconian policies, the United States can and should pursue drug policy reform centered on decriminalization. Aiming for the evidence-based policy described in the nation's 2016 Drug Control Strategy, the United States should allow Portugal's decriminalization data set to change this nation's drug policy mindset.[498]

2. National Biotech Ethics Committee and Strategy

> Society is trusting our lawmakers, political appointees, and agency heads to apply those instruments to biological technologies that could literally change the future of humanity.[499]

In a world of globalization and rapidly emerging technological innovation, the United States needs a strategy and a committee on national biotech ethics new biological and technological developments are intended to enhance human life, but simultaneously they pose an existential threat to humanity. With cutting-edge discoveries like gene-editing, biology is one of the most critical technology platforms of this century.[500] Though the implications arising from their existence will ultimately affect illicit drug use as highlighted in the thesis scenarios, emergent biotech advancements transcend drug policy.

Existential risk is not a new concept: humanity has always coexisted with the risk of asteroids, volcanic eruptions, pandemics, earthquakes, and other natural disasters. Compounding these risks, society is now introducing transformative technologies that pose a new kind of peril, the likes of which the human species has never experienced before.[501] According to physicist Stephen Hawking, AI threatens to trigger unstoppable growth until society experiences singularity—the point where human civilization is

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[498] Office of National Drug Control Policy, *National Drug Control Strategy*, 32.

[499] Amy Webb, "Crispr Makes It Clear: The U.S. Needs a Biology Strategy, and Fast," *Wired*, May 11, 2017, www.wired.com/2017/05/crispr-makes-clear-US-needs-biology-strategy-fast/.

[500] Ibid.

[501] Nick Bostrom, "Existential Risk Prevention as Global Priority," *Global Policy* 4, no. 1 (2013): 15–31.

irreversibly changed, ushering in a new human era.[502] Researchers at Cornell University developed a programmable synthetic skin that could change the entire appearance of robots and wearable consumer technologies.[503] Elon Musk's company SpaceX claims it will send a manned rocket to Mars before the year 2024.[504] CRISPR technology allows scientists to alter the human genome permanently, an ability that could revolutionize fields like healthcare or lead to human augmentation and extensive geopolitical destabilization.[505] In the near future, these separate technologies will converge with the ability to change drastically medicine, agriculture, and human life at an incomprehensible rate.

Policymakers lack the technical understanding and domain expertise to apprehend how most of these contemporary technologies work. As of 2017, there is only one PhD scientist in Congress, and the country has no coordinated biology or technology strategy.[506] This is critical because emerging technologies are advancing faster than the government is able to understand and regulate them. Without preparation for emerging trends and technologies, it may be too late before an issue, like genetic privacy, leads to profound consequences.[507] Without a national biology platform, the country leaves private companies alone to toy with technologies that have the potential to reshape the human species.[508]

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[502] James Barrat, *Our Final Invention: Artificial Intelligence and the End of the Human Era* (New York: Macmillan, 2013), 95; Rory Cellan-Jones, "Stephen Hawking Warns Artificial Intelligence Could End Mankind," *BBC News*, December 2, 2014, www.bbc.com/news/technology-30290540.

[503] Brad Jones, "Scientists Have Created Programmable Synthetic Skin," *Futurism*, October 12, 2017, https://futurism.com/scientists-have-created-programmable-synthetic-skin/.

[504] Brad Jones, "Elon Musk is Officially Sending Humans to Mars in 2024," *Futurism*, September 29, 2017, https://futurism.com/elon-musk-is-officially-sending-humans-to-mars-in-2024/.

[505] Daniel Sarewitz, "CRISPR: Science Can't Solve It," *Nature* 522, no. 7557 (2015): 413–414, doi 10.1038/522413a.

[506] Julia Franz, "The Only Physicist in Congress, on the State of Science on the Hill," *Public Radio International*, January 23, 2017, www.pri.org/stories/2017-01-23/only-physicist-congress-state-science-hill.

[507] Liz Ahlberg, "Genomics to Surpass the Biggest Data Producers, Experts Warn," *Illinois News Bureau*, July 7, 2015, https://news.illinois.edu/blog/view/6367/232638.

[508] Arguably the decade's biggest invention in biotech, a single company owns the patent and rights to CRISPR gene-editing technology. Susan Young Rojahn, "Broad Institute Gets Patent on Revolutionary Gene-Editing Method," *MIT Technology Review*, April 16, 2014, www.technologyreview.com/s/526726/broad-institute-gets-patent-on-revolutionary-gene-editing-method/.

The federal government needs to form a separate committee with the authority to develop a science-oriented biotech strategy outside of the realm of political or religious bias. The National Biotech Ethics Committee must comprise nonpartisan researchers, policy experts, futurists, scientists, ethicists, and individuals with domain expertise. Led by a chief ethics officer, this group should develop a common lexicon for discussing these topics and work directly to educate the executive branch on the implications of accelerating change. This committee should not be part of the national institutes of health, science, or technology. Rather, the Biotech Ethics Committee should act as a conduit between the executive branch of government and the scientific community. In understanding the potential consequences of emergent sociobiological and technical developments, the committee should take into consideration economics, behavioral theories, the environment, population demographics, cultural implications, and megatrends using a multi-faceted analytical approach. According to futurist Jim Dator, "once certain values, processes, and institutions have been enabled by technologies, they begin to have a life of their own."[509]

3. An Office of the Future

> Institutionalized forward thinking proactively strengthens homeland security capabilities and delays the time it takes the government to react to change.[510]

In a landscape of exponential technological growth and a rapidly expanding IoT, it is imperative for the United States government to create the Office of the Future. This office should develop a sophisticated toolset to prepare the country for emergent phenomena on the horizon. It is important to balance adaptation and planning. Where bureaucracy is reactive, the Office of the Future would proactively anticipate upcoming issues and technologies still in their embryonic stages. According to technology policy expert Alec Ross, security is supposed to be "a public good administered by government,

[509] Dator, *What Futures Studies is, and is Not*, 2.

[510] Nieto-Gómez, "A Director of the Present?"

not a private good purchased in the marketplace."[511] Has the U.S. government fully addressed the need for digital security in a new era of cybersecurity and conflict?

To avoid bureaucratic paralysis, the Office of the Future should operate independently under an *Auftragstaktik* (decentralized) command philosophy. Under this broad concept, the executive branch oversight should provide the cabinet-level director of the Office of the Future with a general direction to develop strategic foresight, allowing the office the freedom to determine how to accomplish their mission.[512] For example, the office could utilize forward-thinking solutions such as crowdsourcing to solve problems. Prospective thinking must occur on a continual forecasting basis, as technological innovation and digital disruption changes constantly. According to scenario planning expert Kees Van der Heijden, it is crucial to institutionalize the ability to interpret signals.[513] What could the DEA have done 5–10 years ago to better prepare for the changing ecosystem of illicit drug use in 2017?

The creation of an Office of the Future would be evolutionary, though not without precedent. In Silicon Valley, the Institute for the Future and the Foresight Institute research revolutionary technologies and their fundamental importance to the human future.[514] The Foresight Factory conducts similar research on behalf of Fortune 500 companies.[515] An institutionalized approach to anticipating trends on the horizon does not belong solely in the private sector domain. In the United Kingdom's Government Office for Science, teams work on year-long foresight projects focused on areas where emerging science informs policy.[516] In Australia, the government funds a futures project

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[511] Ross, *Industries of the Future*, 151.

[512] John T. Nelsen II, "'Auftragstaktik:'A Case for Decentralized Battle," *Parameters* 122 (September 1987): 22; Robert G. Walters, "Order Out of Chaos: A Study of the Application of Auftragstaktik by 11th Panzer Division during the Chir River Battles 7–19 December 1942" (master's thesis, Naval Postgraduate School, 1989), 11.

[513] Kees Van der Heijden, *Scenarios: The Art of Strategic Conversation*, 2nd ed. (Hoboken, NJ: John Wiley and Sons, 2005), 7.

[514] For more information, see (for example) the Foresight Institute at https://foresight.org, and the Institute for the Future at www.iftf.org.

[515] For more information, see (for example) Foresight Factory at www.foresightfactory.co/us/.

[516] For more information, see (for example) future studies projects through the U.K.'s Government Office for Science at https://www.gov.uk/government/organisations/government-office-for-science.

focused on migration of skilled labor.[517] Within the U.S. Department of Homeland Security, Federal Emergency Management Agency conducts its own strategic foresight initiative focusing on future disasters.[518] To provide the most benefit to Americans, a dedicated office should collaborate with the private sector to focus on all areas of strategic foresight systematically.

4. Health and Behavioral Healthcare System Transformation

> The success or failure of any government in the final analysis must be measured by the well-being of its citizens. Nothing can be more important to a state than its public health; the state's paramount concern should be the health of its people.[519]
>
> Franklin Delano Roosevelt

a. Move Drug Policy from the Realm of Law Enforcement to Public Health

The U.S. government should transition the domain of drug policy from law enforcement to public health. This realignment falls in line with the frequently repeated conclusion that the country's drug problem "needs radical thinking as a public-health crisis rather than a moral crusade."[520] Researchers have established that a zero-tolerance drug policy impedes public health approaches, subsequently marginalizing and stigmatizing those who suffer from addiction.[521] Moreover, experts in healthcare fields claim that zero tolerance dismisses evidence-based harm reduction strategies, such as syringe exchange programs.[522]

Part of the public health success seen in the case study of Portugal was due to a general shift to treating drug use using a medical model rather than a criminal one that bestows criminal sanctions. With a policy of decriminalization in place, there would no

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[517] For more information, see (for example) http://australianfutures.co.uk/faqs.html.

[518] For more information, see (for example) Federal Emergency Management Agency's Strategic Foresight Imitative at www.fema.gov/strategic-foresight-fema.

[519] Lawrence O. Gostin, "Vision of Health and Human Rights for the 21st Century: A Continuing Discussion with Stephen P. Marks," *Journal of Law, Medicine, and Ethics* 29 (2001): 140.

[520] Nutt, *Drugs without the Hot Air*, 7.

[521] Godlee, *The War on Drugs Has Failed*, 1.

[522] Wood et al., "The War on Drugs," 989.

longer be a reason for law enforcement to enforce a strict penal code related to the consumption of illicit substances. Moreover, this system transformation would better prepare the nation for a future in which people use drugs other than biochemical substances to get high. Homeland security and public health have a shared mission to maintain social and economic stability as well as government functioning; a drug policy realignment from law enforcement to public health will help further this mission.[523]

b. Expand Access to Healthcare and Behavioral Health Services

In Portugal, decriminalization has reduced stigma related to drug addiction. Citizens are no longer afraid of criminal involvement for seeking treatment. Instead of being prosecuted, individuals caught using drugs receive a non-enforceable invitation to seek treatment. As a result, the number of individuals seeking treatment for substance use disorders nearly doubled in the years following implementation.[524] Formalizing the expectation that treatment is available, Portugal's model hinges on the existence of a highly functioning drug treatment system.[525] The United States is the only industrialized nation without government-sponsored universal healthcare.[526] If the United States intends to decriminalize drug use, it must complement this action with a move to strengthen the existing drug treatment system.

The best way to strengthen the existing drug treatment system is to implement a universal healthcare system like the socialized health system found in Portugal or almost all other developed nations. In the United States, a mélange of for-profit, nonprofit, and government-provided funding at privately and publicly funded facilities provide healthcare. Although the United States spends more on healthcare per capita than any other nation, it drastically underperforms and continually ranks as one of the worst

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[523] Jessica M. Bress, "Safety, Security, and Resilience: Bridging Homeland Security and Population Health," *Berkeley Public Policy Journal* 2, no. 1 (2017): 35–48.

[524] Greenwald, *Drug Decriminalization in Portugal*, 15.

[525] Hughes and Stevens, *Effects of Decriminalization*, 2.

[526] Kimberly Ann Petersen, "The Affordable Care Act: A Prescription for Homeland Security Preparedness?" (master's thesis, Naval Postgraduate School, 2014), 4.

performing systems among developed countries.[527] A universal public health system would provide complete access to behavioral health services to all citizens.

Health is the cornerstone of ensuring a population is safe, secure, and resilient in the face of threats.[528] Universal healthcare represents a preferred homeland security practice. According to Fremont Police Captain Kimberly Petersen, "Our ability to obtain health care is part of the homeland security preparedness puzzle."[529] With a fractured healthcare system, the United States limits its ability to be resilient and fails to achieve full preparedness. Universal health coverage is indispensable to achieving individual health security.[530] Security threats are not static. As the United States faces surges and innovative forms of drug epidemics, it is imperative that the homeland security enterprise remain adaptable. Adopting universal healthcare will systematically strengthen the nation's homeland security and ability to be resilient. Ability to obtain healthcare, including behavioral health treatment, is vital to Americans and reinforces an all-hazards framework to security.[531]

E. LOOKING FORWARD

> We need policymakers and thinkers who have that intuitive revolutionary feel for the inescapable demands of innovation.[532]

Society changes to keep up with technological innovation. Pacemakers, organ transplantation, and Lasik eye surgery were wild, fringe innovations when they first appeared in in the public but are now accepted by the mainstream. The next industrial convergence will likely be a collision between the biological and computer sciences. In the future, policymakers will likely merge subjective judgment with computer-based

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[527] Karen Davis et al., *Mirror, Mirror on the Wall: How the Performance of the U.S. Health Care System Compares Internationally* (New York: Commonwealth Fund, 2014), http://www.resbr.net.br/wp-content/uploads/historico/Espelhoespelhomeu.pdf, 1.

[528] Bress, "Safety, Security, and Resilience," 45.

[529] Petersen, "The Affordable Care Act," v.

[530] David L. Heymann et al., "Global Health Security: The Wider Lessons from the West African Ebola Virus Disease Epidemic," *The Lancet* 385, no. 9980 (2015): 1885, doi: 10.1016/S0140-6736(15)60858-3.

[531] Petersen, "The Affordable Care Act."

[532] Ramo, *Age of the Unthinkable*, 37.

forecasting.[533] According to futurist Rodrigo Nieto-Gómez, "upcoming trends are visibly influencing the homeland security environment in a way that should not be surprising."[534] To prepare for the arrival of new trends, it is important to value divergent views and emergent thinking. Scenario thinking is one method for harmonizing the spectrum from imagination to pragmatism. Fictional scenarios challenge assumptions and show how moving parts could intersect to produce counter-intuitive outcomes. With a phenomenal instinct to pioneer new policy approaches, the United States will thrive as a leader in a complex revolutionary age of change.

[533] Tetlock and Gardner, *Superforecasting*, 23.

[534] Nieto-Gómez, "A Director of the Present?"

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