

Office of the Director of National Intelligence
Washington, DC 20511

FEB 19 2015

Mr. Steven Aftergood
Federation of American Scientists
1725 DeSales Street, NW, Suite 600
Washington, DC 20036

Reference: FOIA Request DF-2010-00031

Dear Mr. Aftergood:

This is in reference to a letter sent to you by the Federal Bureau of Investigation (FBI) (Enclosure 1), in response to our referral to FBI. The referral was made pursuant to your 23 December 2009 email to the Office of the Director of National Intelligence (ODNI), in which you requested, under the Freedom of Information Act (FOIA), copies of two ODNI SHARP (Summer Hard Problem Program) reports from July 2009 (Enclosure 2). ODNI provided you with the document on Nuclear Attribution on 19 September 2014.

FBI indicated in their letter that they had not identified any FBI equities in the document, and administratively closed the request. However, as the document is responsive to your request, ODNI is providing it to you (Enclosure 3).

ODNI has determined that material must be withheld pursuant to the following FOIA exemptions:

- (b)(3), which applies to information exempt by statutes, specifically 50 U.S.C. § 3024(m)(1), which protects, among other things, the names and identifying information of ODNI personnel; and
- (b)(7)(E), which affords protection to all law enforcement information that “would disclose investigative techniques and procedures.

If you wish to appeal ODNI’s determination on this request, please explain the basis of your appeal and forward to the address below within 45 days of the date of this letter.

Office of the Director of National Intelligence
Information Management Office
Washington D.C. 20511

If you have any questions regarding the denial of ODNI information, email our Requester Service Center at DNI-FOIA@dni.gov or call us at (703) 874-8500.

Sincerely,

Heather J. Jordan

*J*Jennifer Hudson
Director, Information Management Division

Enclosures

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SHARP

2009

MIXED
REALITY:
Geolocation & Portable
HAND-HELD
Communication Devices



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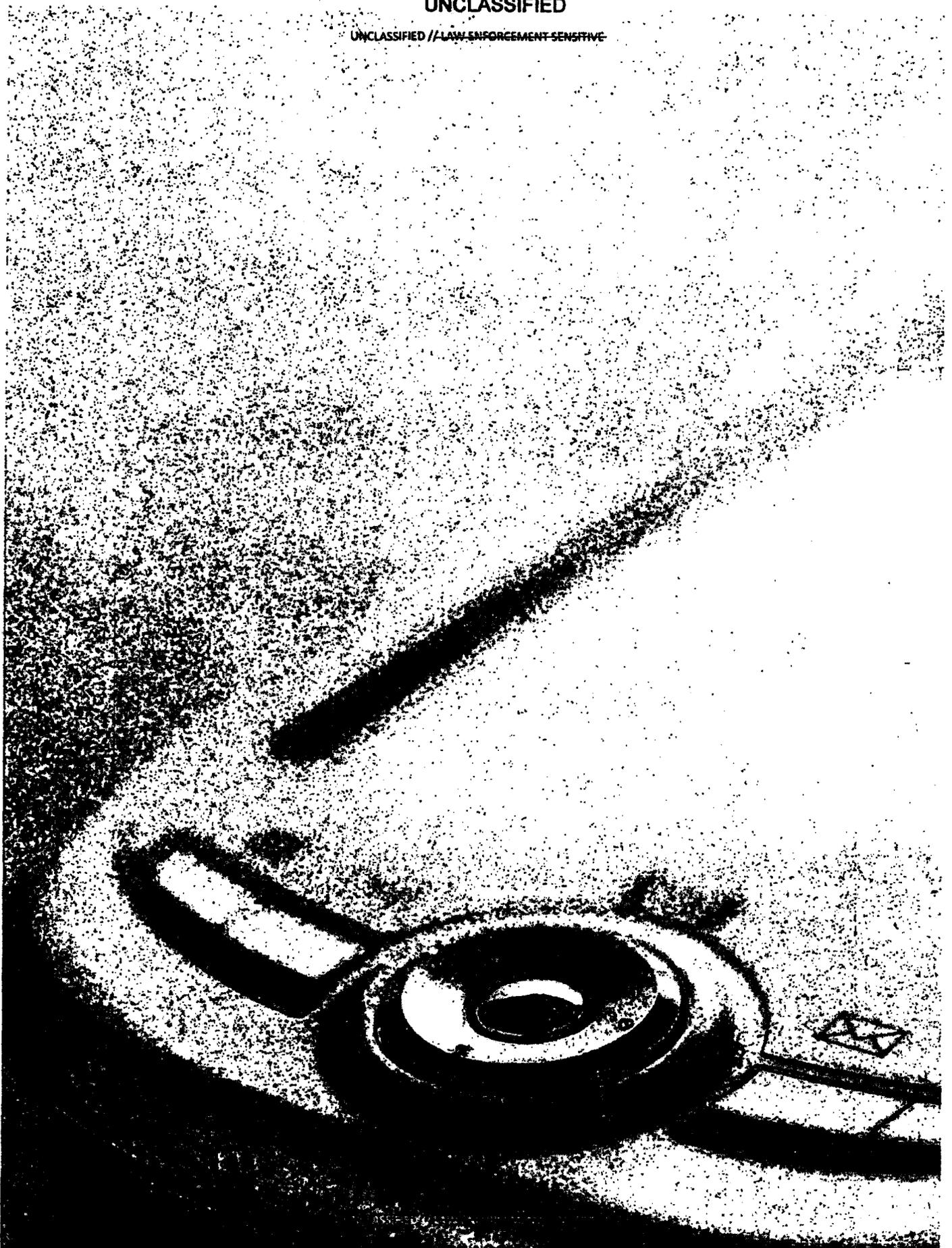
A COMPUTER IN EVERY POCKET:
Mixed Reality, Geolocation & Smart Phones

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Office of the Director of National Intelligence
Deputy Director of National Intelligence for Analysis
Washington, DC 20511

(U//FOUO) On behalf of the Director of National Intelligence, I am pleased to share with you an interesting report titled, *A Computer in Every Pocket: Mixed Reality, Geolocation, and Smart Phones*, produced by our Summer Hard problem Program (SHARP).

(U) Each summer a remarkable event occurs. Over the course of four weeks, professionals from the US Government, academia, the private sector, and state and local law enforcement gather to study, debate, and analyze what has been judged to be a particularly thorny national security problem. The group meets in a secluded location that takes them away from the demands of their offices, so they can think expansively and boldly about hard challenges and practical solutions.

(U) Participants are encouraged to collaborate extensively with one another and to draw upon their experience while seeking new approaches to the problem being studied. SHARP seeks to catapult the discovery of new analytic insights while promoting two overarching goals: to plant the seeds of cultural change within the analytic community by exposing them to new tradecraft and diverse thinking, and to facilitate the building of networks among analysts and operators from varied backgrounds both internal and external to the intelligence community. The report is intended to stimulate discussion. The information in this document is intended FOR OFFICIAL USE ONLY. It represents the thinking, expertise, and research of a select group of individuals, not of the Director of National Intelligence or the Intelligence Community, per se.

(b)(3)

(U) I would like to thank [REDACTED] Director of Cyber Information Operations and Strategic Studies at the Office of the Under Secretary of Defense for Intelligence (OUSDI), for serving as topic champion and advocate of the SHARP Mixed Reality session. Without her leadership, inspiration, and commitment of time, a successful study that would not have been possible.

(U) I hope you will enjoy reading this report and discover, as I have, the boundless creativity that is unleashed when diverse professionals come together with a common passion for solving problems of national importance. For more information, please contact [REDACTED] the SHARP Program Manager [REDACTED]

(b)(3)

Sincerely,



Peter Lavoy



(U) Executive Summary & Key Findings

(U) In 182 words or less...

1. (U) Mixed Reality (MR) describes the interweaving of physical reality and virtual reality to the extent they are perceived as one.
2. (U) MR is uniquely shaped by the individual's degree of investment and engagement in social networks, the degree of online immersion, and competing socio-cultural elements.
3. (U) The adoption worldwide of mobile, wireless technology is leading to unprecedented information sharing among individuals — in real time and across international borders. These advances enable users to individually and collectively affect political, economic, and cultural dynamics within nearly any nation state.
4. (U) A forward-looking understanding of MR's capabilities and global implications will help the US Intelligence Community (IC) gain competitive advantage in...

(U) Anticipating changes in state and non-state actor awareness, orientation, intents, and behaviors

(U) Driving rapid evolution in IC collection, data visualization, collaboration, analysis, and dissemination processes
5. (U) Conversely, constraints caused by the IC's security needs and culture of information control will challenge the community's ability to adopt MR or even recruit future employees who have grown up relying on palmtop computers and crowdsourcing.

(U) What is "Mixed Reality?"

(U) The accelerated worldwide conversion of mobile phones into mobile internet devices is transforming both human society and the internet itself. As of 2008, there were 1.6 billion internet users globally and 4 billion mobile phone users.¹ Over 1 billion mobile internet users are projected globally by 2011.² The number of global internet users and mobile phone users will converge rapidly in the coming years as all new mobile phones become internet-enabled.

(U) As people integrate the use of the internet more deeply into their daily lives — whenever they choose and wherever they are — the virtual world of the internet and the real world will begin to merge toward a point at which they will be perceived to operate as one. This is "Mixed Reality."

(U) The advent of MR is transformative and is increasingly affecting all aspects of life. People's behavior is already changing, propelling us closer to a dependency on uninterrupted, persistent connectedness.

- (U) The increasingly common habit of sharing what you're thinking (Twitter), what you're reading (StumbleUpon), your finances (Wesabe), your everything (the Web) is becoming a foundation of our culture.
- (U) More and more people will share their information (ideas, intentions, content, preferences, 'friend' networks, real-time locations, etc.) to get something beneficial in return.
- (U) If you are interesting enough or generate enough value (whether socially, through your keen insights, or through other qualities), whatever you create online will be mined and exposed.

(U) Many examples of MR technology can seem like science fiction, such as the use of electronic visors to see three-dimensional computer-generated objects interact with a real environment. However, some of the seemingly mundane elements of MR technology (i.e., ubiquitous, sensor-filled, GPS-enabled mobile devices like Apple's iPhone) are already dramatically changing the way people live, communicate, do business, and shape socio-political conditions. Such changes can be as prosaic as people adjusting driving habits based on real-time, precise location and traffic information, and as profound as the emerging ability to track practically anyone anywhere.³

(U) While locative technologies are relatively cheap, efficient, and attractive for commercial developers, and an increasingly expected norm for consumers, the deeper integration of these technologies into daily life will alter perspectives on the relationships between personal location, privacy, and trust.

(U) Why Does Mixed Reality Matter?

(U) Emerging MR technologies make it possible for the first time to use the full resources of the internet in real time, virtually anywhere, on a global scale. As a result, individuals and small groups at the right time and the right place have a much greater ability to influence political, economic, and cultural developments. Two recent examples: The use of Twitter to provide first-hand reports from the scene of the summer 2009 post-presidential election riots in Iran, and the use of Twitter by onlookers to share warning information during the November 2008 Mumbai attacks.



(U) Competitive advantage — economic, military, and even artistic — in every advance of these pervasive technologies is so powerful that failing to participate in and leverage this new reality blinds us and helps our adversaries achieve a decisive information advantage. The availability of millions of networked mobile sensors on Smartphones and other mobile devices presents the United States, its allies, competitors, and adversaries with unprecedented intelligence collection opportunities and unprecedented security vulnerabilities. Adapting to this change is not an option — it is a necessity for US and allied national security.

(U) The United States lags behind many other nations in MR. Further, the US Intelligence Community at large is lagging behind the country, preventing itself from seizing the information advantage available with mixed reality technologies. Having a broad base of intelligence officers who are personally conversant and immersed in the language and use of mixed reality is a key prerequisite for advancing US interests. Adopting the “anytime,

anywhere” mixed reality workplace paradigm inside the Intelligence Community will empower us to respond to global challenges ahead of our adversaries.

(U) Gaining a Better Understanding of Mixed Reality’s Opportunities and Vulnerabilities

(U) The following bullets provide a quick look at the breadth of topics examined during the summer 2009 Summer Hard Problem session:

- (U) We are at the cusp of a new intelligence ‘type’: crowdsourced intelligence (CROWD-INT). The intelligence community has a unique opportunity to engage the public to help filter and solve a multitude of difficult tasks. As “brands,” the various government agencies have the ability to mobilize their citizens to complete tasks for the common good. The wealth of a nation will be derived from its networked population, which will translate into that nation’s ability to mobilize intellectual property, information technology, and other virtual

resources to promote and defend its own interests. Further, there is the potential for a networked population to not only conduct information collection / processing / validation tasks ("sensory and mind" tasks of the hive), but also to coordinate collective action ("hands and feet" tasks of the hive) in multiple realities (physical, virtual, and mixed). So what? Thousands of eyes and hands can be summoned with rapidly decreasing need for notice or advance planning. Applications here will span from state control to non-state group influence to macro-scale "neighborhood watch", from criminal activities to the law enforcement community's investigations and prosecutions, and beyond!

(U) The permeation of MR throughout societies worldwide will present game-changing opportunities for the strategic influence and information operations communities. Getting ahead and staying ahead of MR's evolution is a necessity for US and allied national security,

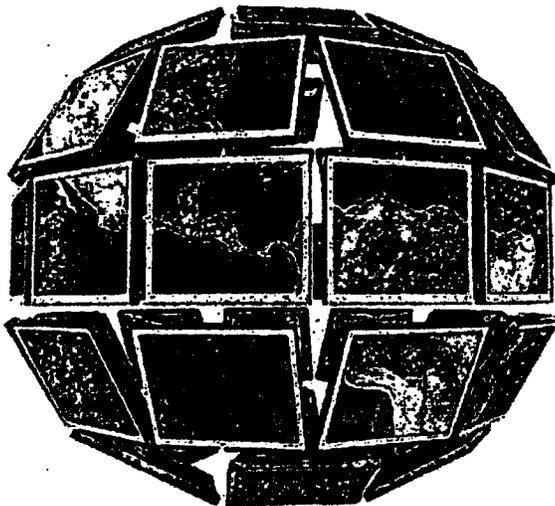
as it will not just be the US and our allies that will seek to gain an advantage via MR-enabled awareness and capabilities.

(U) The concept of privacy has undergone a massive change; many do not realize this fact. Technological development has outpaced the legal community's ability to keep up. Private corporations now define the legal lanes with the use of End User License Agreements (EULAs). While laws in the past were established to regulate US government intrusions into an individual's privacy, to what extent are private corporations (and their owners) limited from collecting an individual's, EULA-granted data? (These data can include real-time location, relationships, appearance, interests, physical world and online trends, and so forth.) The current lack of protection will surprise and shock.

(U) The ability to anticipate future problems in the global economic and financial systems is crucial to safeguarding our American ideals.

These are highly challenging "targets" for the Intelligence Community to better understand, calling for a new, robust kind of analysis. MR-enabled capabilities potentially hold the key for the Intelligence Community to help thwart future crises.

(U) A competitive advantage for US and allied intelligence can be gained through the use of real-time MR simulation and modeling tools for analysis and collaboration. Advancements in immersive multi-modal displays and telepresence have already shown increased benefits for complex collaborative decision making in medicine and military training and lend themselves well to intelligence analysis and operational planning.⁴



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(U) Further, the commercial world's leading-edge recommendation engines and content analysis generators hold potential to be adapted to help the intelligence community to better process the exponential growth of data that will be available with the increased use of MR technologies worldwide. Of particular note, a prerequisite to realizing the benefits of these emerging capabilities is to cultivate an intelligence officer workforce that is conversant and familiar with the language and use of MR. Once the intelligence community is on track to develop and challenge such a workforce, MR capabilities will become a dramatic force multiplier.

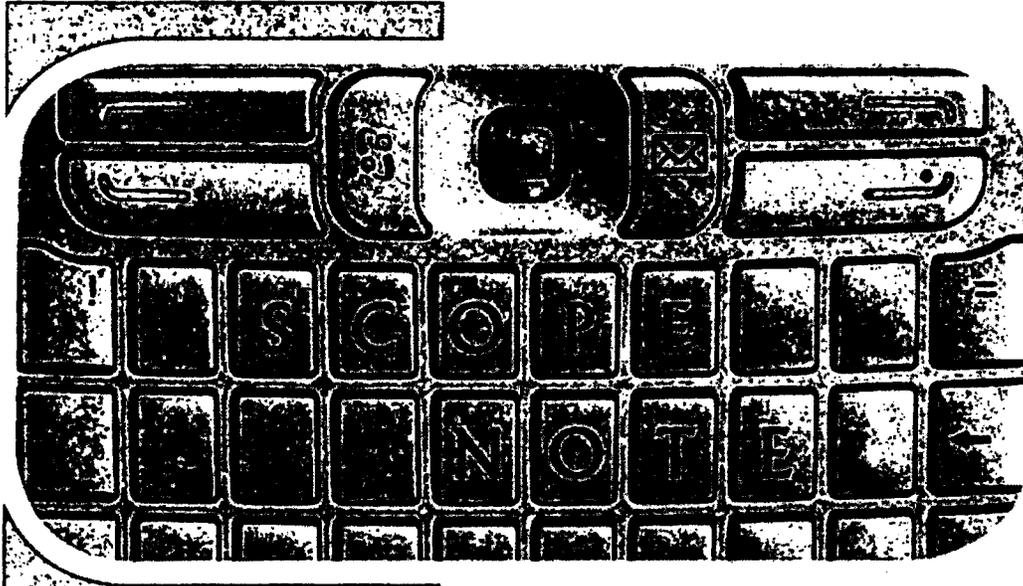
(U) At the end of this document, please take time to read a futuristic, fictional epilogue describing the very distinct journeys of two new employees — one within the walls of the IC, and the other within corporate America. The story illustrates the growing divergence between IC and industry cultures and technical capabilities, — assuming the IC remains on a traditionally cloistered track.

Transparency and security can coexist.
Participation builds trust.
Disconnectedness has tremendous costs and consequences.
A non-wireless future for the IC is untenable.
We have the power to decide our future.

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MIXED REALITY: Geolocation & Portable Communication Devices

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(U) In summer 2009, the Deputy Director of National Intelligence for Analysis challenged a select group of thinkers in Phoenix, Arizona to assess the future global impacts of rapidly advancing, increasingly available, mobile internet devices. During the four week session, this diverse group considered the implications of how that complex technology is fostering the emergence of "Mixed Reality" — a phenomenon in which virtual and real worlds merge, generating a force for cultural transformation driven by accelerating technological advancement.

(U) The 26 innovative thinkers representing the intelligence communities of the United States and the United Kingdom, US law enforcement organizations, the legal profession, and private sector entrepreneurs convened in a nearly continuous brainstorming session, exchanging information and perspectives to interpret the impact of Mixed Reality within and across their specialized areas of interest.

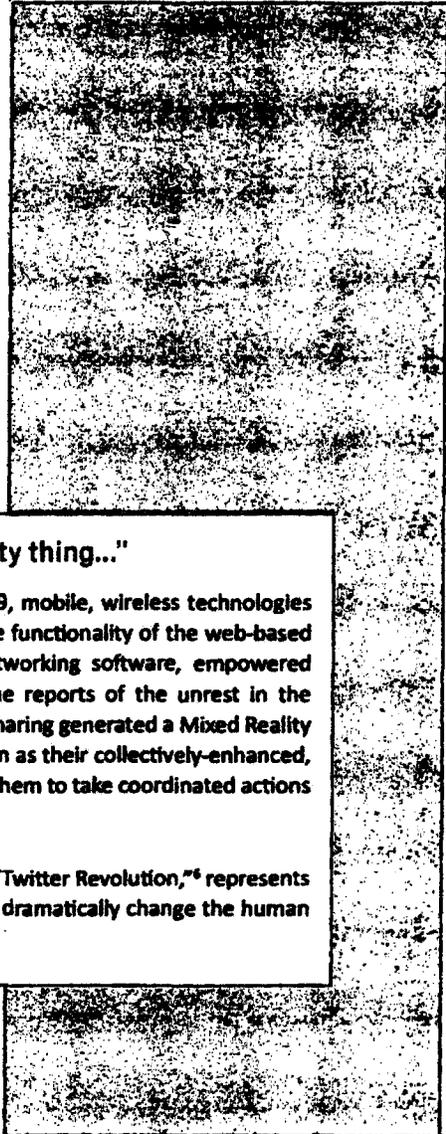
(U) This convergence of different fields and cultures created what the author, Frans Johansson, describes as "The Medici Effect," or "Breakthrough Insights at the Intersection of Ideas, Concepts, and Cultures." Johansson claims that "Innovators are changing the world by stepping into the Intersection: a place where ideas from different fields and cultures meet and collide, ultimately igniting an explosion of extraordinary new discoveries."⁵ True to the author's description, the insights produced through the intersection in Phoenix

are varied and reflect multiple perspectives on the impact of Mixed Reality within several disciplines that share a common interest in national security.

(U) Because of the numerous relevant perspectives that came forth from this Mixed Reality session of the DNI Summer Hard Problem program (SHARP), a decision was made to capture the ideas of the session in a collection of articles. Although unified by the theme of Mixed Reality, the individual articles also stand alone in offering a unique point of view on the topic. Some of these reports assume the appearance of a conventional assessment, while others use storytelling to convey special insights into the impact of Mixed Reality on human society, culture, national and global security in the present and in the not too distant future. Most importantly, this collection challenges the reader to participate in a continuing effort to understand and interpret the significance of

a rapidly moving phenomenon that portends inevitable change — with potential for both good and ill — but which the United States and Allied intelligence communities can ignore only at their peril.

(U) So, pull up your favorite interface device, sit back, and let's mix some realities!



SIDEBAR:

"OK, now help me relate to this Mixed Reality thing..."

(U) This will help to ground the discussion: In June-July 09, mobile, wireless technologies among populations in and outside Iran, combined with the functionality of the web-based Twitter microblogging software and Facebook social networking software, empowered individuals across international borders to share on-scene reports of the unrest in the aftermath of Iran's presidential election. This information sharing generated a Mixed Reality (MR) experience among participants inside and outside Iran as their collectively-enhanced, online-enabled awareness of activities inside Iran enabled them to take coordinated actions that challenged the legitimacy of the Iranian regime.

(U) This experience, popularly referred to in the press as a "Twitter Revolution,"⁶ represents just the nascent beginning of what MR is and how MR will dramatically change the human experience in societies worldwide.

MIXED REALITY: Geolocation & Portable Communication Devices

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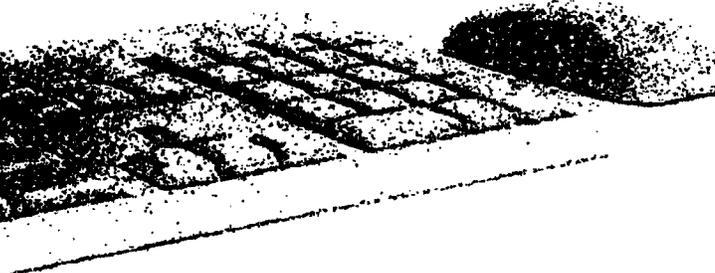
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(U) My Network is Smarter Than Your Analyst

(U) For the intelligence community to survive it will need to find ways to engage the larger internet community to help analyze and solve difficult challenges as our enemies become more and more fragmented. One method of doing this is to engage the collective community in a form of "crowdsourcing."

(U) In the current state of the intelligence community, experts are located in distinct '—INT' silos.⁷ Useful intelligence is sequestered into classification levels and compartments. Information classified to protect sources and methods is often available through emergent open sources. These classification firewalls are creating stagnant pools of information which, at the end of the day are only as useful as the collective intelligence of the few who see it.



(U) On the Internet, new enablers such as open Application Programming Interfaces (APIs), collaborative tools such as Wikipedia, and communication protocols like Twitter create a broader network of social connections and combined interests that result in a new face of human intelligence. This open-source, crowd-sourced intelligence, or 'CROWDINT,' enabled by millions of participants around the world, represents an information filtering and processing capability potentially far better than experts in silos. More and more people are processing and "mashing up" information in their spare time for various motivations, but ultimately the combined effort could exceed the capability and reliability of any closed community.

(U) What is Crowdsourcing?

(U) The term "crowdsourcing" is the bringing together of the user and the producer to create newer and better results. The term has come to describe the practice of giving a wide group of people the opportunity to provide innovative, user-driven ideas or products, and driving them into production, often with the support of a larger company.⁸ Jeff Howe, author of the bestselling book, "Crowdsourcing: Why the Power of the Crowd is Driving the Future of Business," defines the term as "the transition from professional production to community production."⁹

(U) According to Howe, crowdsourcing is leveraging 'spare cycles,' or what author Clay Shirky calls "cognitive surplus." The same way SETI@home taps spare cycles on people's computers to search for extraterrestrial life, crowdsourcing projects are leveraging people's spare cycles.¹⁰

(U) Crowdsourcing is not a new concept. In 1714, the British government offered a prize of 20,000 pounds to anyone who could come up with a method to determine a ship's longitude at sea. Thousands tried, but the money went to John Harrison, an English clockmaker, rather than a scientist or seaman.¹¹ In effect, crowdsourcing is an attempt to find the clockmakers to solve problems, not by using experts in silos.

(U) Crowdsourcing is quite complex. Open competitions such as the Netflix Prize, the X Prize, and the Google Challenge are relatively highly qualified competitions. Perhaps the challenge for business owners is that while today don't yet harness the ability of our massive, diverse crowd to do collective work.

(U) Enablers of Crowdsourcing

(U) Today, crowdsourcing is enabled by a number of internet-based tools, including social networks, sharing networks, and commercial networks. Even a legal framework, Creative Commons Licensing, establishes ownership of ideas and other intellectual property and outlines rules for sharing those ideas. The underlying protocol structures of the Internet like TCP/IP are designed to facilitate open sharing of data on all levels.

Social Networks — Facebook, Twitter, LinkedIn, Loopt
 Sharing Networks — Flickr, YouTube, Yelp
 Commercial Networks — Amazon's Mechanical Turk
 Creative Commons Licensing

(U) Examples of Crowdsourcing

(U) In an attempt to find Steve Fossett after his plane disappeared over the Nevada desert in September, 2007, over 50,000 people participated in an online search and rescue attempt using Google Maps and Amazon's Mechanical Turk. Although they were unable to locate the aircraft, the community discovered six previously unknown aircraft crash sites and covered a 10,000-square mile search area at least once.¹²

(U) Netflix, the world's largest online movie rental service spanning 100,000 DVD titles, launched an open competition inviting users to find ways to improve their existing movie recommendation rating system Cinematch — a service that analyzes the movie-viewing habits of the company's 8.7 million users and

recommends other titles they might enjoy. In 2008, over 35,000 user teams from 180 countries participated, and the company awarded a second annual progress prize of \$50,000 to a team with a 9.44% improvement.¹³

(U) When 22 senators started working over the first health care overhaul bill on June 17, 2009, NPR's photographer took photos of the 200 attendees during the Senate committee meeting. When it turned out to be difficult to identify the lobbyists in the crowd, journalists engaged the NPR audience to help. The response from the community was enthusiastic, and useful information was provided to the journalists, some from high-level Hill staffers, and even from other lobbyists.¹⁴

(U) Ushahidi, Swahili for "testimony," is free web software to which eyewitnesses of war and crisis in out-of-reach places can send news by e-mail or mobile text messages and have it attached to a Google map. Ushahidi grew out of a citizen journalism effort that Ory Okolloh, a native of Kenya, helped lead during the post-

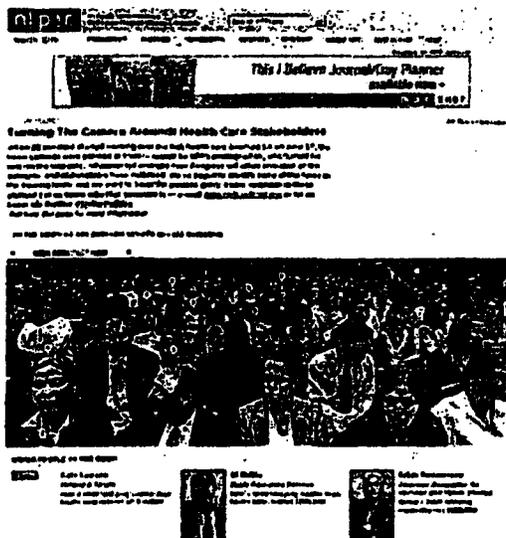
election violence in Kenya in late 2007 and early 2008. The software has been deployed in South Africa to help gather stories of xenophobic attacks in May and is now in use in the Congo and other regions.¹⁵

(U) Gwap, which stands for "Games With a Purpose," is a web site with several games designed to help computers with tasks they can't do automatically. For example, ESP is a game in which opposing players are shown a picture and try to guess what words the other player will use to describe the image. The aim of the game is to help improve image searches on the Internet by creating descriptions of un-captioned images. ESP has been licensed by Google as Google Image Labeler.¹⁶

(U) Crowdsourcing Scientific Problems is Gaining Momentum:¹⁷

- People for the Ethical Treatment of Animals (PETA) is using crowdsourcing to find a way to create artificial meat.¹⁸
- Howard Hughes Medical Institute and the University of Washington target computer gamers to find the optimal solution for in silico protein folding problems using a computer game called "Foldit."¹⁹
- The X Prize Foundation has issued a Lunar Lander Challenge with Northrop Grumman.²⁰
- Even the National Research Council has recommended that the National Science Foundation provide funding inducements to crowdsource scientific innovation.²¹

(U) In 2007, a study was conducted by a group from the Massachusetts Institute of Technology, partnering with Innocentive, to examine the efficacy of crowdsourcing for solving scientific problems. They followed 166 discrete scientific problems from 26 different firms, and sourced solutions from a diverse group of over 80,000 scientists from more than 150 countries. The study found that 29.5% of problems that had remained unsolved at the various firms were solved through crowdsourcing. Furthermore, in assessing the probability of any person to



MIXED REALITY: Geolocation & Portable Communication Devices

become a successful solver, the researchers found that "the further the focal problem was from the solvers' field of expertise, the more likely they were to solve it."^{22,23}

(U) The concept of crowdsourcing is not entirely new for Government. In October 2008, the CTO of Washington D.C., Vivek Kundra (current Federal Chief Information Officer), led an initiative known as "Apps for Democracy". Apps for Democracy created a contest to crowdsource the creation of applications utilizing public data. The project yielded 47 web, iPhone, and Facebook apps in 30 days for a total cost of \$50,000 and estimates that the contest delivered \$2,300,000 in value to the city.²⁴ According to an article in the Washington

Post, "Kundra has introduced popular consumer tools to bureaucratic processes, runs his office like a tech start-up and works by the mantra that citizens are 'co-creators rather than subjects.'"²⁵

(U) Motivating the Crowd

(U) As the size of the task increases, so do the financial incentives. Even when there is little or no financial benefit to completing a task, the person may still process the task because it is quick, relatively easy, fun and/or the "right" thing to do.

There is no need to provide a financial incentive for a task that is considered as contributing for the common good. In fact, this can be

SIDEBAR:

Mechanical Turk

(U) Via Mechanical Turk, Amazon has established a marketplace where firms — known online as requesters — can post tasks that they want crowdsourced. A vast pool of about 200,000 ready and willing people (called 'turkers') look to these 'human intelligence tasks' (HITS) to make small amounts of money — say 10 cents apiece. Amazon collects a percentage from each transaction.²⁶

(U) The name Mechanical Turk refers to a chess-playing machine in the 18th century that turned out to be a trick using a hidden human.²⁷

(U) A typical task posted by a requester at Mechanical Turk is something that's hard for computers to do, but easy for humans to complete in a few minutes. Often these are image-related tasks. For example, current automatic scanning and computing technology can't accurately distinguish between a baby's flesh and pornographic skin tones.²⁸

(U) Other sites using crowdsourcing have put out calls for information and photos about events, or answers to vexing questions. Mechanical Turk is the best known among those that pay for online tasks.²⁹

(U) Given where this industry is today, income doesn't seem to be a prime motivator. Studies found that most people use the site casually, not as a full-time job. Average earnings are about \$2 to \$5 a week; but, some people earn \$50 to \$100 or more. A typical hourly wage can range from \$1 to about \$3.³⁰

(U) The experience's entertainment value may be part of what makes people willing to work for less. Chris Van Pelt of San Francisco-based Dolores Labs said he believes potential turkers are attracted because the HITS have a lower level of responsibility and time commitment, allowing people to start and stop when they want, even allowing for HIT work to be done while doing other things in the background.³¹

a disincentive for the crowd. Tasks for the common good include political transparency for sites using Ushahidi, scanning satellite imagery in the search for Steve Fossett, and revealing false information on controversial news.³²

Small tasks completed as games can also motivate users to complete usually mundane tasks. Sites, like Rmbr.com for example, create a game around tagging photos, a task that is better handled by humans. Users feel rewarded with both high scores and virtual currency; thus, social elements are at work here to stimulate and sustain crowdsourced efforts.

(U) Trends

(U) The data are only as good as the size of your network. Some government agencies will not have the critical mass to make crowdsourcing effective when restricting the crowd inside their agencies. Instead, they will be forced to open significant portions of their mindshare to the IC collective inside a certain classification level, and will embrace crowdsourcing outside of that classification via the social networks of individuals.

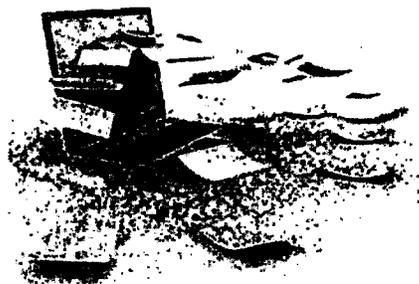
Mobile applications will increase the speed of crowdsourcing since access to the crowd will be immediate, not dependent upon a non-moving access point.

There will be increasing ways to physically mobilize crowds due to location-sharing technologies, whether to passively monitor or act in the physical world.

More communities will achieve a critical mass required to create timely and accurate information about a topic of interest, though communities will cross-pollinate through social networks and communities of competing opinions and micro-niches.

Crowdsourcing will start with the most provocative ideas and slowly trickle down to the "long tail" of topics as smaller interest groups achieve critical mass.

(U) Who Looked at My Data?



(U) The line between data sourced by the crowd or processed by computers will continue to blur. More scandals like SpinVox (see below) will occur as applications and systems include a human component.

(U) Since tools like Mechanical Turk compartmentalize tasks into HITs, the user completing the tasks doesn't know who or why the tasks are assigned to them. Government agencies are likely to use these tools both inside and outside their agencies to help process and filter the increasing amounts of data on the internet.

(U) The increasingly common habit of sharing what you're thinking (Twitter), what you're reading (StumbleUpon), your finances (Wesabe), and your everything (the Web) is becoming a foundation of our culture.³³

(U) More and more people will share their information to get something beneficial in return. For example, every public health care expert declared confidently that sharing was fine for photos, but no one would share their medical records. But PatientsLikeMe, where

patients pool results of treatments to better their own care, prove that collective action can trump both doctors and privacy scares.³⁴

(U) If you are interesting enough or generate enough value (either socially, in insight, etc.), whatever you create online will be mined and exposed. (Please see article entitled, "Privacy in Mixed Reality" for further provocative discussion.)

(U) Everything will be a Game

(U) The line between games and applications will blur as more applications are designed to work like games. More and more games will be designed to complete tasks by humans that are difficult for computers to do. Those playing the game will not know what the resulting data are used for and won't care.

(U) Game programmers will continue to leave their 'traditional' industry to create crowdsourcing games in the guise of casual gaming. Although the games are free to the user, the resulting work will be mined for useful data for both the government and private sector. Some veterans are leaving the industry and bringing their knowledge of game mechanics — which is really about how to keep someone interested for the next 10 seconds — to different industries.³⁵

(U) Aside from crowdsourcing, more and more application developers will apply game thinking to non-game applications. Newer generations will even expect gaming elements for mundane tasks like banking.

(U) Culture Changes

(U) Trust and credibility will be increasingly important as more tasks are completed with crowdsourcing. Reputation systems will be important to reduce fraudulent input from the

crowd, as well as ways for the crowd to self-validate. These reputation systems will improve as crowdsourcing becomes more popular.

(U) In the future, more crowdsourcing will be organic, caused by a catalyst and executed through a loose collection of connected tools and people. The catalyst, in the form of a provocative news article, blog post, or image, will provoke the network to compete for information to provide a better picture.

(U) 'Knowledge Wars' between differing belief systems may create a common ground and therefore a more accurate picture about various topics. However there may be negative consequences when one opinion can shout over the others.

(U) Individuals will crowdsource their own social graph — their connections of friends on sites like LinkedIn, Facebook and MySpace. Everyone will be a concierge service for each other — a symbiotic relationship to make all of our lives easier and more productive.

(U) Reputation systems for crowdsourcing will cross-pollinate between web sites and companies to provide a more detailed reputation for users. This will help to validate submissions by these reputable (or disreputable) users. This will also be used "within the walls" to evaluate worker performance.

(U) Crowdsourcing Intelligence — CROWDINT

(U) The intelligence community has a unique opportunity to engage the public to help filter and solve a multitude of difficult tasks. As brands, the various government agencies have the ability to mobilize their citizens to complete tasks for the common good. The wealth of a nation will be derived from its networked population, which will translate into that

nation's ability to mobilize intellectual property, information technology, and feet on the ground in its own interest.

(U) For example, consider a citizen-driven Presidential Daily Brief and its potential to enable truly democratic communication to the highest levels in the United States.

(U) Homeland Security missions could be served by crowdsourcing mundane tasks, such as remote monitoring of our borders with the assistance of web-cameras as part of a large scale "neighborhood watch" activity, as it were.

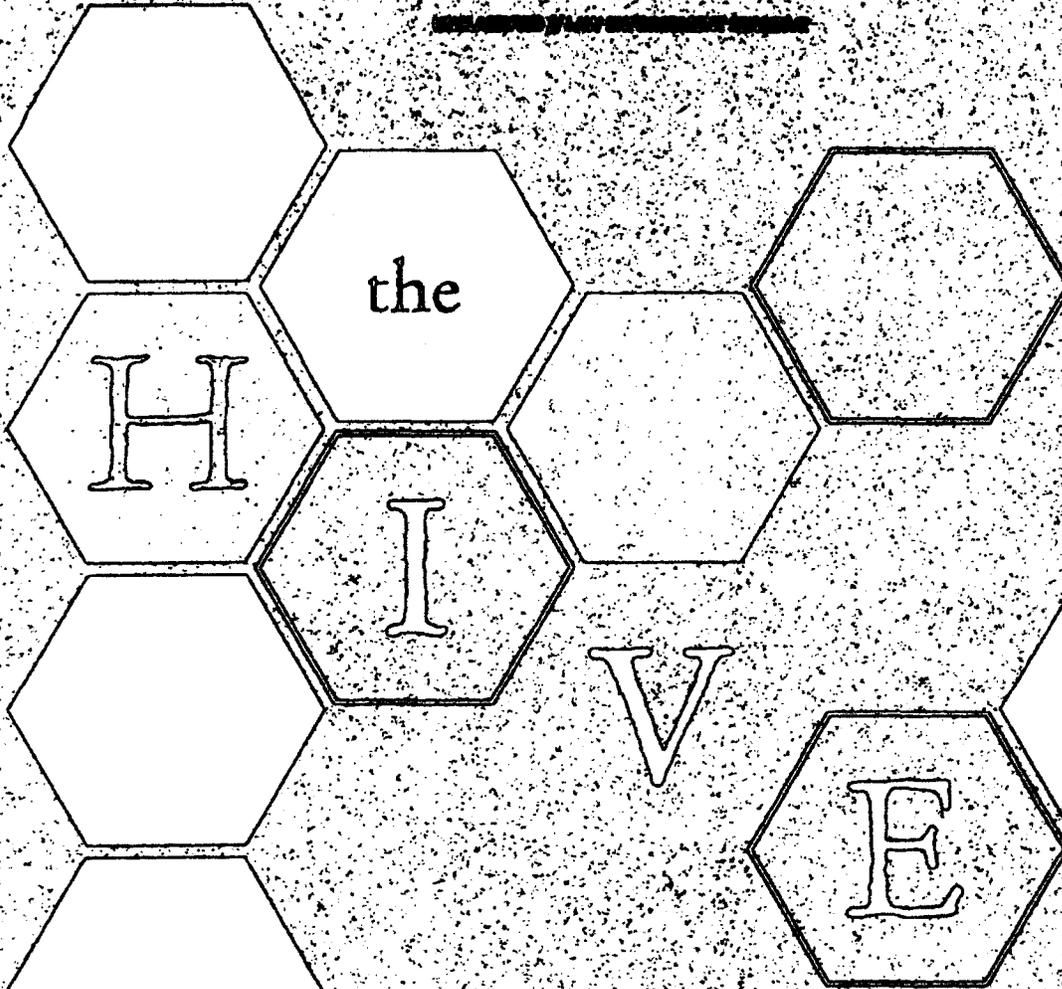
(U) Crowdsourcing Deception

(U) When large tasks are decomposed into small, compartmentalized tasks, the people completing them often are unaware who is asking for the data or understand its intended use. Additionally, Internet-based services might not be completed by computers even when the task seems nearly instantaneous.

(U) One example is the use of spammers to defeat CAPTCHA, a system that generates text in an image that is only recognizable for humans. Many free email tools use this system

to prevent software applications from creating email accounts for generating spam. Spammers have been able to defeat this by creating pornographic web sites that can only be viewed after entering the text displayed in CAPTCHA. The text image displayed on the porn pre-entry page is the same text image presented to create an account on another site.³⁶

(U) The biggest scandal involving crowdsourcing to date is at Spinvox, a company that provides voicemail transcription services, claiming that state-of-the-art speech recognition technology was the basis of its service.³⁷ Although Spinvox had always maintained that humans only played a minor role in converting voice messages into text, it was exposed in July 2009 that Spinvox had at least five call centers responsible for transcription services with over 8,000 human agents. In fact, some insiders indicated that less than 2% of messages were handled by automated translation services.³⁸



(U) Bottom Line

(U) Social networks in combination with MR technologies together present a way to collectively think and take action, what we are calling here a "Hive" effect, which present us and our adversaries with the opportunity to conduct potentially faster, more thorough, more effectively clandestine, and more deniable versions of the activities we perform today. Rapid adoption of networking technologies and services, via mobile devices which have rich interfaces and a multiplicity of sensors, has made it possible for the networked "Hive" to not only think collectively, but to move about in the world, manipulate objects, and see and hear anything, anywhere, and at any time. Thousands of pairs of eyes, and hands, can be put to purpose with rapidly decreasing need for notice or advance planning.³⁰

(U) This discussion is primarily concerned with the HIVE operating in the physical world (the HIVE Body, if you will), rather than processing information (the HIVE Mind), which is addressed in the previous section, "My Network Is Smarter than your Analyst."

(U) The Hive Gives the Intelligence Community New Operating Capabilities:

(U) A remotely directed Hive could perform collections in denied areas, as evidenced by Google's "MapMaker" collection of street level data on Pakistan in early 2009, for which Google did not have a license to acquire by officially sanctioned means.⁴⁰

(U) A Hive can take virtual action — and tantamount to kinetic action — even if the individual actions of each of its members are independently innocuous, as evidenced by the Iranian electrical grid overload protests. It is worth noting that this particular action appeared to be internal to Iran and grass-roots, but this kind of action could easily be directed externally. (See related sidebar, "Iran Electrical Grid Attack.")

(U) A Hive could be used to take deniable action as participants in alternate reality games, based on flash mobs' demonstrated willingness to participate in complex mass actions in the physical world with little or no qualification of their controllers.⁴¹

(U) A Hive can unwittingly be used to perform clandestine collection, as evidenced by Microsoft's Photosynth 3D models of various world landmarks assembled from photos taken by unassociated tourists.⁴² As mobile devices gain ever more sensor capabilities and MR interfaces become commonplace, it will be easier and easier to assemble highly detailed, multifaceted, and close to real-time pictures of intelligence targets.⁴³

(U) A key aspect of the Hive is the ability of parts to "hive off" — to temporarily (and sometimes permanently) split off from the main group to accomplish some task or goal. The Hive learns about the world and takes actions in the world through subgroups.⁴⁴ In this way it is very much like a set of terrorist cells. In tasking the Hive, it is important to take into account its strengths:

- The Hive is best at discrete or decomposable tasks
- The nature of Hive activity is not innately serial. Tasks can be done in parallel.
- Hive tasks can be addressed predominantly by generalists

(U) What is a Hive?

(U) An MR-connected, instrumented, and social networked human Hive can be compared to a hive of honey bees. In such a Hive community, ad hoc groups (or 'ad hococracies') of varying scale are created and dissolved on an as-needed, task-oriented basis. Each ad hococracy works within the community's doctrinal and communications framework, which allows members to contribute to the common good with a minimum of management.⁴⁵

(U) It has become commonplace to discuss the "Hive Mind," but a Hive is much more than just a "mind." The Hive has arms, legs, eyes, and ears, and this is of great importance to the Intelligence Community.⁴⁶

(U) The greatest strength of the Hive is that it is fundamentally a meritocracy. People motivated by altruism or social reputation contribute to solving a problem. The contributions are filtered and edited by others who have shared interests and expertise. Ad hococracies are often self directed and rarely stable. They also are small and task oriented because they are driven by niche interests. They can, however, be harnessed into larger communities. Wikipedia is an example of activity of a larger community.⁴⁷

(U) Pervasive data networks, attached to mobile devices with rich interfaces and multiple sensors, enable the Hive to take real-world collective action. Combined with social software, cloud resources, and mobile services, the effectiveness of hives can be multiplied.

(U) The first aspects of the "Hive Body" have been seen in recent phenomena as diverse as "Tweetups," the role of mobility and social software in the Iran election protests, flash mobs, alternate reality games, and crowd-sourced mapping of denied areas.⁴⁸

Tweetup: A coordinated action taken by a number of individuals involved in a common cause. The term was coined among users of Twitter, a globally popular micro blogging application.

(U) Why Hives Form

(U) Members of a Hive community choose to take part in task-specific, temporary sub-Hives for many reasons, but it generally boils down to their having something to gain: motivation to participate in a task-Hive tends to be for personal amusement, enhancement of one's reputation in the community, occasionally sheer altruism, and sometimes, money.⁴⁹ In the last case, money, task-Hives generally take on the form of contests or 'Mechanical Turks,' as discussed in the previous section, "My Network is Smarter than Your Analyst." In the world of online and online/offline communities, reputation has very real benefits in terms of professional opportunities, commerce (e.g. eBay), and entertainment.⁵⁰

(U) The most significant differences between a Hive and a team, company, club, or most other forms of social or productive organizations are that:

- Hives are composed, for the most part, of generalists.
- Members of Hives have a proclivity to connect with each other, and tend to connect most with other members who are adjacent (in network terms).

- Some Hive members will have some connection to non-adjacent members and with others outside their primary community.
- Hives are flat organizational structures, while other forms tend to be more hierarchical, particularly as they grow.
- Tasks are performed by self-selecting sub-teams that form and disband as needed.⁵¹

(U) Requirements for a Good, Strong Hive

(U) It is essential that a Hive be based on weak bonds or loose connections. If members all get to know each other well, strong bonds will form, and the community will take on the characteristics of what network theory describes as a *fully connected* or *clique network*. This kind of network tends to be self-reinforcing, exclusionary, and prone to group think. This is not good at solving novel problems, and not expansive by nature.⁵²

(U) A large enough community (at a minimum, 150 people — the maximum number of people a normal person is capable of remembering to a material degree⁵³) generally becomes a *scale-free network*. Scale-free networks are characterized by connections that appear to be random, but with some members acting as bridges or hubs, such that the network graph has sub networks.⁵⁴ Note that this presents opportunities for exploitation by both sinister and sincere parties.

(U) The importance of a community being of sufficient size to be scale-free is that its members will connect with other communities and draw in new members. They will form *loose bonds*, in network theory parlance, which causes networks to have a tendency to form and reform subnets based on changing conditions. Sizable scale-free networks tend toward democratic / adhocratic self-governance, and will have enough members to effectively form "hived off" task groups.⁵⁵

(U) How to Control a Hive

(U) You don't. Hives are by nature distributed. Instead, you can *influence* a hive, largely through constructively participating in it and/or setting the stage such that its community doctrine and interface influences the way it operates.⁵⁶

(U) A hived off 'task Hive' can be self-managed, take explicit direction from without, or take implicit direction by means of interface and design.⁵⁷

(U) Hives can often act faster than stable, hierarchical organizational structures, but a few factors determine just how fast a task Hive can form and take action. A prerequisite to task Hive formation is the existence of a community Hive: members must share common doctrine, and/or a common interface, and must have their interests and capabilities be known to, or easily discoverable by other members. If a community does not already exist, one must be formed, significantly lengthening the lead time for any action to be taken.⁵⁸

(U) Even if a community Hive already exists, the timeline from strategy formation through tactical planning to implementation is determined by the below listed factors, each of which can substitute for the others to some degree:

- (U) bandwidth
- (U) communications latency
- (U) interface richness
- (U) resource requirements

(U) **Bandwidth** is the main determinate of how complex instructions can be. Face to face, one-on-one communication, with appropriate visual and other sensory aids is extremely high bandwidth, and to the extent this can be replicated over a communications medium, physical proximity of Hive members prior to action is less necessary. Because in-person communication with large numbers of people

one-one-one cannot typically take place in the task's area of operations, and is necessarily serial, eliminating the necessity of this reduces the Hive's time to action.⁵⁹

(U) **Communications latency** determines how much pre-planning and rehearsal a Hive needs. If messages travel by carrier pigeon, real-time control and feedback is impossible and task Hive members must rehearse in advance, and have contingency actions prepared. If all members of the task Hive, and their remote controllers (if there are any) are connected in real-time with rich, MR sensing and communications **Interfaces**, then the members can be controlled with fine granularity in near real-time.⁶⁰

(U) Finally, if **resources** are required that task Hive members do not typically have on their persons, they will need to acquire them and bring them to the target area.⁶¹

(U) Real World Hive Examples

(U) Flash mobs have the appearance of spontaneity. However, for the most part, mobs with complex purposes require some degree of pre-planning and resource placement. In contrast, a simple flash mob can work with little or no pre-planning. For example, a flash mob that exists to take pictures of a location, or one which gets participants to say something or take some trivial physical action — like freezing in place — do not require much pre-planning. All they need is a sufficient number of members of a community to act out the task at that location and time.⁶²

(U) More complex flash mob actions, such as the San Francisco Pillow Fight⁶³ or the Antwerp Central Station Dance⁶⁴ require participants to bring resources to the 'area of operations,' or require rehearsals in advance. To the extent that community members have greater resources at hand and/or have higher bandwidth communications, the need for preplanning decreases. In a world of high bandwidth ubiquitous networking, geolocation,

MR interfaces, and ubiquitous/mobile sensors, the latency of flash mob-type actions decreases dramatically. Complex choreography and local sensor-based data acquisition can be directed in real time.⁶⁵

(U) Although flash mobs can be entertainment, the first flash mob-style attack on real world assets took place in the wake of the June 09 Iran presidential elections. As street protests became less and less practical, Iranian citizens took to means such as synchronized use of electrical appliances in order to overload the power grid.⁶⁶ Please see related sidebar.

(U) Hive operations do not need to be confined to single instance actions, and can be organized to undertake complex campaigns over extended periods of time, sometimes without the fully witting knowledge of participants. The best examples of these kinds of actions have occurred in crime and in alternate reality games.

(U) A small scale, but nevertheless instructive example of a crime that involved the unwitting participation of a Hive was an armored car robbery that took place on October 1, 2008 in Monroe, Washington. The perpetrator used Craig's List to recruit would-be road maintenance workers to come to a location near the scene of the planned crime, all dressed in hardhats, reflective vests, and dust masks. He robbed the armored car, dressed in the same outfit as his unwitting accomplices, and escaped in the confusion.⁶⁸

(U) A larger scale example of a Hive undertaking a complex action was the alternate reality game "Why So Serious?" that was run over 15 months, concluding in July 2008. This game was a promotional tool for the movie, The Dark Knight. Of note, ten million players participated in the game and took actions that included converging, in Joker disguise, on real locations across the world to commit mock crimes.⁷⁰ It is worth noting that the people who create and operate alternate reality games, by industry convention, are called "Puppet Masters."⁷¹

SIDEBAR:

**(U) Iranian Grid Attack
Protesters Coordinate Electrical Grid Attack in Iran**

(U) "Tuesday [July 21, 2009] thousands of disgruntled Tehranis tried to bring down the electrical grid at 9 p.m. by simultaneously turning on household appliances like irons, water heaters and toasters. Streets lights in the eastern suburb of Tehran Pars reportedly went off shortly after this, but electricity was not interrupted in central Tehran."⁶⁷

(U) This attack was coordinated while the Iranian government was shutting down mobile networks and even severing the internet connectivity for the country. And yet, as it is designed to do, the network routed around this "damage" enough to allow protesters to create a threat to the electrical grid.⁶⁸ Imagine what could be achieved with unfettered access to community coordination tools both online and via mobile devices — for both those seeking to create productive or destructive effects.

SIDEBAR:

(U) How Deeply the IC Can Embed Itself

(U) How deeply can the IC embed itself in MR communities while maintaining credibility and protecting national interests?

(U) Self-organizing networks operate on fluctuating, tacit rule sets — by cultural norms that evolve cohesively and in response to their environment. Mixed reality communities (like crowds and Hives previously discussed) are good examples of such networks, in which people may participate in a massive alternate reality game one moment, contribute to crowdsourced research efforts the next, and lead small-group restaurant coordination the next. By participating in all of these groups, each individual expresses a variety of roles, the rights, regulations, and restrictions of which are implicit, loosely joined, and subject to change.

(U) This is the nature of being human. It's no different from being expected to know how to act at your grandma's birthday party, at the bar with some friends, or in a meeting with your CEO. What this means for the IC is that it must find a way to allow its members to participate fluidly and flexibly with those groups that affect their interests, over the long term, and in a natural, comfortable way.

(U) The best possible way to do this is to retain staff who are either already participating in such groups or regularly participate in similar groups. Attempting to integrate an individual into a new culture group is unlikely to occur in an hour's time — learning the unspoken rules, vocabulary, and behaviors takes an extensive period of time. Those tacit norms are the group's self-defense mechanism against unwelcome intruders.

(U) The other critical element is for the IC to make sure its members are up-to-date and participating in new mediums and new technologically-abetted social structures — as they occur. By being at the forefront of these emerging technologies (and by making this status an IC norm), IC members are empowered to take action in the IC's interest in a timely manner.

(U) Of course, this requires flexible thinking, independent analysis, and a healthy amount of trust in one's employees. But without such training, the IC will remain permanently understaffed, undereducated, and out-classed in its efforts to protect national interests. Only through engaging can one interact with MR communities: Acquire new information, understanding and perspective; and, share information and shape other's understanding and perspective.

MIXED REALITY: Geolocation & Portable Communication Devices

SIDE BAR:

(U) Crowdsourcing Residency

(U) "Tribewanted is a unique community tourism project that is simultaneously based on Vorovoro Island, Fiji and online."⁷² The project allows anyone to sign up to go to the island and help build up its infrastructure. In exchange, they get the opportunity to participate in a unique community and exchange ideas. This sort of culture exchange was previously limited to the well-heeled, who could travel internationally, or to the virtual world - but now playing citizen to a foreign nation is as easy as a mouseclick.⁷³

(U) In Tribewanted, members select a Chief every month. They then vote on the items to resolve that month. Based on an online community they build a method to govern themselves, and use the online/virtual world to affect real world impact. Over the last two years they have brought electricity, plumbing, sewer, a water reservoir, community and private housing, and WiFi networks to Vorovoro Island. They have leveraged skills in their online community to build this infrastructure from ground up. They have proved that micro-niche communities in the virtual are actionable special interest groups in the real.⁷⁴

SIDE BAR:

(U) PhotoFlyThrough

(U) All the photos on the internet create a fly-through of the world.

(U) Crowdsourcing and Hive concepts will come together with the aggregation of geo-tagged images, still photos, and video to create 3D virtualizations of any geographic space on earth. Microsoft's "Photosynth" is just the beginning of this.⁷⁵

(U) Bringing this capability to the mainstream consumer will present valuable rehearsal potential for improved scenario-based emergency responder training, civil-military operations preparation, and... realistic, geo-aware rehearsals for terrorists.

SIDE BAR:

(U) 4Chan vs. Scientology

(U) 4chan.org, a popular site for trivia from around the web, spawned an organization, Anonymous, to attack the Church of Scientology. Anonymous decided to protest the church's penchant for suing anyone who published negative commentary about the church. Once Anonymous launched its campaign, Scientology.com suffered distributed denial of service (DDoS) and Gigalorder attacks. Many Scientology call centers were called with the music of Rick Astley (called "Rickrolling"). Many Anonymous members also "mistakenly" ordered pizzas and taxis for Scientology staff. In other cases black pieces of paper were faxed to Scientology offices, a known exploit that forces a fax machine to print indefinitely.⁷⁶

(U) The Church of Scientology attempted to sue the source of the DDoS attacks, only to learn that they had mistaken the source of the attack. In retaliation for their legal attempts, more than 9,000 people dressed in Guy Fawkes masks protested in front of Scientology centers around the United States. Along the way, over 9,000 Scientology documents and videos were leaked to the Internet, including an incriminating video of Scientologist misbehavior. As a result of these protests, thousands of news articles, reports, and public statements were issued, almost universally strongly anti-Scientology.⁷⁷

(U) How Will MR Affect Societies WORLDWIDE?

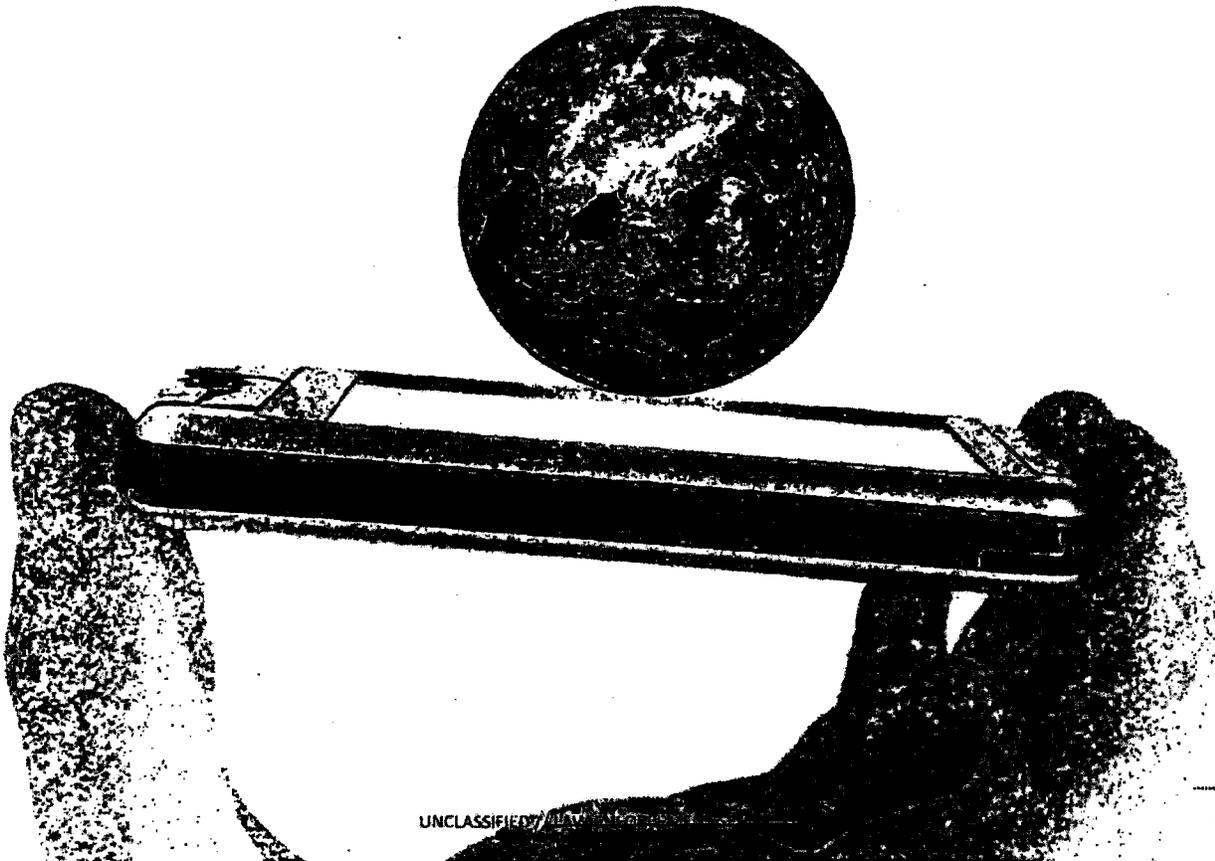
Key Points

(U) Society is changing. Society is changing technology. Technology is changing. Technology is changing society. Adapt, repeat.

(U) The increased sharing of individual personal time/space and human-to-human connection information — a major driver of mobile-accessible mixed reality (MR) — has brought about new privacy vulnerabilities.

(U) The capability to influence the perception of another via MR will affect current-day, cultural conventions of behavior, beliefs, personal relationships, and the concept of identity.

(U) As MR's impact on societies worldwide will vary from case to case, policymakers and analysts must be vigilant against mirror-imaging their perspective on MR onto other societies.



(U) The Mixing of Society and Technology**(U) Recommenders**

(U) Recommendation engines use variations of Bayesian statistical analysis known as collaborative filtering whereby similarities between user selections, playlists, and preferences can be deduced. Other systems supplement these activities with various forms of semantic analysis whereby textual metadata are analyzed for contextual similarity. The efficacy of these systems is constantly being tested and modified and depends upon the quality of the underlying metadata as well as the availability of user behavioral data.

SIDEBAR:

**(U) Digital Natives
Become the IC,
Customers and Partners**

(U) A key assumption about the operating environment of the IC in 2025 is that the digital natives who constitute the IC, its customers, and partners "will have a significantly different set of expectations of the IC."⁷⁹

(U) The evolution of tools that make content creation and sharing accessible to all users is enabling the internet to assume a more prominent role in society. With these changes in technology comes a concomitant evolution of participating societies. The internet, enhanced by technologies that make real-time feedback and participation possible, has now become an engine for social, economic, and political change.

(U) Mobile devices (e.g., iPhones, Blackberry, handheld GPS units, Nintendo DSi) that operate on WiFi, WiMax, and cell phone infrastructures enable users to take the internet with them in their pocket and allow persistent connectivity. Previously isolated regions are gaining connectivity as the supporting infrastructure expands. Applications running on these devices are rapidly providing new ways for humans to interact with information, the environment, and

each other at any time they wish. One of these is the microniche — a grouping of individuals sharing a common, usually very focused interest. These social structures are being enabled by the ability to find people holding similar interests and to communicate with them in real-time. These types of trends will result in significant challenges and changes to social norms.⁷⁸

(U) Users of these technologies can be classified as either digital natives or digital immigrants.⁸⁰ While not an exact match to a person's age, this classification has more to do with age (digital natives were born with access to these technologies) than is appropriate for describing the broad stratification of use across the mixed reality technologies.

(U) In contrast, stratifying society into six layers — outsiders, touchers, explorers, mashers, creators, hackers — based on the depth with which individuals interact with cyberspace provides a useful approach to analyze various potential ways that mixed reality will affect society. Additionally, because there are often a variety of reasons and motivations for the depth of engagement, there are additional implications for the adoption of mixed reality by a user based on that depth.⁸¹

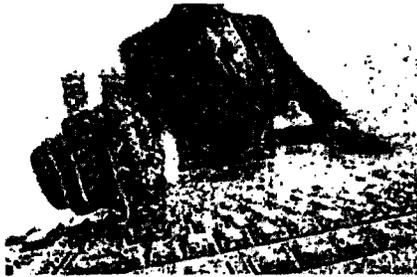
(U) Understanding Society's Stratification

(U) Outsiders

(U) Outsiders comprise those who do not touch the internet. By choice or due to lack of access, these individuals do not directly or actively participate in this part of the modern world. Depending on the reasons and motivations behind inclusion in this group, phone use also may be absent.⁶²

(U) Even in the future of a more ubiquitous mobilization of the internet, outsiders by choice likely will remain as outsiders, shunning new technologies as they have in the past. Outsiders eventually will be presented with the opportunity to move to another layer of interaction with cyberspace. Such a move will be the most challenging for these individuals as the move will encompass new technologies, new policies and laws, new communication channels, and new societal norms.⁶³

(U) Touchers



(U) Touchers have casual contact with the internet and interface technologies. They use email, can do simple browsing, and simple searches. Individuals at this depth are either reluctant to use the technology, unable to interface well with the technology, unwilling to learn, or too busy. This group uses a smart phone as just a telephone. The more advanced touchers are able to accomplish more technical tasks when provided with specific guidance.⁶⁴

(U) Many touchers are only touchers because they are unable to engage with the internet in ways that are intuitive or suitable for their needs. As mixed reality changes the complexion of the user experience, these touchers will be able to increase their depth of contact. Other touchers, especially those who are time-challenged, will find a variety of timesaving applications and devices, making it easier to become more engaged. Those who limit themselves to be touchers because they favor the human interaction afforded by physical reality may always remain touchers. Improvements in the sense of presence afforded by mixed reality may motivate their transition to increasing use of the technologies and movement into the next layer.⁶⁵

(U) Explorers

(U) Explorers, also described as "power users,"⁶⁶ do advanced online searches and rely on information they can locate to answer their questions. They make use of both web-based applications and smart phone applications. If they have need for an application to perform a task they will hunt for it. These individuals participate fully in the information sharing future of the internet, freely contributing data, observations, and opinions via a multitude of applications. Truly connected, explorers are eager to apply the new channels of communication to all aspects of their lives.⁶⁷

(U) Explorers will be excited by the new data streams that will become available through ubiquitous, persistent connectedness. These users will find themselves always apprised of things they are interested in — be it topics on which information is being published or people they are observing — and will contribute new information via their applications. The new interfaces provided by mixed reality will further encourage their exploration and have the potential to expand greatly the number and depth of the things they track. Deeper exploration of a wider variety of novel subjects

could allow users to make unintended discovery and innovation, a phenomenon popularized as the "Medici Effect" by Frans Johansson.⁸⁰ Advances in content-creation technologies will provide these individuals with new ways to interact with society.⁸⁰

SIDE BAR:

"Internet of Things"^{80,81}

(U) This term refers to the ability to encumber all objects with the ability to be an active node on the internet. Future opportunities and risks will arise as people develop ways in which these items can be controlled, located, and monitored.

The objects themselves could become monitors as well providing a potentially rich networked sensor array never before possible.

(U) Mashers

(U) Due to advances in information sharing software, a new category of users emerged recently. This group combines information in new, useful, and often unexpected ways. The result of their work is referred to as mash-ups.⁸² These users are much more opportunistic than goal-driven and prefer to utilize data that others produce and maintain.⁸³

(U) Mashers will benefit greatly from the explosion of information afforded by the persistent connectedness — both the variety and volume — that mixed reality applications will provide. This group is the future's wild card. It is difficult to predict what will be produced next by this group, as their focus is on providing novel views, usages, and insights from other data streams.⁸⁴

(U) Creators

(U) As creators and publishers of new content, this societal layer develops applications, web sites, and data stores. Their creations are the applications that explorers use to share content with their social network and mashers use to combine. Creators make information available to users and interfaces, often with a single purpose in mind. This group of users often looks for ways to make information easier to both find and use as well as to enhance the experience of the user — and to further the bottom line of

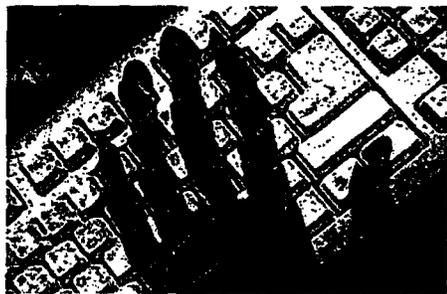
those who pay for the creator's products and expertise. This group encompasses many skill sets and often is divided by competencies.⁸⁵

(U) Mixed reality will provide new challenges to the creators in developing content. The access to data to personalize applications will be used (and misused) in a wide variety of ways, from customizing gameplay style to anticipating the need for information based on travel or interaction patterns. Micro-advertising is a commercial avenue that highlights the creative use of various aspects of the types of information these technologies will make available.⁸⁶ Creators will encounter considerable challenges as they develop and deploy new information visualization interfaces to feed users in all societal layers. Privacy issues will be forced to the forefront of these challenges as people struggle with determining what personal information should not be shared even though it provides a richer, MR experience.⁸⁷

SIDEBAR:

New Creators of Content

(U) All users of these technologies are creators of content, often unknowingly. Applications and web sites capture information about the activity of the user. Known as metadata, this information is collected, aggregated, and analyzed for usage statistics by third-party commercial entities. Today, privacy and anonymity while web browsing from a workstation are achievable, but not commonly available for smart phone applications.

(U) Hackers

(U) This category involves the deepest level of MR engagement. Hackers are users who redirect information for various reasons.⁹⁸ This can include misappropriation of data not meant to be widely shared, or collection of seemingly innocuous data that can be repurposed. The classification "hacker" is divided widely by skill and there is sub-categorization based on intent.⁹⁹

(U) The volume of information produced by the new mixed reality technologies will provide copious opportunities for hackers. Included in this information are unprecedented levels of personal data that often are recorded without the user's knowledge and stored in ways that circumvent US laws. This rich source of information will provide many opportunities for misappropriation and repurposing.¹⁰⁰

(U) One of the benefits of mixing realities is the alteration of the user's perception. This raises perplexing questions that shade the definition of the world in which hackers reside. If each user has a perception of reality that is personalized via mixing realities, the alteration of that perception constitutes a "hack." As with other hacks, the ability to change someone's perception of reality could be used to hide danger, obscure the identity of an individual committing a crime, cause a particular behavior, or even provide an experience not unlike a hallucinogen. Denial of access to information and services, a common method employed by hackers to cause impact, could become a much more serious crime as the immediate consequences will be more directly tied to the victim's hacked reality.¹⁰¹

(U) Coevolution

(U) The concept of coevolution is the influence of two systems on each other as each evolves. In our world, one system is technology, the other is society. As innovations and inventions are introduced into the technological system, the various strata of the social system will try to influence their use and adoption. Once the new technology becomes available, the societal need that drove the innovation is satisfied. Society, or one aspect of it, evolves and eventually generates new needs, which further drive evolution in technology. Innovations and inventions that are not adopted soon after introduction fail because they do not satisfy a societal need; put another way, the need they satisfy has not yet been articulated by any facet of society. Of note, the particulars of these society dynamics vary worldwide and from case to case.¹⁰²

(U) Historically, the evolution of technology has been driven by the evolving needs of various user communities. The pornography industry has driven the development of file sharing, web cameras (webcams), and security.¹⁰³ The gaming industry, and more recently Wall Street, have driven advancements in graphics resolution to provide richer environments and

illustrations. They also have demanded ever increasing processing speed to display these graphics more efficiently.¹⁰⁴ Society's increased demand for mixed reality applications will drive the development of a wide variety of human-computer interfaces that enable humans to interpret computer output through all of the senses and provide input to the computer through a variety of movements and contacts.¹⁰⁵ The desire to connect more intimately with other individuals and grow a social network will be the major driver of mixed reality technologies.¹⁰⁶

(U) Impacts

(U) Mixed reality can impact each of these strata of society in a different way, and can affect one group in multiple ways depending on the underlying intention of individuals in a particular group. Through the new technologies, especially those of interfaces, major changes will occur in the way individuals interact with each other and interact with information. The ubiquitous nature of mobile devices will impact everyone — even outsiders and touchers — in every aspect of their lives.

(U) Relationships

(U) One currently emerging impact on society is the redefinition of personal relationships. The ability to follow friends at increasing levels of detail about their daily life can eliminate the need to meet and "catch up."¹⁰⁷ The improvements in interfaces that make encounters more realistic — with sound, sights, smells, and touch — make physical proximity less important.¹⁰⁸ Voyeurism will become an acceptable and even encouraged practice, at least to friends and relatives. Determining who else is watching might not be so easy. With the information and access available, it is hard to determine when cyber-voyeurism would become stalking.

(U) The group, or network, to which a person belongs provides them support, encouragement, and can be a source of information and advice. The persistent connectedness afforded by ubiquitous small scale digital devices changes

the way in which people engage these groups. The ability to simultaneously reach hundreds, thousands, or even millions of people and solicit their input is enabled by these technologies. Crowdsourcing — the practice of asking a question or posing a challenge to a large group of people for innovative solution — is becoming a powerful model for research and information finding. Other examples include Wikipedia (<http://www.wikipedia.org>) and Jove (<http://www.jove.com>). Social media such as Facebook (<http://www.facebook.com>), Twitter (<http://twitter.com>), Yammer (<http://www.yammer.com>), and IRC (<http://www.mirc.com>) are being used this way as well.¹⁰⁹

(U) Access, Power and Jobs

(U) There is a growing trend to move services to the internet. Many governmental agencies (e.g., Social Security Administration, <http://socialsecurity.gov>) and companies (e.g., GEICO, <http://www.geico.com>) now announce on their telephone greeting their web site and encourage its use instead of the phone. As government and commerce move to the internet and downsize their brick-and-mortar footprints, online access will have to be provided for all users. The ability to access the internet will become viewed as a right — something required to participate fully in society. Similarly, there will be a need for more electricity to power the various access devices and accessories. Skill sets for jobs will change too, and will undoubtedly require familiarity with technologies that will mix the realities of individuals.¹¹⁰ If comprehensive equitable access to the internet and various interface devices is not provided across populations, then it will become increasingly difficult for have-nots to compete in the job market.

(U) Economies and Education

(U) Historically, economic status has been a defining element of societal stratification.¹¹¹ The various mixed reality enabling devices likely will be available only to those who can afford them, hardening this stratification. The opportunity will then exist for various devices to become

status symbols. If they are readily detachable from one's person, it is likely that those devices also will become targets for real crimes such as theft. That the "have nots" prey on the "haves" has long been true in societies. This technology is not a solution for resolving economic disparity. The proliferation of a wide variety of devices likely will continue the economic stratification within each of the six user categories discussed above.

(U) The field of education is one of the early adopters of these technologies and has demonstrated the powerful application of persistent connectedness and immersive perception. Adoption of these technologies in education introduces a potential additional contributor to the direct impact of economic status on scholastic achievement.¹¹² If economic disparity governs access, the impact of these technologies to education could be disastrous. Yet, assuming access for all students, mixed reality could have a significant positive impact on education. There will be an increasing need to educate the classical mind — the logical, reasoning mind — and the creative mind. Education will not have to be so concerned with teaching "how," but will once again be able to turn to the more philosophical and artistic pursuits similar to that of the Renaissance.¹¹³

SIDE BAR:

(U) TECH301 Technology Bootcamp

(U) An immersion training that provides analysts with an immersive, hands-on experience with various enablers of mixed reality devices and applications. Designed to provide context to those incorporating mixed reality data in their analysis, experienced users of these technologies are encouraged to attend to understand the privacy and security issues these devices and applications can raise. Course can be repeated periodically as needed to stay abreast of upgrades, updates, and new developments. Contact instructor for more information.

- (U) Duration: 40 hours
- (U) Location: TBD
- (U) Dates: ... needed ASAP!

(U) Jobs that require the understanding of these technologies, such as information analysis, will have a necessary requirement to have experience with their use. The integration of the technologies into the mainstream of life provides a rich experience with the perspective required to fully analyze information obtained from them. Examination of such pervasive technologies will require this context and will not be adequate if done only in a laboratory.¹¹⁴

(U) Location

(U) Locative information is perhaps the most difficult aspect of mixed reality to come to grips with. On the one hand, being able to track and locate many things would be useful — products, family members, friends, known criminals, car keys, and so forth. On the other hand, many will see the broadcast of their physical location as a clear violation of their personal privacy. It may be possible with future technology to be

selective in who could receive your locative information but the ability to hide, or disguise one's location, may well become impossible.¹¹⁵

(U) As location-aware technology continues to be seamlessly integrated into devices, it will become an assumed part of the mixed reality. Location awareness will be perpetual and passive, requiring no action or permission by the user. While geo-location detection and position sharing currently requires user consent, the convenience and functionality of location will trump user privacy concerns. Users will eventually take for granted the sharing of their location. The sharing of one's location can pose physical risks to the individual, especially when combined with the stream of various activity records and other personal data. Today's cultural understanding of privacy is in the midst of redefinition. (Please see this product's persuasive article entitled "Privacy in MR.") Studies show that even anonymized location sharing reveals all, as analysts have been able to determine home/work addresses, business connections, political affiliations, even medical conditions by clustering anonymous GPS tracks — linking identity to location.¹¹⁶

(U) Privacy and Vulnerability

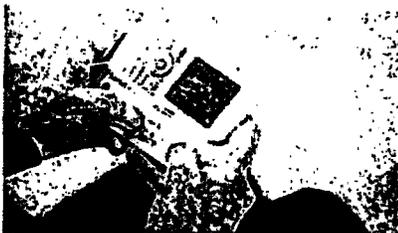
(U) The various users in the strata discussed above have widely varying views of privacy depending on their immersion level and experience. People who know, or have experienced, cyber stalking and other crimes of mixed reality, are much more likely to be as concerned with the sharing of personal information as those whose jobs make them aware of the personal information available through these technologies. User-driven modifications to the type of information that can be gathered and the uses to which it can be put are likely in the near future. These changing viewpoints, regulations, and laws will significantly impact the utility of these technologies to the intelligence community.¹¹⁷

(U) Memory and Perception

(U) Memories retained by humans are a result of an experience some time in the past. Development of memories is governed by the senses and the strength of a memory can be tightly correlated with the strength of the sensual input during the experience. Despite this, a memory is a perception of an experience. It is entirely possible to induce a memory based on a recounting of an experience without ever having the actual experience. Many early childhood memories are constructed by parents and relatives in this fashion, where the memory is not a result of actual experience but is a part of cultural conditioning.¹¹⁸

(U) In mixed reality, where perception can be altered, the ability to influence memory will be enhanced. Mixed reality will be able to supply not only the description of an experience, but stimulate the sensory inputs of the body as well. In this way, mixed reality technologies will affect the ability of the human mind to discern the real from the unreal. The ability to influence perception has significant consequences to society and law enforcement.¹¹⁹

(U) Identity in other than the physical world poses additional issues. In many of the emerging mixed realities, as in virtual world realities, the virtual component of the self is represented by an abstraction — an avatar. It is difficult to determine the real world identity behind an avatar. Extending the avatar concept to the ability to influence perception provides new avenues for obfuscation of identity that will be leveraged by various criminal and other nefarious actors. This will make the identification of perpetrators increasingly difficult. The means by which identity is determined in a mixed reality is vastly different from the means currently used in the physical world.¹²⁰

(U) Microniches

(U) Large scale social networks, social media sharing, and geographically-aware mobile computing, empower individuals to form both weak and strong group affiliations around special interests. These technologies are enabling the formation of these groups to form virtually as well as geographically to share interests, media, information and preferences. These affiliations encourage social bonding but also are dividing societies in an increasingly granular and often divisive manner. The wide array of social, mobile, and geo-referenced devices and applications these groups use to communicate make it easy to form quickly and organize for fun, education, political activism, as well as for criminal and terrorist-related activities.

(U) **Friends and Places.** Facebook has become the premiere social networking site with over 250 million profiles worldwide.¹²¹ Facebook opened its API (Application Programming Interface) to allow development of plug-in applications as well as simple methods to form online groups with minimal privacy settings. Many other social applications make use of the API, gaining access to the social network of a Facebook user. Users allow this type of invasion into their social network because it is convenient: they do not want to have to re-enter all of their contacts each time they adopt a new application. Some applications that use Facebook "friend" networks include www.loopt.com, www.foursquare.com, www.twitter.com, and www.heythere.com. Microniches can also form around geo-referenced data instead of a contact list. Geocaching (www.geocaching.com) is a special interest group that enables its

members to hide and discover hidden caches at geo-referenced positions in urban areas as well as remote locations worldwide.

(U) **Sharing and Recommending.** Individuals seek contact with others who share their taste in art, music, literature, and movies, along with common values that go to the core of an individual's identity (for example, religion). Various capabilities exist that enable this type of niche formation. Image sharing on the internet allows an individual to publish pictures to the world that formerly would have been only accessible to a select few. Music sharing, brought to general public awareness by Napster, is another source of social niche formation. iTunes allows the purchase of music files and supports user recommendations. Amazon (www.amazon.com) allows users to post lists of their favorite books and reviews and to register interest in the lists of others. YouTube (www.youtube.com) allows the sharing of user-created video clips and Friendster (www.friendster.com) allows niche formation around movie preferences. All of the media sharing sites provide a way for a user to comment on the works or contributions of another. This ability to communicate helps form the social bonding necessary to form a niche. Additional niches form around various games and entertainment enabled by these technologies.

(U) **Social Networking and Graphs.** Analogous to the bulletin boards of the early internet, a wide variety of social networking applications are available. Certain of them, such as LinkedIn (www.linkedin.com), serve a particular demographic which suggests, but does not restrict, the types of niches found within. These sites allow for extensive media sharing, social networking, and group formation. Other sites aggregate niche interests in a variety of hobbies touching every taste and interest. These sites encourage the recruitment of friends and associates to the same application. Many applications can display a visual representation of one's social network graph, and some provide

rewards to the members with the largest network of friends.

(U) Getting personally involved in geo-referenced social networks is much easier with the recent convention of instantly importing an existing contact (i.e., "friend") list from another source. This list is a social graph and brings individuals within it into the network. Most applications ask the user to approve the use of a particular contact list; however, some use an accessible list without asking. The ability of these applications

to then auto-invite your friends, on your behalf, to join you in the application accounts for some of the exponential growth seen in the user base.

(U) When considering participation in the social networks enabled by these technologies, it is essential that users understand what about themselves they reveal in their data. Merely by using the application, they implicitly agree to share their data. Many of these applications don't even offer the flimsy protection of an End User Licensing Agreement (EULA).

SIDEBAR:

(U) What's in Your App?

(U) There is an ongoing cost of joining in the persistent connectivity native to mixed reality: Your actions, communications, location, and movement over time will be recorded. Mobile, online device information — all time/date, and increasingly, location stamped — will be analyzed. And you may never know.

(U) In order to understand the impact of this information gathering, let's take a close look at a popular iPhone game, Parallel Kingdom. This game uses geolocation to move your in-game character to a point on the game map that corresponds to your physical location (via the iPhone's geolocation functions). The game board is Google Maps. The information that the Parallel Kingdom company has access to for each user includes:

- (U) Character name, character gender;
- (U) Date/time character created;
- (U) Email address, PK account password, phone number;
- (U) Contact list (made available to the application if you select Invite Friend);
- (U) Last login date/time, last logout date/time;
- (U) Time in game;
- (U) Character inventory;
- (U) Location in game (recorded each time the character moves);
- (U) Actual physical location (coordinates recorded each time you select Relocate);
- (U) Movement (date/time, method, permissions);
- (U) Chat logs;
- (U) Actions taken within game with date/time/location stamps;

(U) The only information the game needs to collect to support play is the character name, gender (for rendering the character), inventory, and current location in game (without the date/time stamp). The other information is collected for some unknown reason but on the surface seems to be rather innocuous. The game has a site on the internet (www.parallelkingdom.com) where some of the data is presented. Various graphs of movements are shown illustrating both continental and transcontinental movements of characters. While it is not displayed on the graph, data exist to establish whether travel was undertaken in the physical world or just in the game.

(U) Movement within the game is allowed by a random movement function, movement to an owned in-game property, permitted movement to another player's property, or by pressing the Relocate button. When taken in combination with other data gathered, such as chat logs, social networks can be constructed. Analysis over time of these data could reveal personal information such as travel patterns. This sort of information could be valuable to piecing together real identities.

(U) When considering participation in the social networks enabled by these technologies, it is essential that users understand what about themselves they reveal in their data. Merely by using the application, they implicitly agree to share their data. Many of these applications don't even offer the flimsy protection of an End User Licensing Agreement (EULA).

SIDEBAR:

(U) International Clashes of Culturer

(U) Given the rapid global growth and interconnectivity of mixed reality capabilities, culture-based clashes will arise. Long-standing assumptions regarding control and legitimacy (state authority, tribal allegiance, ethnic heritages, cultural norms, and/or religious doctrine) will be challenged as the nature and availability of mixed reality perceptions of alternatives are shaped by crowds. Some cultures may be structured to flex and adapt to the risky, ensuing chaos. There will be those who cannot. The inability to adapt will cause tension and discontent within the culture.

(U) For cultures that allow mixed reality capabilities to empower individuals and interest groups, the adaptability within those cultures could help them to collectively deal with and overcome grave societal problems such as ethnic strife, resource competition, and natural disasters. Leveraging the social networking real-time communication inherent with these capabilities could enable these cultures to collectively work through these types of threatening problems.

SIDE BAR:

(U) People Herding

(U) Authoritarian governments will eagerly seek to leverage the rich location data that is permeating the globe. Consider the potential for these governments to use mixed reality capabilities to "herd" selected individuals, groups or general populations to desired locations — either to shape their collective awareness or to achieve a specific desired effect under a guise, such as luring out dissidents and trapping them. Other national states also may seek to manipulate their respective populaces with these technologies in a variety of situations. Mixed reality capabilities will also empower resistance groups to varying degrees within authoritarian states — potentially turning the tables on those governments and herding population groups to believe and act upon an alternate definition of reality.

(U) Could we be seeing the initial manifestations of people herding in the mandate of the People's Republic of China to filter web search results provided to their population?

SIDE BAR:

(U) Social Nets and Conflicting Allegiances

(U) The richness of mixed reality-enabled experiences will join people to their social networks at a more immersive level. In many cases, these experiences will enable people to meet physiological needs of acceptance and understanding, along with believing they are contributing to the collective pursuit of the particular social net's self-identified worthwhile ideals.¹²²

(U) Parallels in understanding this dynamic may be drawn to the formation and sustainment of street gangs. Gang member identity is the core, defining element in a street gang member's life. Allegiance is to the gang — other allegiances (like those springing from state citizenship) are insignificant.¹²³

(U) Similarly, mixed reality-connectedness may enable the growth of social nets that engender a similar level of group mutual commitment and allegiance spanning across physical and virtual spaces. Just as street gangs mark physical borders of their influence and take hostile action against threats, future social nets could mark idea or value "borders" and marshal cross-medium action against threats. What happens when the state government intrudes on the idea/value borders of these future social nets?¹²⁴

(U) Further, given that geolocation is part of the foundation of mixed reality, and given the street gang metaphor, it seems likely that future social nets will not only seek to establish idea/value borders but also to associate those borders with physical borders. Mixed reality could help boost the growing influence of non-state actors (relative to state actors) that seek to hold tightly to both defining ideas/values and physical space (i.e., Lebanese Hizbollah). To what extent will these social nets lay claim to and defend sole ownership of virtual spaces?¹²⁵

(U) MR, COGNITION AND INFORMATION operations

(U) Key Judgments

(U) The permeation of Mixed Reality throughout societies worldwide will present game-changing opportunities for the Information Operations (IO) community. Getting ahead and staying ahead of this evolution is not an option — it is a necessity for US and allied national security.

(U) Mixed Reality will increase the influence that a social network has on the cognitive mindset of its members, which presents a targeting opportunity.

(U) Pinpointing identity will continue to be a challenge. Moreover, crowdsourcing offers another layer of plausible deniability.

(U) As Mixed Reality further merges the virtual and real worlds, there will be a greater spillover of cyberspace-based events into the real world, as illustrated in the 2008 Russia-Georgia conflict.



(U) Introduction

(U) The evolution and adoption of Mixed Reality that is transpiring throughout societies worldwide will have a seismic impact on IO that the US and its allies can ignore only at their peril.

(U) The information we consume shapes our perception of the world. Our information environment has expanded from traditional news and media outlets to encompass decentralized social networks (both real and virtual), blogs, email, text messaging, entertainment, and aggregated news sources online and in print. Information has changed from static to experiential; it is becoming personalized, unique to the individual and accessible anywhere at anytime.

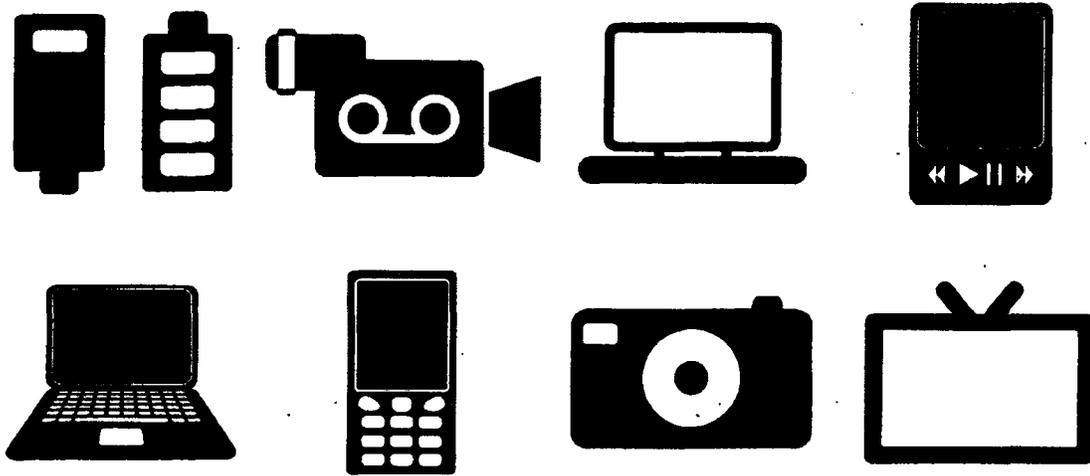
(U) Mixed Reality is creating a rapidly expanding, target-rich environment for a new order of Information Operations against unaware targets. The information environment consists of three dimensions: physical connectivity, informational content, and human cognition 1. Mixed Reality capabilities are active in and spreading through all dimensions of the information environment. At any moment, location-aware mobile applications exchange real-time, precision-tailored, crowdsourced information responding to a given user's decision (i.e., cognitive) needs.

(U) This spreading phenomenon presents both powerful influence opportunities for the IO community and debilitating vulnerabilities for their unaware targets. As a community, we must understand the opportunities and vulnerabilities of how mixed reality is affecting the information environment. If we do not address the implications, we risk falling behind and becoming targets.

(U) The Evolving Information Environment

(U) Mobile devices are becoming an increasingly popular method for accessing information and social networks on the internet, resulting in a more dynamic, intense, and personal interaction between the user and the information. Mixed Reality strengthens social networks by enabling continuous, seamless information exchange across physical and virtual spaces. Over time, the influence on the cognitive mindset of members of stronger, trusted social networks is going to increase.

- (U) Figure 1 shows a cross section of the modern information environment, this includes:
- (U) Internet/Intranet — Information and news from all sources, video, audio, both accessible on public and private networks.
- (U) Social-Networks — The technology that exists on the internet to facilitate social networking, as well as the information and ideas that flow freely between people.
- (U) Media — Includes the large corporate-owned conventional broadcast media forums to social media forums empowering the enthusiastic individual
- (U) Social Environment — The “reality” of the social network.



(U) Figure 1: The Modern Information Environment

(U) Mixed Reality technologies enable information from these sources to be closer in cognitive proximity to the user than traditional media delivery platforms. Smartphones, mobile computers, netbooks, surface computers, and remotely stored personal profiles ensure that the information presented is tailored to the user's preferences. In time, the sheer volume of both user-generated and auto-generated information available through these channels will likely create a significant, valuable "critical mass," enabling crowdsourced information to take on an even higher level of credibility than ever before.

(U) Understanding the Audience

(U) To successfully conduct IO, we must know our audience and how it consumes information. Collecting market survey data on an audience facilitates understanding the types of devices that it is using and the services to which it subscribes. Technologies and services that are popular in one country or region may not be popular in another. Even as Internet access spreads to the developing world, there are distinct differences in behavior and the mode and quality of connectivity.

(U) The evolving information environment facilitates discussion, debate, and exchange of ideas between individuals on a global scale. More people have access to global information at any time and in any location, which enables them to become a part of an emerging group culture and remain updated, in real time, on events unfolding either down the street or across the globe. This environment is facilitating the establishment of self-organized, decentralized groups that share similar interests, regardless of the members' physical location. It is conceivable that these groups could challenge and compete with the influence of nation states [2].

(U) IO Opportunities and Challenges**(U) Shaping Operations**

(U) The uptake of these technologies presents new opportunities to shape the information environment in order to achieve strategic diplomatic and military agendas of the US and its Allies. Mixed Reality is enabling us to reach audiences differently, by targeting and interacting with their networks and the information they consume. To accomplish this, we must understand the audience and understand their network.

(U) In order to understand the audience, we must not only understand what information they consume, but we also must understand how they use and internalize that information to form their perception of reality. Knowing where the audience obtains information as well as how they interact with others in their network provides insight into what information sources and individuals they value and trust. We can also use the information they disseminate to provide insight into the audience's thought processes and biases. After we have gained insight into who the audience is, we must understand how the network works.

(U) Understanding the network involves understanding how information flows. Information introduced into a social network can proliferate as long as each user has social capital. Information from an unverified source on the traditional internet has far less weight than information that comes from a contact within one's own social network or "crowd." Mixed Reality technology can draw people deeper in the social network, creating advantages to actors who wish to influence specific groups and/or individuals.

(U) Researching the audience and the network is imperative to communicating messages that the network will trust and propagate. By gaining credibility and understanding the internal workings of the audience, IO operators can communicate messages that will have a deep and lasting impact on the audience.

(U) Case Study: Chinese Information Control

(U) Mixed Reality will give nation states and non-state actors another opportunity to control information. China, for example, already shapes information that is imported into and exported out of China through Internet access controls and gaming content restrictions.

(U) Currently, the Chinese government employs technological solutions to censor the Internet. This "Great Firewall of China" blocks objectionable content or content that is deemed a threat to the government such as pornography, violence, and political talk that challenges the Communist government. Blocked web sites include YouTube, Flickr, and Wikipedia.¹²⁸

(U) The blocking that the Chinese government employs to restrict Internet content is ambiguous and inconsistent, which leads to the population self-censoring their Internet use. If a site is blocked due to content, the user is not told the reason. Additionally, sites and content are not

blocked consistently. Some days a resident can reach all BBC News articles and other days they cannot. According to a Chinese software engineer interviewed by a reporter from *The Atlantic*, it is the unpredictability of the firewall that makes the censoring more effective. It forces the Chinese population to always be on guard because they do not know what the system is looking for on that day.¹²⁷

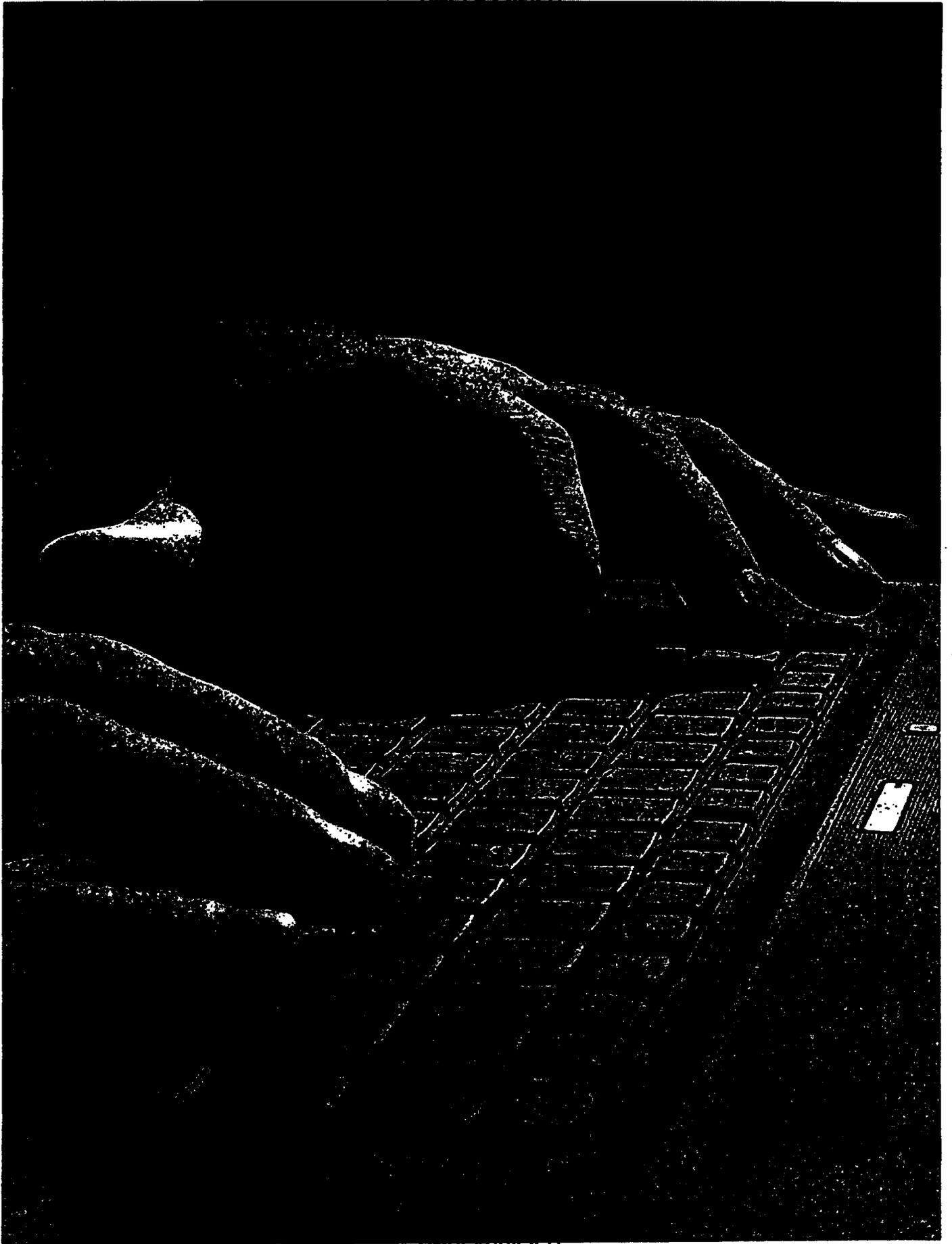
(U) Not only has China been able to control information flow through the use of technology, but also they have been able to enlist companies providing services to them. Yahoo and Google have both been criticized for supporting the Chinese government's Internet censoring. In 2005, Yahoo was accused of supplying information to China that led to the jailing of a journalist who was found guilty of sending foreign-based web sites the text of an internal Communist Party message.¹²⁸ Google, on the other hand, operates a separate web site, Google.cn, that it self-censors to satisfy Chinese restrictions.¹²⁹

(U) The Chinese government is also able to influence video gaming companies to alter gaming content in order to meet their standards. World of Warcraft, a massively multiplayer online role-playing game (MMORPG), developed by the American company Blizzard Entertainment, has 11.5 million players worldwide — 5 million of those players reside in China. In November 2008, Blizzard released an expansion that has not yet been released in China. Blizzard has failed twice to gain the Chinese government's approval on the expansion even though Blizzard has made software revisions in an effort to remove the unapproved content.¹³⁰ Neither Blizzard, nor the Chinese government, have released a description of the objectionable content.

(U) China is also involved in developing virtual world technology. Xu Hui developed HiPiHi, which has been described as the Chinese version of SecondLife. HiPiHi, however, models and reflects the Chinese culture: red banners drape the orientation area entrance, and "newbies" are encouraged to "build a harmonious world."¹³¹ HiPiHi, as part of its global strategy, is exploring the possibility of developing standards that would enable interoperability between it and other major 3D virtual worlds, such as SecondLife.¹³² If they successfully market and export HiPiHi, or if they are able to integrate it with SecondLife, HiPiHi developers will undoubtedly be able to export Chinese culture and ideals.¹³³

(U) Even with all of the censoring and restriction, most people in China feel freer than any other Chinese population in history. Perhaps that is a testament to how effective and clever a job the government is doing in expanding the discussion space for topics that do not threaten its survival.¹³⁴

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(U) CROWDSOURCING

(U) CROWDSOURCING DYNAMICS PROVIDE BOTH OPPORTUNITIES AND CHALLENGES TO IO.

"Help Israel Win"

(U) Crowdsourcing can be an effective manner to propagate a message. In December 2008 - January 2009, while Israeli Defense Forces were executing IO during the Israel-Hamas conflict in Gaza, a group of Israeli students banded together to form an ad hoc activist group named "Help Israel Win." The students developed a software program named "Patriot" that they used to conduct distributed denial of service (DDoS) attacks against pro-Hamas/anti-Israel web sites. One of the group's organizers stated that, "we couldn't join the real combat, so we decided to fight Hamas in the cyber arena."^{135,136,137}

(U) Crowdsourcing can, however, adversely affect how operations and deception operations are shaped. With every device and application becoming a sensor in the real world, all real world information is being stored in the virtual world. Consequently, hundreds of thousands of people can review and analyze this information. This heightened situational awareness is likely to empower the crowd to detect, assess, and reject a clumsy effort to seed information, defeating the purpose of the information operations.^{138,139}

(U) Sourcing witting or unwitting actors may appeal both to states and non-state actors who wish to remain detached from the execution of their stated goals in an effort to gain deniability while passively supporting and enjoying the strategic benefits of the sourced actions.¹⁴⁰

Estonia, May 2007

(U) One illustration of such activity is the events in Estonia. Despite the protests of Russia and ethnic Russians living in Estonia, Estonia removed the Bronze Soldier Soviet war memorial in Tallinn. Shortly thereafter, Estonia fell under a massive DDoS attack. Prior to the attack, hackers had already infiltrated computers around the world and installed malicious software on them. Attackers leveraged this giant botnet to flood target web sites belonging to the Estonian government, news organizations, banks, and

firms specializing in communications.¹⁴¹ In this attack, the computers forming the botnet became unwitting actors in the cyberattack.¹⁴²

(U) Estonia accused the Russian government of orchestrating the attacks; but, Tallinn was not able to substantiate that claim. Even though investigative teams found that several IP addresses contributing to the attack traced back to computers located within Russian state institutions, there was enough plausible

deniability that the investigators were not able to definitively attribute the attacks to the Russian government. Regardless, the hacktivists disrupted Estonian services and employed millions of unwitting participants' computers to conduct the attack.¹⁴³

(U) Incidentally, the only individual fined in connection with the attacks was a 20-year old Estonian man of Russian descent who confessed to attacking an Estonian political party web site. He claimed the attack was an act of protest against a political figure who had become a hated figure for Estonia's Russian minority.¹⁴⁴ Of note, this crowd-sourced cyberattack of Estonia servers demonstrated the elusive, difficult-to-attribute nature of such cyber activity.

(U) Cyberspace Remixed

(U) The more Mixed Reality permeates our society and converges the real and virtual worlds, the more people will become networked together. The numbers of devices connected to cyberspace will grow; yet, cyberspace will become more about the people interfacing with it.

(U) Currently, legal and IO communities are debating what defines a hostile act in cyberspace. In order to classify a hostile act, we must know the actor's identity and intent. Today, attribution is a difficult problem as those intending malicious attacks upon US Interests are taking necessary steps to conceal their identities.¹⁴⁵ Intent also is an important part of classifying a hostile act, but the mixed cyberspace and physical effects of a cyber attack may not tie strongly to the source's intent. Thus, determining intent and affixing it to a specific actor are elusive. With the proliferation of Mixed Reality technologies, our physical and virtual world identities will continue to merge, making discernment of attribution

and intent even more challenging. As we live more of our lives on the net, we will be expected to determine not only when a hostile act occurs, but also in what environment (physical or virtual) it occurs so that we can determine appropriate proportional responses.¹⁴⁶

(U) Cyber warfare can become a powerful course of action in the future as more of our lives in the real world are dependent on what happens in the virtual world. We are beginning to observe attacks in cyberspace supporting activities in the real world to achieve chilling effects. One recent example of such an attack occurred during the Russian-Georgia dispute over South Ossetia.¹⁴⁷

(U) The Russia-Georgia conflict in July-August 2008 demonstrated this mixed physical and cyberspace synergy. During the conflict, the



world witnessed a cyberattack against Georgia's online assets in coordination with Russian troops crossing into Georgia's disputed territory, South Ossetia.¹⁴⁸ The cyberspace-based attack against Georgian banking and communications infrastructure and key government web sites comprised web site defacement, web-based psychological operations, a propaganda campaign, and a DDoS attack. Georgia accused the Russian government of the cyberspace attacks, but Moscow denied any involvement.

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(U) The cyberspace attacks quickly spilled over into the real world. Cellular communications had been shut down. The attackers struck hard at Georgia's banking system; the financial sites could not distinguish the legitimate traffic from the fraudulent traffic. In an effort to mitigate the threat that the attacks would spill over into the global realm, major international banks shut down their online connection with Georgia. These service disruptions left Georgia isolated and silent, which was one of the principal aims of the cyberspace attacks.^{148, 150}

(U) This coordinated virtual and physical attack caught the attention of many in the United States and left them pondering the future of cyber warfare. Traditional news outlets, the blogosphere,^{151, 152, 153} and US politicians, including then Presidential candidates Barack Obama and John McCain,^{154, 155} all discussed this cyber warfare.

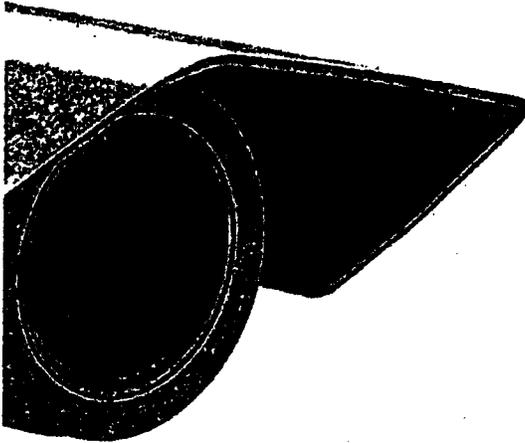
(U) The cyberspace attacks on Georgia helped expand people's perception that cyber warfare is more than just bots, rootkits, and malware. The permeation of Mixed Reality throughout societies worldwide will present game-changing opportunities for the IO community. Getting ahead and staying ahead of this evolution is not an option — it is a necessity for US and allied national security.

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(U) Editorial:

Privacy in Mixed Reality



(U) Privacy as we once knew it is dead. In the next few years, we will increasingly gather real-time data, including location, appearance, interests, relationships, speech, text, audio, and video on everyone, all the time. Our notions of privacy must adapt. The traditional concept of privacy is that government is regulated to ensure privacy. But this pales in comparison with the scope and extent of private data collection by corporate — and criminal — interests. The collection, sale, and use of private information by private parties have not been similarly regulated.¹⁵⁶

(U) Scenario: So, Sergei...

(U) So Sergei, how were you able to sell real-time location and activity information about hundreds of members of the United States Intelligence Community and their families completely legally?

(U) Do you know how many Smartphones there are in the US? 90 million. All of them support downloading and installing applications. So we hired anonymous, freelance developers via E-Lance.com to code a little app that lets people know where their friends and family members are. It also scrapes real-time location and contacts data from each phone — we know who our users are, who they know, where they've been, and where they're going. Every day. All the time. The best thing? Under the EULA, it's totally legit — and nobody reads those things. We thought we were going to catch a few celebrities, for instance sell Britney Spears' location to the paparazzi. But some guys I knew from the old days were a lot more interested in Blackberry users in Langley, Virginia. And the companies they visited. And their kids, and who they knew, what they were talking about and where they went when.

(U) Law regarding privacy governs the relationship between the government and citizenry. The highest technological risk to privacy is not government collection, but private industry failures that permit capture of collected data. This article therefore proceeds in the following sections:

- **Section 1** examines the different privacy regimes — public and private — that govern privacy under US law.
- **Section 2** discusses privacy under the private law regime: privacy policies, contracts, and End User License Agreements.
- **Section 3** discusses privacy under a public law regime, including the public law impact of geolocation tracking, reasonable expectations of privacy, and the impact of bulk data processing on the reputation of the United States and its citizenry.
- **Section 4** will demonstrate that while privacy cannot survive in its current form, it may change into something else, as represented by the practices and understandings of the new generations of digital natives.

I. The Death of Privacy

[Hiro]’s been putting together a lot more emphasis on his auxiliary emergency backup job: freelance stringer for the CIC, the Central Intelligence Corporation of Langley, Virginia.

Neal Stephenson, Snow Crash

(U) In the near future, intelligence gathering will necessarily move from being specifically targeted by governments to being ubiquitously applied by citizens. A blanket processing of the massive amounts of data collected by the populace about itself, for itself, to power services it demands, will be typical. Everyone

will collect information about everyone else, all the time, voluntarily, in order to facilitate finding their friends, documenting their daily lives, and sharing their interests. Cell phone cameras will increasingly capture nearly every event of human importance. Networks will have more and more localized information. This “hyper-localized” information will include information about where an individual’s friends are, about what they are interested in, and about who knows who else in any given context. Corporations will gather unprecedented amounts of data from their customers in order to advertise, market, and determine new viable business models.¹⁵⁷

The business is a simple one. Hiro gets information. It may be gossip... a fragment of a computer disk. It can even be a joke based on the latest highly publicized disaster.

Neal Stephenson, Snow Crash

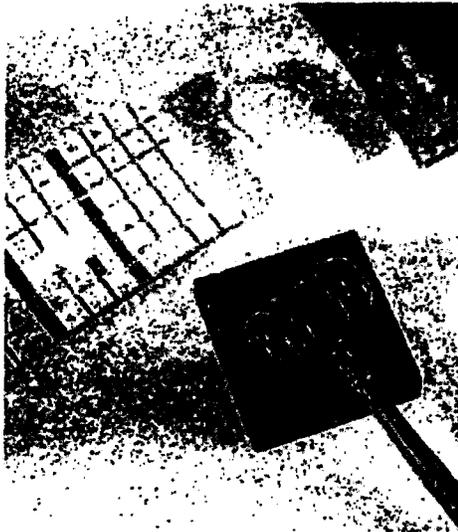
(U) Mixed reality will usher in this worldwide information overload and the IC will not be immune. In order to keep up, resources must move from information collection to information analysis. One way this can be done is to leverage the public analytic output in lieu of requiring that all analysis originate in the IC. A challenge for the IC will continue to be understanding publicly provided information, and integrating it usefully with secretly gathered information.¹⁵⁸

(U) Most future intelligence collection will be open source. The real world is unclassified and recorded. Theoretically, the global brain knows everything — that is recorded). This means that the relative weight of secret processing is reduced compared to the importance of understanding what the world knows. Mixed reality will only increase this trend, as objects become seamlessly linked to internet environments. **Knowing what we know will be more important than finding out what we don’t know.**¹⁵⁹

He uploads it to the CIC Database... Millions of other CIC stringers are uploading millions of other fragments at the same time.

Neal Stephenson, Snow Crash

(U) The bulk of this information will be obtained from private data collectors. Standards of probable cause or of appropriate targeting of US persons under FISA are generally understood to limit full-scale IC data mining. But the government can purchase in the private market information it could not itself collect — or, more importantly, it can encourage the cultural dissemination of information by the populace itself in support of US interests. An example would be government use of ChoicePoint, or cloaked purchases of commercially available databases.¹⁶⁰



(U) There are three currently accepted models of government access to private information. First, access pursuant to legal process: a search warrant, administrative subpoena, or national security letter. Second, access through outreach to companies, which may choose to voluntarily disclose data as permitted by the End User

License Agreements they have entered into with their users.

(U) Third, access through the purchase of data in a commercial database by the government, acting as a private entity.¹⁶¹

(U) A fourth (proposed) model may strike a legislative balance between privacy and need. In the past, institutions that stand at the crossroads of critical information technologies have been required by law to adopt specific standards for retention of records and access pursuant to legal process. This is a model European lawmakers have used with success. Europe has adopted a two-year retention requirement for internet service providers, to assist in law enforcement.¹⁶² However, this retention rule is set in the context of the European Data Privacy Directive, which radically limits what private companies can do with information they collect. This protects privacy, but limits the uses to which companies can put information.

(U) Conversely, American industry has adopted disposal policies, rather than use limitations, to protect privacy. For internet service providers, disposal after a set period is an industry custom that leaders (including Google) have self-adopted. For example; Google anonymizes search results after nine months.

(U) Law succeeds when it adopts well-tested rules. Thus, a retention law must be accompanied by a disposal law. Under proposed reform, companies would retain the records for law enforcement, but also would dispose of or completely anonymize them after the statutory period.¹⁶³

(U) Additionally, policymakers could profitably support formation of a national "Do Not Track" registry. The national Do Not Call list has been a popular success. It permits citizens to meaningfully exercise consent regarding targeted advertising over telephone lines. In theory, a national Do Not Track registry would

permit citizens to meaningfully opt out of pervasive and controversial location tracking. If citizens desire limited use of geolocation (for example, for mapping applications), the Do Not Track registry could require a scrubbing of the database after a set period of time (this also is modeled on the Do Not Call list requirements, in which telemarketers must periodically scrub databases).¹⁶⁴

(U) There are also non-legal solutions that educate the user. These include fostering development of consumer-grade free software that identifies for the novice what the Smartphone is doing; public advertising to advise Smartphone users of the risks of disclosing their location information; and development of standard summaries for contract terms, similar to product warnings, for Smartphone apps.

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated.
4th Amendment, US Constitution

II. In Google We Trust



(U) The Google EULA has greater implications for intelligence collection than the United States Constitution. Non-Disclosure Agreements (NDAs) trump the First Amendment. Permission to disclose data to the government trumps the

Fourth Amendment. Private actors gather the most information in US society, and private law contracts govern all of those transactions.¹⁶⁵

(U) The current legal paradigm for intelligence gathering is top-down. But most information is generated peer-to-peer, and most intelligence is created from the bottom-up. The Constitution, federal statutes, and executive orders restrict the government's ability to collect information concerning US persons. But this law is no longer usefully applied because peer-to-peer information gathering is governed by private law EULAs.

(U) Private corporations can and do gather any information that the end user agrees to in the EULA. Thus, private companies are gathering information on every aspect of US persons' lives. This presents a threat to national security, as terabytes of personal information become available to anyone willing to buy it or able to access it. (For example, foreign governments owning significant portions of top social networking sites, or organized crime targeting US corporate databases.)

When logged on to the CARS system, your computer is considered a Federal computer system and is the property of the US Government. Any or all uses of this system and all files may be intercepted, monitored, recorded, copied, audited, inspected, and disclosed to authorized CARS, DoT, and law enforcement personnel, as well as authorized officials of other agencies, both domestic and foreign.
Cash for Clunkers Dealers' EULA

(U) The privatized nature of information collection also presents an opportunity for US data collection. American corporations gather enormous world-wide databases on purchasing

patterns, preferences, search terms, physical locations, communities, networks, and interests. Under present law, this information often can be obtained with an administrative subpoena rather than a search warrant. Further, the information may almost always be voluntarily disclosed under the Stored Communications Act if a service provider has included in the contract a provision that permits them to do so — and all do in order to remain competitive.

III. Privacy and National Security

You give Google a perpetual, irrevocable, worldwide, royalty-free, and non-exclusive license to reproduce, adapt, modify, translate, publish, publicly perform, publicly display and distribute any Content which you submit, post or display on or through, the Services.

Initial Google EULA for Chrome Browser

(U) In the global market of ideas, privacy and freedom are core American values. But these principles are threatened by mixed reality. Our constitutional society secures rights against the government. It does not secure peer-to-peer rights or rights waived through obfuscated legal agreements. The right to privacy that applies against the government does not apply to neighbors, service providers, or search engine operators.¹⁶⁶

(U) The mixed reality future paints a seductive view of data linked not only to computers but to people, places, and things. US actors need to act with restraint to mitigate threats to the Constitutional order such that First and Fourth Amendment interests are adequately protected. This is not solely a matter of law, but of principle and ideals. Principles matter more in a Mixed Reality world because reputation is the primary currency of exchange for this technology.

Reputation Economics

(U) A reputation economy is a shift from money to insight as the currency of exchange. For a 14 year-old girl, twittering about her cat is a form of insight for her peer group — but that currency is not fungible to a group of corporate lawyers. Social networks depend on reputation economies to drive adoption, maintain cohesion, and produce value for their members. The currency of Facebook is friends' comments and their participation in each other's online lives. The currency of eBay is a seller's history. Reputational capital creates the ability to mobilize social networks on large and small scales. Those networks, once mobilized, actualize in the real world through Mixed Reality technologies.

SIDEBAR:

(U) Whuffie

Whuffie is the colloquial term for reputational currency. "[W]huffie recaptured the true essence of money: in the old days, if you were broke but respected, you wouldn't starve."

Cory Doctorow, *Down and Out in the Magic Kingdom*

(U) For example, Ashton Kutcher, a Hollywood actor and one of the most followed users on "Twitter," could inspire as many as 3,038,929 users to gather on short notice, through "tweetups" and social standing. This compares favorably to the 885,548 followers of the White House official account.¹⁶⁷

(U) The United States' reputation will increasingly become a directly monetizable asset. Twitter thought leaders can currently make or break markets — or political coups. The

Anonymous group within online radical free-speech coalition was able to quickly organize large groups of people in multiple countries and across multiple internet technologies to target Scientology. Application creators, social platform participants, and thought leaders will be able to mobilize significant populations very quickly, intentionally or otherwise.

The Moral High Ground

(U) The intelligence community has repeatedly identified the need to seize the moral high ground. IC recruits must feel that government service is worth the risk and lack of pay as compared to the private sector. Regular citizens with critical information must feel that reporting the information will be safe and beneficial to them personally.

"By measuring the thing that money really represented — your personal capital with your friends and neighbors — you more accurately gauged your success."

Cory Doctorow, Down and Out in the Magic Kingdom

(U) In a Mixed Reality future, trust will become a primary currency of exchange for the intelligence community. The effectiveness of an intelligence actor will depend largely on the network she can command — just as it is, increasingly, in the private sector.

(U) In order to leverage the moral advantage, the IC needs to celebrate moral exemplars. A culture of ethical behavior and morality can be bred using mixed reality technology by allowing those moral leaders to communicate and share knowledge quickly and transparently to large

numbers of IC employees, thus leading by example and reputational investment, and not by bureaucracy and autocracy.¹⁴⁸

(U) The effectiveness of the intelligence community in leveraging social networks and mixed reality will depend on the amount of goodwill that intelligence actors can organize, either overtly or covertly. Suppose that intelligence actors not only lurked in networks, but actively engaged such that they were able to generate on-the-spot, real-time information about locations anywhere in the world. Cell phone users in Pakistan, voters in Iran, rioters in China — and all may provide intelligence to US actors, if those US actors can command their trust.

(U) This combination of moral will and moral skill will allow the US to conduct more effective Information Operations in military theaters and elsewhere. Our ability to mobilize large numbers of people and affect their decision making process is limited primarily by our ability to influence their information environment — which is a social space. In the coming mixed reality world, that influence can only be effective through trust in the social network.¹⁴⁹

(U) Trust sells. Social networks can provide means to generate, organize, and mobilize that trust. However, the trust can only be generated by participation in and contribution to the groups. This requires a change of paradigm from clandestine information capture to participation in groups which then can be leveraged for valuable purposes.

Digital natives, also termed Millennials, have demonstrated different — not lesser — standards of privacy.

IV. The World After Privacy

This section analyzes what a reasonable expectation of privacy will look like in a Mixed Reality future. The first subpart addresses the current regime governing reasonable expectations of privacy as a constitutional law standard. The second section addresses shifting generational expectations of privacy.

Reasonable Expectations of Privacy in Mixed Reality

(U) The constitutional baseline is the Fourth Amendment standard governing reasonableness of searches and seizures. This analysis often becomes one of determining what is a *reasonable expectation of privacy*. This standard is both subjective and objective: it depends on what privacy citizens actually do expect, and on what privacy is actually available to them.¹⁷⁰

(U) Privacy analysis protects people, not places. The question is not if government actors can access the data, but whether they should, given the privacy interest at stake.¹⁷¹

(U) For cell phones, as for regular telephones, it is not dispositive that the data are routed through a third party. The Supreme Court has declined to create a broad "third party exception" for telephone technologies, recognizing that the value of telecommunications technology to a democratic society is sufficiently important to provide Fourth Amendment protection to telephone calls. Nevertheless, true business records disclosed to a third party may be subject to a case-by-case exception under the Fourth Amendment.¹⁷²

(U) Courts have already expressed concern that constant location tracking violates expectations of privacy. *Hidden, continuous, indiscriminate, and intrusive surveillance* is considered by all courts to raise red flags about the warrantless use of the technique.¹⁷³ Thus, electronic eavesdropping presents "inherent dangers" and requires more procedural protection than do everyday conventional searches.¹⁷⁴

(U) Therefore, a majority of courts have held that real-time tracking of people via their cell phones requires a warrant supported by probable cause.¹⁷⁵ Studies show that a wide majority of those polled do not desire or expect warrantless access to their location data.¹⁷⁶ A minority of courts have permitted real-time cell phone tracking without a warrant. However, the practice of permitting retention of historic CLSI (cell-site location information) logs with an administrative subpoena, on the standard of "relevance" rather than probable cause, remains widespread.¹⁷⁷



(U) This standard is in flux. A recent high-profile federal court decision extended the Fourth Amendment probable cause standard to historic as well as real-time geolocation data. The court voiced concerns that even historic location data would permit tracking of citizens as they go to church, abortion clinics, X-Rated movies, political gatherings, or other daily activities. Further, the court expressed concern over government claims that CSLI / GPS technology was not accurate enough to identify the person's location with precision. This argument is decreasingly accurate, given sub-meter GPS precision (see section on Law Enforcement).¹⁷⁸ However, other courts have disagreed, holding that cell phone location data are no different from other business records, and can be recovered without a warrant.¹⁷⁹

Changing Expectations in a Mixed Reality World

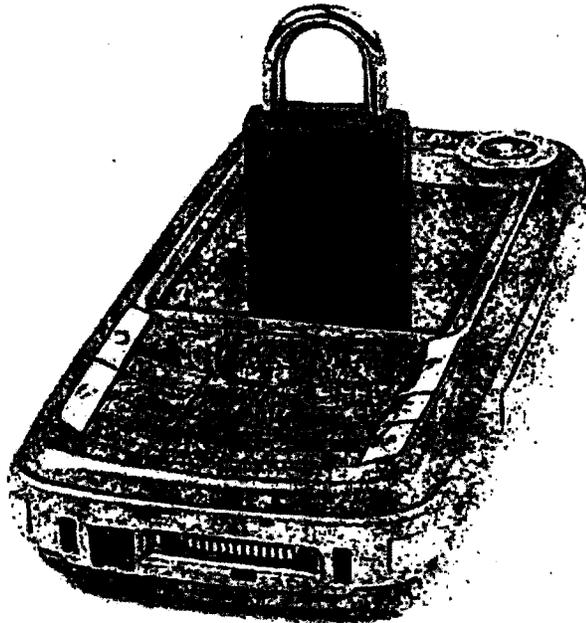
(U) Expectations have changed with culture. Generational, technological, and cultural shifts in privacy have resulted in a new approach to personal information.

(U) For Millennials, control is privacy and the expectations of privacy are measured by control. When you take control out of their hands, you have violated their privacy. Millennial expectations of privacy thus conflict with traditional law enforcement and intelligence community conceptions. Law enforcement and the IC understand private information as what is "offline," in the house, and public as being what is "out there," or online. A millennial expects information over which she exercises control to be private; and information over which she does not to be public.

(U) Privacy in the future will be arbitrated rather than absolute. Expectations of privacy will be a matter of Friends settings, not FISA. There is a very real risk that government actors will determine that all digitally available information is posted without an expectation of privacy.

(U) The standard account assumes that privacy vanishes as technology progresses. This is inaccurate. Historically, as privacy becomes technologically impracticable (due, for example, to overcrowding), social norms increase privacy to compensate.

(U) Following this trend, expectations of privacy will be different, not less. Privacy concerns will increase when mixed reality pushes internet tracking down into real space. Citizens who have been unconcerned at being tracked across the internet will react negatively to being tracked as they go about their real space lives. This phenomenon has been documented when, for example, the FTC blocked the merger of online marketer DoubleClick with offline companies that tracked real-world credit card purchase histories. This merger would have allowed online surfing and purchasing to be linked with real-world movements and buying decisions.



(U) Millennials are aware of privacy concerns; they merely come to different conclusions regarding the risk versus reward of posting information on different channels. The standard account is that digital natives are insufficiently mature to understand the downstream effects of behavior; for example, sexting (the intentional production and distribution of sexually explicit images of one's self via cell phone). Millennials do not have a lesser legal expectation of privacy, but they expect privacy less often and in different circumstances.

(U) Millennials craft rather than conceal. The privacy expectation of a Millennial is not in the decision to post content, but in the process of managing the message of the content. In order to be in the online world, inhabitants must participate. Because digital natives place a high value in participation in the culture, they manage risk (or attempt to), rather than avoid it altogether.

(U) Part of the brand identity that digital natives select is that they are older and more sexually experienced than they really are. Thus, the decision to post sexually explicit messages is not a determination that privacy does not matter, but rather a cost-benefit analysis applied to a social setting.

(U) With Mixed Reality, the home is back. Courts have generally tended to draw a hard line at the door to the home. Thus, warrantless cell phone tracking — even if permitted by courts — ought to be limited so as to automatically terminate at the door to the home. To do otherwise is to risk blanket invalidation on the grounds that the technology unconstitutionally penetrates spaces not open to public scrutiny.

Participation is not Optional

(U) Every day, people often join social networks only to find that their identities have already been usurped, and that misinformation about them is prevalent. Failure to participate generates negative social currency and creates a void to be filled by identity entrepreneurs. Politicians who do not join Twitter have their names "twitterjacked."

(U) Lack of participation will be more obvious than engagement. Social networks reject anonymized newcomers. People who "de-lurk," or come from nowhere, are assumed to have anonymized for a reason and thus will be ignored at best. Reputational currency requires historic participation in the reputation economy.

(U) IC actors must determine how to build reputation on social networks without compromising security.

(U) Interestingly, imposters often are embraced by social networks. There is a developing sense of online "fair use of identity." Popular social network personalities are often mocked and their identities adopted. This becomes even easier when the real entity or person has failed to engage a social network.

Evelyn's Story

Evelyn is a model, successful but new in her career. She delayed creating a Facebook page. When she finally began, she found 12 different pages discussing her, many in negative ways. Evelyn learned that the only way to manage her personal brand was to opt in, not opt out.

(U) This creates a void that entrepreneurs, intelligence community actors, or insurgents can exploit. Thus, privacy will increasingly be a matter of managing participation, rather than lurking, or restricting access to the technology.

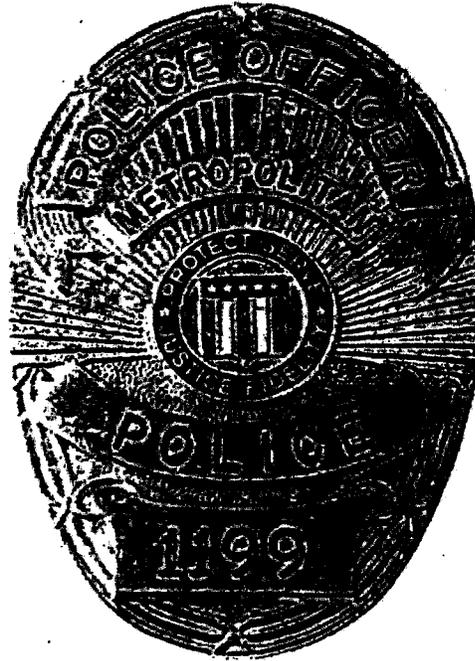
You Will Be Represented

(U) If you don't represent yourself, someone will represent you, and not necessarily in a positive way. Late joiners find that early adopters have already claimed their identity. For example, several high-profile politicians discovered that their names were being used on Twitter without their knowledge or consent. Although the social network rapidly detected the imposters, the social network was not able to ascertain the true identity of the intruder. The resulting conversation and publicity was very negative for the politicians.

(U) This is not unlike the practice of cybersquatting prevalent in the early days of the commercial internet. Then, entrepreneurs squatted on real-world companies' trademarks to leverage their reputation. Now, entrepreneurs are taking real-world identities to do the same. Establishing a personal brand is therefore a higher priority than hiding identities from social networks.

(U) LAW ENFORCEMENT ISSUES

BY CHARLES COHEN



The potential risks (and conversely, the potential rewards) for Law Enforcement (LE) related to Mixed Reality are comparable to those faced by LE with respect to DNA 15 years ago.

(U) Overview

(U) Mixed Reality (MR) devices and applications have fundamentally and irrevocably changed the LE environment. Upon widespread adoption, MR presents new risks and opportunities for the LE community. MR affords criminals the ability to communicate with one another, as well as coordinate

their activities in ways that the LE community is ill prepared to interdict. However, MR technologies — if widely adopted by criminal organizations — would increase the ability of properly trained and equipped LE elements to observe, surveil, and collect information on criminals legally.

Key Points

(U) Mixed Reality technology has fundamentally and irrevocably changed the Law Enforcement environment.

(U) As Mixed Reality technologies become increasingly ubiquitous, they will continue to act as a vector for a growing number of offenders seeking to exploit the chasms that exist in current Law Enforcement structures.

(U) The level of complexity of both the corporate organization, along with the organization of the physical infrastructure behind the companies developing Mixed Reality applications, places it beyond the investigative resources of almost all LE agencies in the United States.

(U//LES) [REDACTED]

(U) The current state of knowledge, at least among the LE community, is insufficient to address these issues in any meaningful way. In fact, the capability to conduct any significant forensic examinations on Small Scale Digital Devices falls outside the competence of most small to medium law agencies.

(U) Along with the challenges posed by Mixed Reality technologies to investigators, come helpful aspects for those trained to take advantage.

(U//LES) [REDACTED]

(U) The prevalence of images on the Internet and frequency with which those images are geo-tagged is another area of interest as it can aid in investigations and simultaneously identify clandestine Law Enforcement assets.

(U) The challenge presented here is not derived from a specific application or technology. Rather, the ability to use multiple technologies to produce superior results is our cause for concern. Currently, domestic and foreign criminal actors routinely use available technologies as vectors for their activities (to include those associated with entities wishing to do strategic harm to the United States and its interests, e.g., terrorists and/or non-state threat actors). It is therefore likely that MR technologies will be adapted for use by criminal elements.¹⁸⁰

(U) A Case Scenario

(U) The following scenario is a factual case in point use of MR by criminal entities between April 2008 and January of 2009.

(U//LES) [REDACTED]

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SHARP

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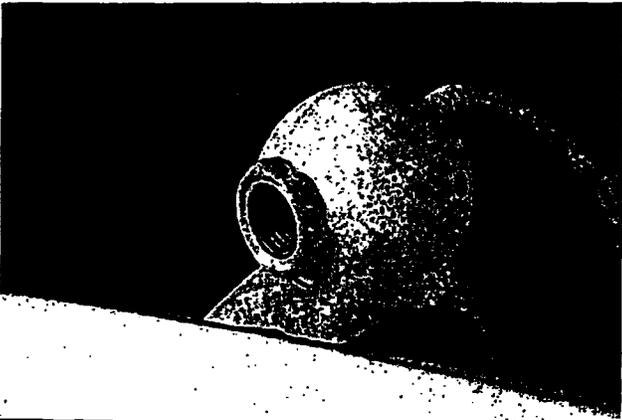
[REDACTED]

Web cameras. In this particular scenario, they described seeing someone in dark clothes and a ski-mask place an unknown item into a trash can, a fabrication.

(U//LES) [REDACTED]

(b)(7)(E)

(U) First, group members placed hoax bomb calls to universities throughout the US using a Voice over Internet Protocol (VoIP) service that, while owned by a US corporation, is incorporated in Luxembourg. VoIP combined with an Internet-based telephone number spoofing application hid their true location and identity from investigators. This telephone spoofing technology allows users to determine what number is displayed on a call recipient's caller identification screen. Therefore, when the hoax bomb threats were received by the universities, as well as on police Computer Aided Dispatch (CAD) systems, the number was recorded as (000) 000-0000.



(U//LES) [REDACTED]

(b)(7)(E)

[REDACTED]

[REDACTED]

(b)(7)(E)

(U//LES) [REDACTED]

(b)(7)(E)

(U//LES) [REDACTED]

(b)(7)(E)

MIXED REALITY: Govt & Portable Communi Devices

(b)(7)(E)

[REDACTED]

Additionally, cross-jurisdictional constraints result in acute challenges, especially when investigation-relevant information is sought from an MR service provider outside the United States.

(U) Criminal Tradecraft

(U) Skilled offenders regularly exploit the jurisdictional and functional gaps that exist between federal, state, local, and tribal LE communities (in addition to those of the military and LE communities). For example persons engaged in online fraud regularly exclude from the prospective victim pool those people living within the same jurisdiction. Many skilled offenders solely target persons living in different countries in order to further mitigate the risk of investigation and prosecution. As MR technologies become increasingly ubiquitous, they will continue act as a vector for a growing number of offenders seeking to exploit the chasms that exist in the current LE structure.¹⁸⁶

(U//LES) [REDACTED]

(b)(7)(E)

(U) Risk Vs. Reward

(U) Along with the challenges posed by MR technology to investigators come helpful aspects for those trained to take advantage. LE personnel wishing to exploit MR technologies for investigative purposes need to understand the myriad of available technologies and how to find information of evidentiary value. In order for investigators to be able to take advantage of the data that are produced by people who use MR technologies, they must be able to recover that data in a forensically sound and lawful manner.¹⁸⁷

(U//LES) [REDACTED]

(b)(7)(E)

(U) Many people now carry devices that are commonly described as "Smartphones". This description does not completely capture the essence of these devices because, in many instances, voice communication is incidental to their common use. A better descriptive term is **Small Scale Digital Devices (SSDD)** that also happen to have telephonic capabilities. The ubiquity of SSDD use, combined with the myriad types of data that passes through them

(U) This scenario illustrates that while a single MR technology may pose a specific risk to LE operations, the ability of criminal actors to use multiple technologies certainly does.

SHARP 2009

(and resides on them), make them ripe for LE investigative exploitation.¹⁸⁸

(U) Investigative Implications

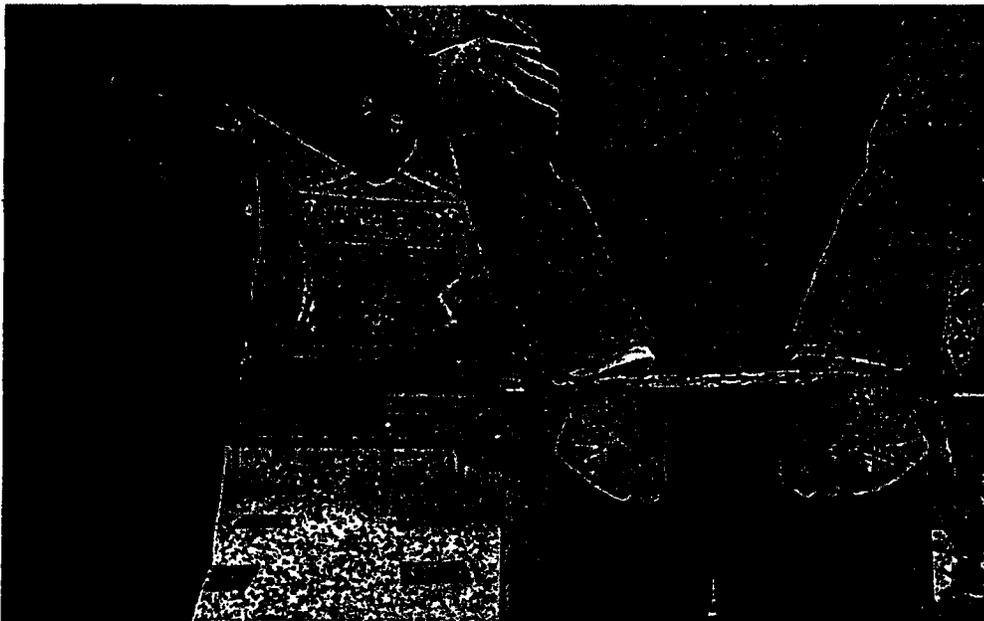
(U) From a LE perspective, a day can be imagined in the near future in which an individual's SSDD could play an integral part in a sexual assault investigation. Many SSDD's have sub-meter GPS capability, an accelerometer, an internal compass, and various applications that routinely ping mobile phone towers. Additionally, many applications loaded on SSDDs have the ability to capture data streams in the normal course of operation that is in addition to their expected function. Armed with this data (which resides on the SSDD itself or on a server) an investigator conceivably could recreate the whereabouts and actions of an individual in time and place.¹⁸⁹

(U) For example, the location of the device over time can be tracked and by extension, the location of the individual over time may be inferred (data are tied to the individual). Further, the internal accelerometer and compass allow the orientation of the device to not only be

determined (on three axes) but to be correlated to the location of the person who possesses the device as well. Together, these data can indicate the orientation of the suspect's body at various points in time. Finally, the accelerometer also can provide the relative motion information of the phone, and by extension, the suspect.

(U) Combined, these disparate pieces of information conceivably could reveal that the suspect was 1. at the location of the assault at the time of the assault; 2. that his body was horizontal at the time of the assault; 3. that the suspect was repeatedly moving back and forth along an axis within a specific range of motion while at a specific angle of incline relative to the earth. Additional information scraped from the internal memory of the SSDD and remote servers might show the true interests and activities of the suspect pre-, para-, and post-assault. Even the elevation of the suspect over time will be available.

(U) As this kind of forensic information moves into the courts, issues related to the "chain



of custody" are certain to be raised: Was the accused actually in possession of the device at the time the assault occurred? Other MR data may be used to resolve such questions: Was something specifically traceable to the accused, such as a posting on Facebook, made at a specific time from a specific location? Such nuances of MR and the law will be in play for years.

risk and exploit opportunities. The current state of knowledge, at least within the LE community, is insufficient to address these issues in any meaningful way. This should be expanded to consider what additional information could be collected that is not already being collected in order to anticipate future vulnerabilities and opportunities.¹⁹¹

(U//LES) [REDACTED]

(U) In addition to the risks associated with the collection of data acquired legitimately (i.e., services in which the user has knowingly participated), LE is tasked with investigating occurrences of information collection for nefarious purposes in clandestine ways (spyware). The diversity and volume of information that is collected via an SSDD makes it extremely lucrative for criminal organizations.

(b)(7)(E)

(U) One example of a product specifically designed to covertly collect from SSDDs is found at www.flexispy.com. This product is commercially available for between \$140.00 USD and \$355.00 USD per year, depending on the number of exploits in which one is interested and the specific SSDD model that is being exploited. Flexispy allows anyone with access to the targeted SSDD (for about fifteen minutes) to collect a myriad of MR-related information. Once installed on the device, it works unobtrusively in the background and is difficult to detect by the user. The application allows covert remote listening, remote control of the victim's phone via SMS, SMS and email logging, call history logging, geo-location tracking, call interception, and remote real-time GPS tracking. Even worse, as will be described below, the use of this application puts all information traveling through a victim's SSDD within the purview of the Syrian Arab Republic (which hosts some of Flexispy's servers). This product works on SSDD brands including Blackberry, Nokia, iPhone, and Win Mobile OS devices.¹⁹²

(U//LES) [REDACTED]

(b)(7)(E)

(U) Vulnerabilities (hardware)

(U) Many of the applications investigated at SHARP 2009 either capture, or have the ability to capture, large volumes of personal identifying, kinesthetic, and business information. An area that should be of immediate concern, to both the Intelligence and LE communities, is who creates these applications and what information they collect. The Intelligence and LE communities should proactively develop relationships with the creators of applications and SSDD hardware whenever and wherever possible. When mutually beneficial relationships are not feasible, it will be important to mitigate

(U) The low price point for the Flexispy application and the ease of its implementation, make it attractive for most criminal enterprises.

Conversely, it is outside the ability of most LE agencies within the US to identify the implementation of the application, much less attribute its installation to a criminal suspect in a forensically sound manner. In fact, the capability to conduct any significant forensic examinations on SSDDs falls outside the competence of most small to medium law agencies. Those agencies that do have the capability to engage SSDD forensics mostly lack the expertise and equipment to conduct examinations at a level of sophistication necessary for the investigation of this and similar applications. The three most common LE SSDD forensic tool providers (Cellebrite, Paraben, and Susteen) do not detect the existence of Flexispy.

in Switzerland, and the servers through which the data from a victim's SSDD travels to the criminal are located in the Syrian Arab Republic. The level of complexity, of both the corporate organization of the companies behind this application, and the technical organization of the infrastructure places it beyond the investigative resources of almost all LE agencies in the US.^{183,184,185,196,197}

(U) Vulnerabilities (Applications)

(U) SSDDs are not the only aspect of MR that represents a paradigm shift for the LE community. The prevalence of images on the Internet and frequency with which those images are geo-tagged is another area of interest. For point of reference, www.facebook.com



(U) If the presence of an application like Flexispy were to be detected by LE, the next challenge would be following the requisite legal processes to obtain the secondary and tertiary evidence necessary to prosecute the responsible party. Flexispy, Ltd. owns www.flexispy.com, which is incorporated in the Seychelles. Flexispy, Ltd. was spun off from Vervata Company, Ltd., which is incorporated in Bangkok, Thailand. The administrative contact for www.flexispy.com is

www.flexispy.com has about 250 million regular users (as of the writing of this assessment) with 120 million unique users logging in each day. As of April, 2009, Facebook housed 15 billion photographs with 850 million new photographs added per month. While no statistics exist, anecdotally a majority of those photographs on Facebook depict at least one person. Trends in digital cameras mean that an increasing number of photos contain geographical, date, time,

and other metadata. As SSDDs have evolved, most now include a camera and software that facilitate the uploading of images and video to online social networking sites in real time. This represents an opportunity for LE to place a subject of interest at a specific location, at a specific time, engaging in specific activities, with specific individuals.^{198,199}

(U) As with all technologies, MR is neutral. In the same way that the increasing volume of images on the Web represents an opportunity for LE, it also represents a risk. As an example, www.face.com offers facial recognition capabilities for images loaded on Facebook. LE can use this application to identify associations among criminal actors and locate subjects. Because www.face.com is a publicly available application, it also can help criminals identify potential or intended victims (as well as LE personnel). Imagine the ability of an abusive former spouse to crawl the Web for images of a former significant other using this technology. Also, imagine the ability of a criminal organization to crawl the Web for images of a suspected undercover officer within their group.²⁰⁰

(U) The nature of the technology, (such as that used by www.face.com) is such that it often falls outside ability of LE to serve legal process to obtain any records kept in the normal course of business, and information related to individuals who use the technology. For example, Face.com is owned by Vizi Labs, Inc., an Israeli company that does not have a physical presence in the US. This means that the ability to serve legal process on this company is beyond the ability of all but a few US Law Enforcement agencies.^{201,202}

Recommendations

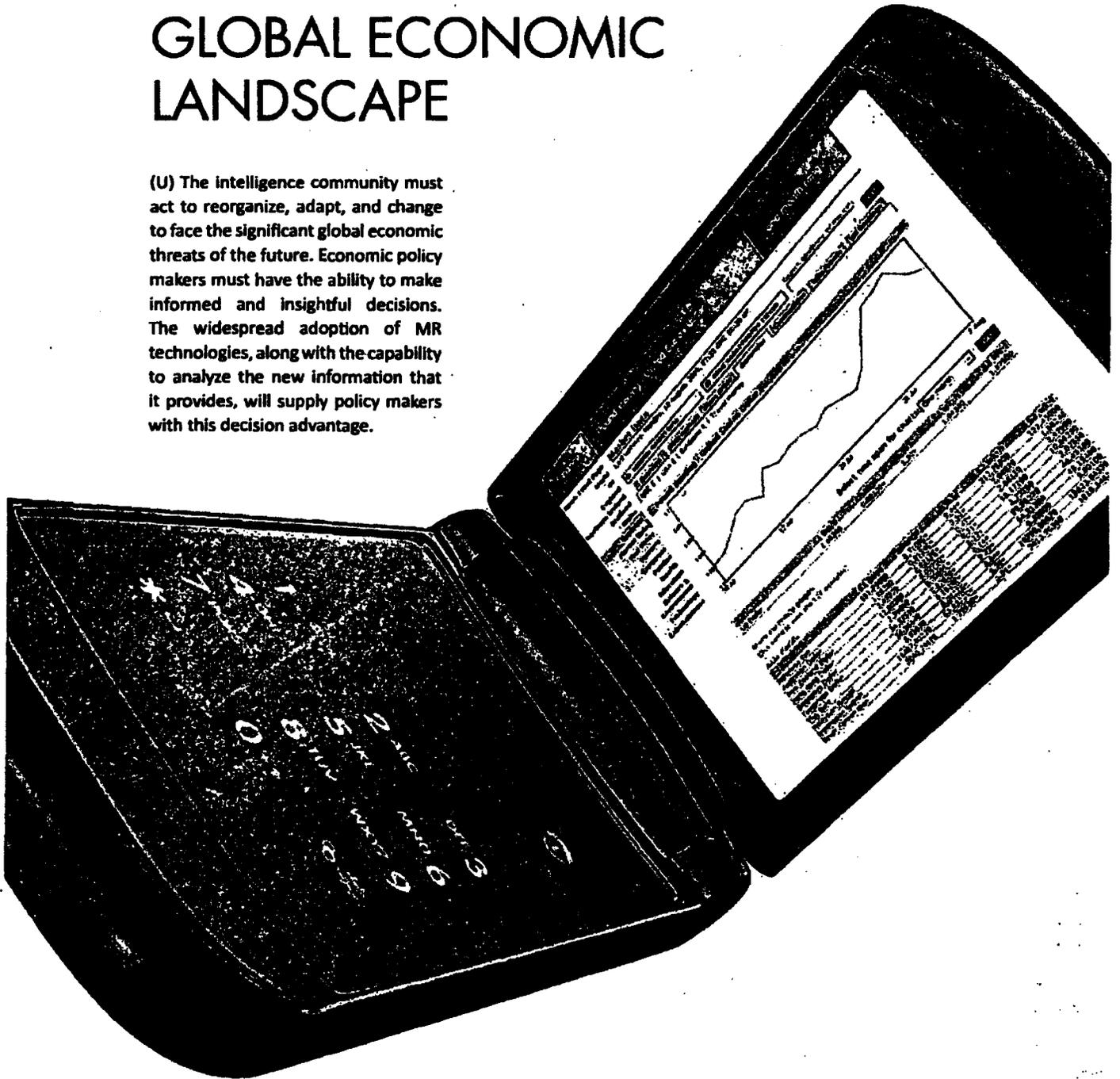
(U) The implications of widespread MR adoption by criminal organizations (aiding actions that would result in criminal prosecution) are such that they demand immediate attention from the LE community. To that end, the following are specific steps that can be undertaken now to help all levels of the LE community address these implications:

- Establish a coordinated program to determine what information is collected (overtly or covertly) by MR applications used by citizens of the US. Non-US LE and pseudo-LE entities should be leveraged to add value. Organizations, such as InterPol and EuroPol, along with other NGOs would be of benefit in this endeavor. Further, it must be determined what information is kept on client devices versus what information is retained on servers (and where); what companies produce the applications; what companies retain server-side information; the location(s) of those servers; the retention periods for the retained information; what risks exist due to the nature of the information or company retaining the information; and by what process the information can lawfully be obtained in the course of a criminal investigation.
- Develop and distribute forensic tools that have the ability to recover all data from MR devices (and applications contained thereon) in a forensically sound manner for use by LE at the federal, state, local, and tribal levels. Currently, few federal facilities have the capability to conduct such examinations for matters leading to criminal prosecution. Consequently, they no longer meet the capacity of need. Consider that there were 53 million Smartphones sold in the U. S. in 2008. Sales in 2009 are projected to increase by 25%.²⁰³
- Revise and update those federal and state statutes that address matters related to the retention, preservation, and release of the business records of MR technology companies (applications or hardware), as well as personal information stored by MR companies, in order to keep pace with advances in technology.
- Revise and update those federal and state statutes that address the lawful and judicially approved interception of communication for the purpose of criminal investigations in order to keep pace with advances in technology.
- Establish a coordinated and systemic training program to inform appropriate LE personnel how to best integrate MR data of potential forensic value (gleaned from MR devices and applications) with other investigative techniques.

(U) Each of the five recommendations above illustrates both a current vulnerability to and an opportunity for US LE. Adoption of these recommendations will provide LE with an information advantage over sophisticated criminal enterprises. The potential risks (and conversely, the potential rewards) for LE related to MR are comparable to those faced by LE with respect to DNA 15 years ago.

(U) **MONEY MASTERY:** MIXED REALITY AND THE GLOBAL ECONOMIC LANDSCAPE

(U) The intelligence community must act to reorganize, adapt, and change to face the significant global economic threats of the future. Economic policy makers must have the ability to make informed and insightful decisions. The widespread adoption of MR technologies, along with the capability to analyze the new information that it provides, will supply policy makers with this decision advantage.



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(U) ALTERNATE PERSPECTIVE ON INFORMATION SECURITY



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(U) Time and technology are not on our side, and choosing not to engage the emerging real-time Web only makes us irrelevant and more prone to intelligence failure.

(U) The recent political crisis in Iran illustrates the consequences of limiting IC access to the internet. Twitter, which allows anyone with a mobile phone to report anything to a mass audience, became a critical source of information on breaking developments in Tehran because journalists and diplomats were often confined to their homes and offices. Because some agencies block access to Twitter, some officers found themselves having to go to their cars and access the latest developments on the crisis from their personal mobile phones. Others found they could cover the crisis more effectively from home with unfettered internet access that they are denied at work.

(U) The argument that Twitter, blogs, and other outlets for "citizen journalism" are not as reliable as

formal media outlets ignores the fact that in fast breaking situations, all reporting is prone to error. Such inherent errors and unreliability require analytic caution,²⁰⁶ but are not sufficient grounds for ignoring this new media. Analysts have learned to assess and weight new information sources, such as CNN, as they have developed, and history has shown that analysis benefits from a broader spectrum of intelligence.

(U) We need a fundamental re-examination of our security needs to survive in this world. Such an examination must begin by asking what we hope to accomplish and by acknowledging that risk is a necessary component of any security system. We are not alone in this need: a recent survey of private sector employees in 10 countries found that three out of four IT professionals believed their security policies needed updating, and the top reason users gave for circumventing their security policy was their view that the policy was incompatible with their job demands.²⁰⁷

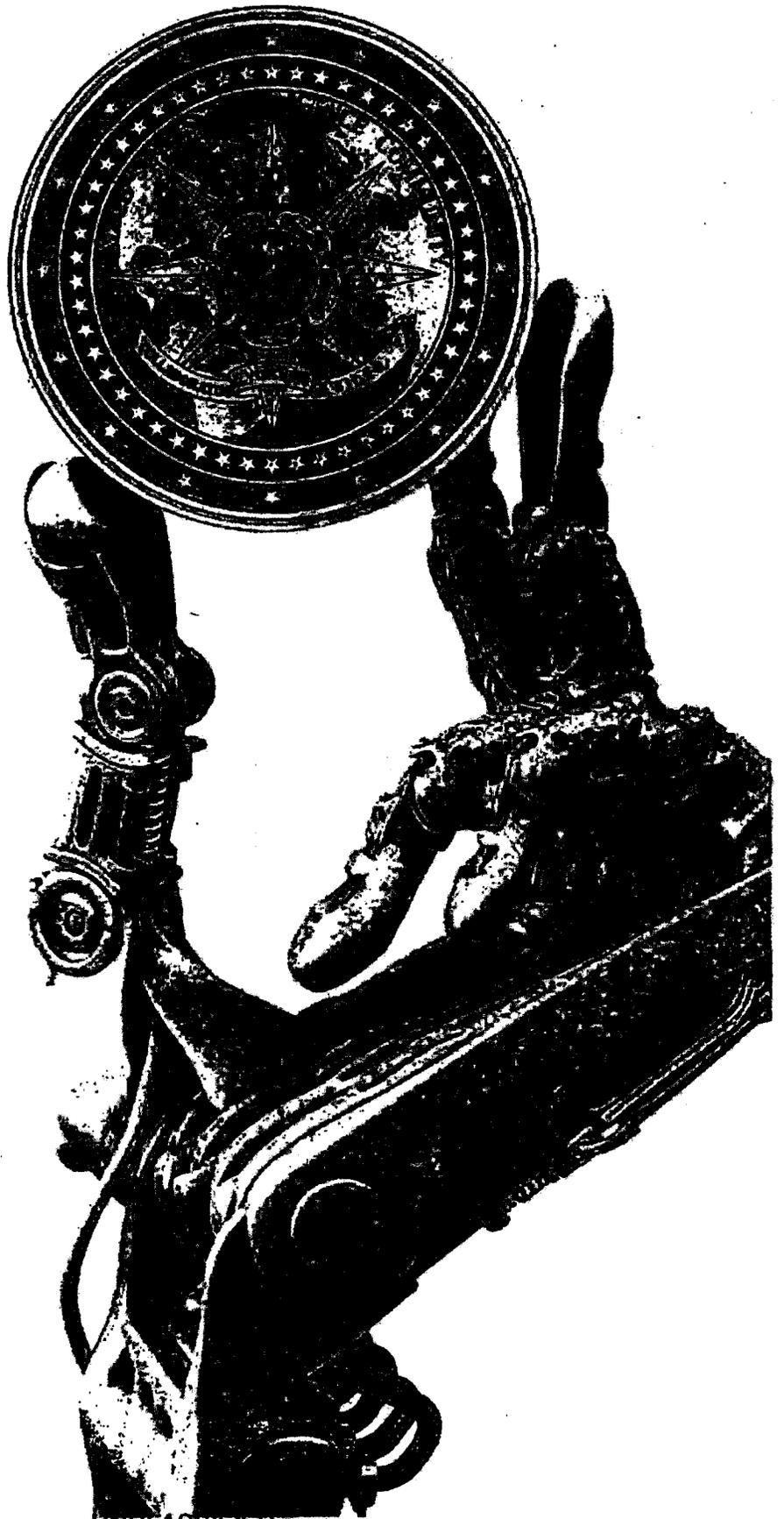
(U) One alternative to the current system is to come out from behind the walls of our fortress and defend ourselves through the agility to be gained by active engagement with the rest of the world. This system would be light and nimble, working with the global hive to spot emerging threats early and responding to imminent threats more quickly. The security managers of the future would be well known to the hive, feeding the reputation system to ensure that security constantly improves by fixing flaws.

(U) The other key factor is personnel security. An emerging theme in the discussion of security in the private sector is that "technology does not equal security," as noted recently by Cisco's senior security adviser.²⁰⁸ Indeed, major IT leaders such as Google and Apple, while embracing sharply different corporate cultures, both embrace a focus on personal rather than structural or technological solutions for security.^{209,210}



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(U) Keeping the IC ONE STEP AHEAD

(U) When Pull Comes To Push

(U) Summary Statement

(U) Commercial recommendation engines, semantic analysis systems, content analysis generators, and sentiment analysis should be leveraged by the Intelligence Community (IC) to augment cognition, situational awareness, analysis processes, and products.

(U) Key Points

1. (U) The exponential increase in open source information means that an effective IC analytic body without automated augmentation from external sources is difficult to imagine.
2. (U) Attention paid to IC analysis (classified and otherwise) metadata, taxonomy can reap large dividends downstream. Allowing analysts to "tag" products as well as sources, and create folksonomies (user-derived taxonomies), will accelerate the analysis process with little incremental overhead.
3. (U) User rating and review of IC products and traffic could yield excellent benefits as analysts struggle to keep up with as well as find the most timely and relevant content.
4. (U) Geo-referenced "Push" technologies could benefit analysts and IC personnel by aggregating and automatically displaying relevant content.
5. (U) "Scraping" textual data from the web and using it to estimate widespread beliefs and attitudes utilizing semantic along with sentiment analysis could alert the IC to threats and changes in near real-time.



(U) Introduction

(U) The IC can benefit by applying evolving recommendation engines, made possible by location-aware software and hardware, to augment cognition and raise situational awareness. These technologies are robust enough to warrant serious consideration, and are being vigorously pursued for consumer applications. Underlying technologies include collaborative filtering, semantic analysis, and the semantic web.^{211,212,213}

(U) Information awareness lessons can be learned from the commercial Internet. Much time, research, and money has been spent to automatically gather, parse, and further disseminate relative information, largely for better marketing strategies for commercial entities. These strategies include; contextual analysis, semantic analysis, collaborative filtering, geo-referencing, metadata enhancement via tagging, and the automation of background processes that push relevant content to the user.

(U) Technology currently offers (or soon will) virtual intelligent assistants that politely "push" ranked, rated, and relevant message traffic, links, blog posts, Tweets, videos, photos and other resources (classified or otherwise) to the analyst desktop, based on near real-time awareness of information of interest. The resource pool for this information should be sourced from within IC repositories and Knowledge Management systems, along with the open Internet. Consumer examples are cited herein, that, with some imagination, could readily be adapted to IC use cases. With the exponential increase in open source information, it is difficult to imagine an effective IC analytic body without automated augmentation from external sources.

(U) Computational linguistics and semantic analysis are already staples of IC research efforts. The community would do well to consider tailoring such efforts to improve productivity of scarce analytic resources through a self-training capability against internal IC datasets and the internet. Specifically, this genre of tools would "intuit" potential items of interest from both internal and open sources. This would occur in an automated fashion through observation of how analysts use those sources.

(U) The transparent observation task, which would run in the background without the user's intervention, would infer the context of the analyst's activities. The analyst's response to this menu of items would then provide performance feedback to the software, continually improving it. The end result would be a focused daily "newsfeed". (Note that the algorithms' capability to self-train would be dependent upon access to both 1) internal IC sources and 2) external open source material.) Lessons can be learned from consumer focused Internet technologies evolving a "recommendation" layer that emphasizes "Push" versus the "Pull" of traditional research. The realization of the so-called "Semantic Web" will speed this trend by adding more robust metadata to web pages, including ontology and taxonomy, which in turn will aid in search and "discoverability". In effect, these systems "hover" around user activities, learning from them, and continually seeking out relevant content based on their findings.

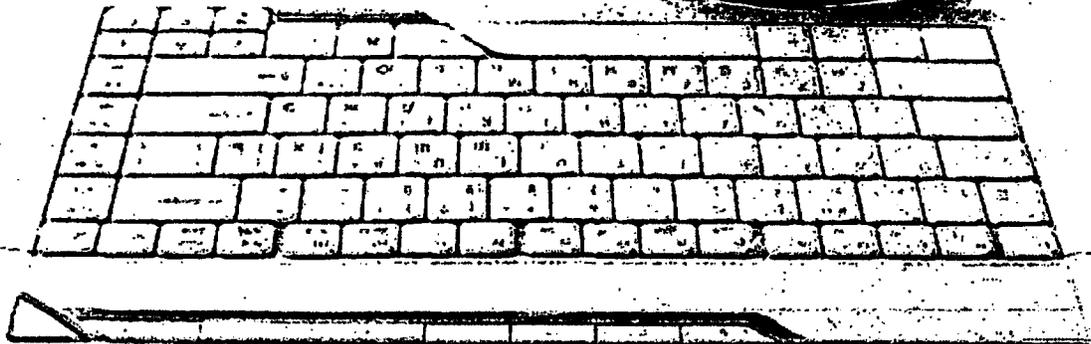
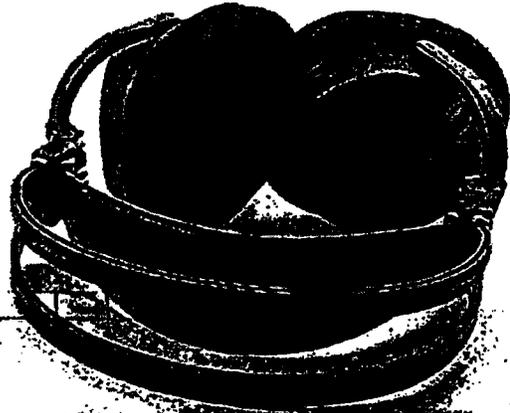
(U) Examples From the Commercial Internet

(U) The Digital Music Space

(U) Music has been a fertile field for the development of recommendation systems. The crash of CD sales and music retailing has created a necessity for digital marketing and discovery. Music has metadata built in, provided by commercial metadata providers like Gracenote (<http://www.gracenote.com>) and All Music Guide (<http://www.allmusic.com>). These two services have proprietary taxonomies and ontologies. For example, Gracenote divides music into over 1,600 genres with genre maps changing by territory and specialization.²¹⁴ Similarly, attention paid to IC analysis metadata, taxonomy, and ontology can reap large dividends downstream. Allowing analysts to “tag” products as well as sources, and create folksonomies (user-derived taxonomies), can accelerate the process with little incremental overhead.

(U) Apple's iTunes recently added a “Genius” feature. When activated, the user's iTunes music collection is sorted and analyzed for content. Thereafter, a sidebar suggests related tunes while a virtual D.J. “suggests” which tunes to play next. Clicking an icon causes Genius to instantly create a playlist around the “seed” song.

(U) One Llama LLC began at the University of Illinois within the NCSA Applied Learning Group D2K (Data to Knowledge) initiative. One Llama uses a combination of semantic analysis collaborative filtering techniques to arrive at its recommendations. Although not really “push,” it is still worthy of what can be done by a small team using mostly open source algorithms and software platforms. One Llama (<http://www.onellama.com>) scours thousands of Internet radio stream playlists storing over a billion artist-track pairs. An artist name or track name displays a ranked order of related stations. In another example, One Llama uses a “Semantic Tree” to cluster similar tunes around a “seed” tune allowing for the



exploration of the branches (<http://company.onellama.com/section/labs/discover/>).

One Llama derives its data from open sources including blogs, independent ratings, and reviews of music. Similarly, user rating and review of IC products and traffic could yield excellent benefits as analysts struggle to keep up and find the most timely and relevant content.

(U) One of the most successful examples of "Push" from the consumer music world is Pandora (<http://www.pandora.com>). With roughly 10 million visitors per month, Pandora is a personalized, interactive Internet radio service that competes with LastFM (www.last.fm), Slacker (www.slacker.com), and the subscription services Rhapsody and Napster. Users begin with a "seed" song or artist that the system builds a personalized "station" around based on semantic and algorithmic similarity. Metadata is manually added to tracks by Pandora "musicologists" at the rate of about 12,000 tracks a month, each tagged based on about 150 criteria.²⁵ Over its 5 year history, Pandora has refined its clustering and similarity algorithms to create playlists related by multifactorial correlations. These correlations are in large part responsible for spawning millions of dedicated fans.

(U) Finally, Amazon and Netflix politely push recommendations based upon purchases and wish lists. Subscribers to the digital video recorder service TiVo receive recommendations based on viewing history and the tagging of shows that viewers are assumed to be interested in recording in the future.

(U) Media

(U) YouTube (<http://www.YouTube.com>) added its "News Near You" Feature in July of 2009. Upon user navigation to Channels>News & Politics, YouTube records your IP address and therefore your location in order to display timely news video clips with geographic relevance. Geo-referenced Push could similarly benefit Analysts and IC personnel by aggregating and automatically displaying relevant content.

(U) Beyond Broadcast Media (www.bbcastmedia.com) was spun out of Northwestern University's Intelligent Information Laboratory (<http://infolab.northwestern.edu>). The Lab has developed "Context Aware" systems that "shadow" a user and push relevant content by algorithmically understanding the context of a given broadcast stream or body of text. Demonstrations include News at Seven, (<http://newsatseven.com>), which "assembles" a news broadcast delivered automatically by avatars, and "Brussels", a contextually aware "rich interface" news tracker, which is described as using:

"... models of situations called "scripts" to analyze the article you're reading, extract information and retrieve other articles to fill in the details of the situation summary. From the 'bird's eye' view of the situation summary, you can inspect the participants and events to see the sentences and articles that describe them."

(U) The Infolab's "Super Happy Fun Ball" is another proof-of-concept, which is described as follow:

"While you are browsing the web or playing music, Super Happy Fun Ball scours the internet and finds fun and interesting web sites and media related to you and your interests."

(U) Content Analysis, Sentiment Analysis, and Global Media Trend Tracking

(U) Although not strictly within the purview of "push", there are a growing number of open source systems for global media trend tracking and sentiment analysis. These systems take advantage of the Internet's growth in both commercial and user generated open sources that can be "crawled", "scraped" and connected-to.

(U) Mediacloud (<http://www.mediacloud.org>), created at the Berkman Center for Internet And Society at Harvard Law, creates visualizations of key terms by their frequency of use, source, and geography. Harvard Law Professor Yochai Benkler was quoted in the New York Times:

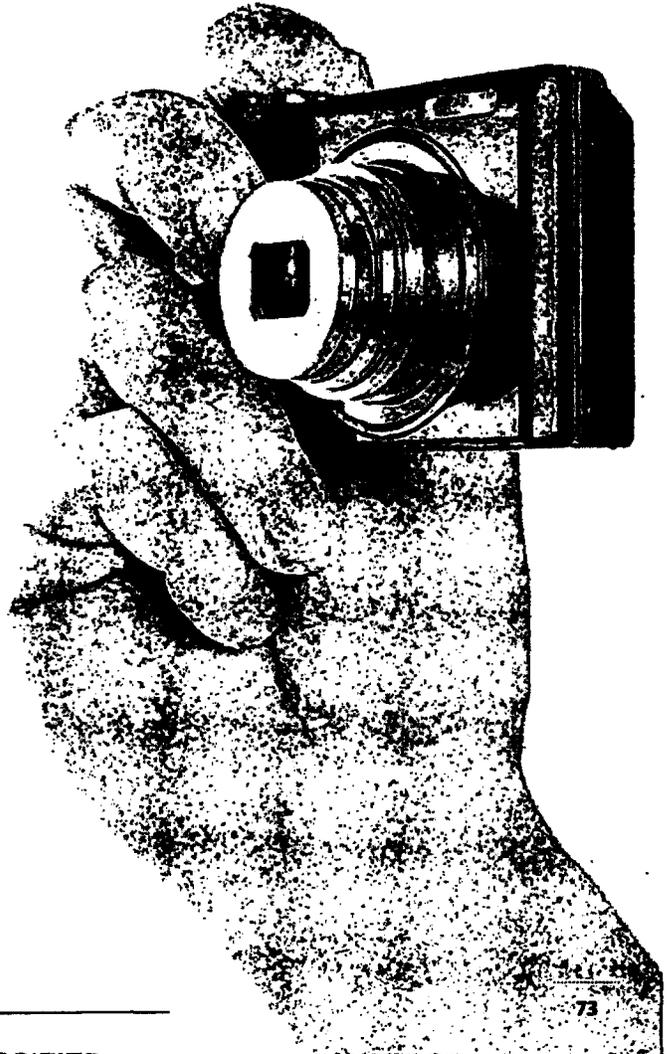
*"If you're really trying to map where an idea starts and how it moves through the public sphere, you need a database like we're developing, with time-stamped data."*²¹⁶

(U) He explained that Google and Lexis/Nexis were not as comprehensive. Memetracker (<http://www.memetracker.org>) is another example, developed at Cornell University, that mines the worldwide web for content trends in near real-time.

(U) We Feel Fine (<http://www.wefeelfine.org>) applies "Sentiment" analysis to visualize the "mood" of people on the global internet by mining the blogosphere:

"At the core of We Feel Fine is a data collection engine that automatically scours the Internet every ten minutes, harvesting human feelings from a large number of blogs. Blog data comes from a variety of online sources, including LiveJournal, MSN Spaces, MySpace, Blogger, Flickr, Technorati, Feedster, Ice Rocket, and Google. We Feel Fine scans blog posts for occurrences of the phrases "I feel" and "I am feeling."

(U) This is an approach that was inspired by techniques used in Listening Post, a wonderful project by Ben Rubin and Mark Hansen. Once a sentence containing "I feel" or "I am feeling" is found, the system looks backward to the beginning of the sentence, and forward to the end of the sentence, and then saves the full sentence in a database. "Scraping" textual data from the web and using it to estimate widespread beliefs and attitudes using semantic and sentiment analysis could alert the IC to relevant changes and threats in near real-time.



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- 196 Web site | "<http://www.vervata.com/flexi.htm>" | Date of Access: 30 July 2009

(b)(7)(E)

(b)(7)(E)

(b)(3)

(b)(7)(E)

MIXED REALITY: Revolution & Portably Communication Devices

UNCLASSIFIED //LAW ENFORCEMENT SENSITIVE