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**Emerging Trends with a Significant
Impact on the U.S. Intelligence
Community**

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**George H. W. Bush School of Government and Public Service
Center for the Study of Intelligence**



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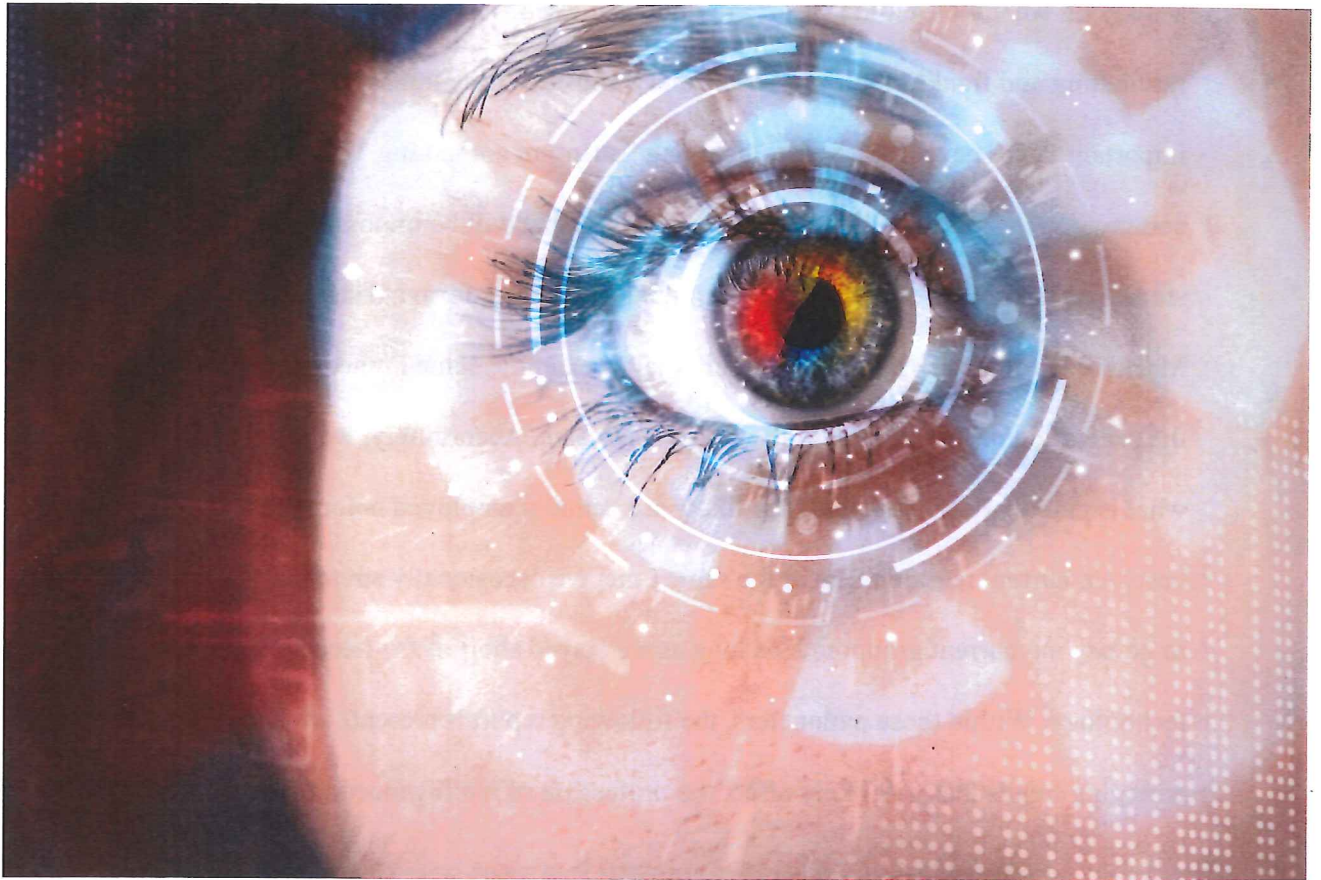


Introduction

In 2010, the Center for the Study of Intelligence asked Deloitte to conduct a study of emerging trends in business, society and technology that would have a significant impact on the profession of intelligence. Last year, our 2013 Bush School Capstone team was asked to conduct a study on what the Deloitte report might have missed. They produced a comprehensive, fascinating and frankly futuristic report that discussed some trends that will be extremely important in the next 10-20 years, including "quantum computing," "data teleportation communication" through light beams and protons that will be impossible to penetrate, and studies on the ability of the brain to manipulate machines from a distance known as the "Brain-Machine Interface." We were asked this year to examine some immediate trends that will affect the profession of intelligence in the next 5 to 7 years. Accordingly, we narrowed our focus as to what is practical and what one may likely see actually employed before the end of the decade based on current research. But at the same time, we occasionally stretched as we were also asked to go beyond current groupthink as long as we stayed short of far-fetched "Star Wars" technology. Within those parameters, the following report represents what we came up with as emerging trends that will likely effect the profession of intelligence in the next 5 to 7 years.

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Collection and Detection



Forensic Phenotyping

The Trend

Forensic Phenotyping is the process of translating DNA from very small “forensic samples into a description of a suspect’s physical appearance, geographical origin, and even behavior characteristics.”¹ It has exciting implications for both law enforcement and intelligence. This process can be completed using the genetic material left on someone’s cigarette, gum, hairbrush or essentially anywhere else. Utilizing 3D software and a technique known as Polymerase Chain Reaction (PCR), one can examine Single Nucleotide Polymorphisms and perform DNA sequencing from the sample of DNA collected. This information can then be applied to a coding system, which will analyze the physical genetic traits associated with the DNA sample and parameterize a 3D model representation of them, ultimately creating a physical representation of the individual who’s DNA was used.²

Implications for the IC

Forensic phenotyping as a scientific method offers great potential to the Intelligence Community. This technology could greatly improve the CIA’s ability to track suspects and identify threats, and opens the door to new methods of intelligence collection, data coding, and analysis. As advancements are made in this technology, it calls great attention to the likelihood and propensity of genetic determinism and the development of genetic surveillance. The ability to extract personal information including: “skin, hair, and eye color, geographical ancestry, gait, or predisposition to smoking” from genetic material lends focus to an entirely different form of personal and physical security, as well as national security.³

While the next five to seven years hold the potential for great development of this technology and its applicability to the IC, it also raises significant security concerns for US clandestine operations abroad. The policy and bioethical questions and consequences of collecting, analyzing, and viewing someone's genetic information without their knowledge or consent will likely be extremely disconcerting to the general population, but will be invaluable to the operations of the Intelligence Community.⁴ The security of U.S. covert operators and their aliases could be jeopardized and the ability to continue utilizing identity-altering methods of tradecraft may be negatively affected as the privacy and ability to generate information from individuals genetic material becomes more widespread. Foreign development of DNA tracking databases are likely to become a growing concern and as such, advancements in DNA spoofing will be vital to the protection of intelligence personnel abroad. Furthermore, the continued expansion of this technology internationally, its acquisition and exploitation by our adversaries, and its use for profiling or to obtain behavioral information will be significant markers of the growing importance of this trend.

Current State of Affairs

The Netherlands currently leads in this field of research but other countries including: the USA, Germany, Canada, Belgium, UK, and Australia have also begun exploring what opportunities lie in the development of DNA forensic phenotyping. Forensic phenotyping technology is currently accessible to law enforcement and medical personnel only in kit form, but this technology is likely to become more accessible in the coming years. Today, the end product of this scientific process is one of "family resemblance" rather than that of an identical

reproduction of the individual whose DNA was being processed. The primary reason associated with this outcome is that today, research and development on the study of facial morphology remains in its infancy stages, as the concept of forensic phenotyping is still so new in the world of science and genetics.⁵

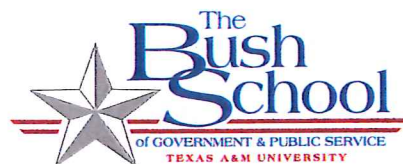
5-7 Year Outlook

While the current results of forensic phenotyping lack a great deal of precision, experts in the field of genetics have begun to work on correcting these imperfections through continued research on facial morphology. The number of genes likely to affect the physical characteristics and make-up of the human face are vast, numbering in the thousands, but new methods such as Bootstrapped Response-based Imputation Modeling (BRIM) are being developed to help further the accuracy of forensic phenotyping. BRIM uses thousands of specially dense quasi-landmarks to measure the face shape of population samples from various demographics and “uncover the relationships between facial variation and the effects of sex, genomic ancestry, and a subset of craniofacial candidate genes.”⁶ This type of research in forensic morphology seeks to “identify genes affecting normal-range facial features and for approximating the appearance of a face for genetic markers,” such as those collected and analyzed in the process of forensic phenotyping.

Additionally, while behavioral analysis remains a particularly controversial aspect of forensic phenotyping, there is science to support the notion that information on the propensity to perform criminal behaviors can be obtained from genetic predisposition. However, “genotypes for behavioral traits will not be easily found,” though some are more optimistic that with continual research many will be discovered.⁷ Experts have noted that the “complexity of these

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quantitative traits, coupled with variability introduced by environmental and nutritional differences, means that even if the genes influencing them were identified there are no guarantees that simple deterministic tests would emerge.”⁸ Sociologists also hold strong reservations to exploration in this area of genetic research, expressing concern that identifying such psychological tendencies may lead research down a slippery slope and come dangerously close to the field of eugenics.⁹



Augmented Reality Eyewear

The Trend

There is already eyewear on the market that creates an augmented reality for the wearer. Augmented reality is the portrayal of both what is in front of the viewer and an interactive display simultaneously, with the display showing explanations of what a person is looking at, including messages, directions, and other data.¹⁰ The current technology uses a combination of glasses and contact lenses, which are designed to have the capabilities of a smart phone.¹¹ Ultimately, the trend is to continue to improve the capabilities of this technology and ultimately camouflage it in such a way that it resembles everyday eyewear.

Implications for the IC

Augmented reality would allow the wearer to access real-time updated information wherever their location, which could be critical during a covert mission when the data is continuously changing. There is technology that can track eye movements in order to determine what information the user wants to focus on. By using the eye-tracking technology, the wearer can discretely move through different sources of information. The eyewear could also be combined with technology such as facial and voice recognition to provide accurate target identification, as well as eye, blood-oxygen content analysis, and facial movement analysis that could be factors in indicating deception. The eyewear would also be able to send and receive messages allowing the officer in the field to maintain constant communication with their agency. This could also include photos or scans of what the viewer is seeing, which would not only allow

for incredibly detailed information to be transmitted, but also mean the IC would no longer have to place as much reliance on an officer's memory. In the future, wearable technology might even be further developed to include technology like infrared or Xaver, which would give operators some capability to see through walls and structures. Overall, it would be an unobtrusive manner to collect intelligence, which would be more difficult to detect than using other photographic technology.

Current State of Affairs

Currently, the augmented reality glasses on the market can receive text messages and connect to the Internet while also allowing the wearer to see their actual surroundings.¹² They have also recently discovered how to make contacts night-vision enabled using graphene, which could be integrated into the current eyewear.¹³ The Google Glass device presently responds to voice commands.¹⁴ Other augmented reality eyewear has incorporated the tracking of eye movement to allow the wearer to select specific information.¹⁵

Google is seeking a patent that will facilitate the creation of contact lens with the ability to take pictures.¹⁶ It has been speculated that the contacts are able to detect when the wearer blinks. Blinking could then be used to send commands to the lens or other connected device. This patent was submitted in 2012 and the concept has yet to be publicly announced by Google.¹⁷

The Department of Defense (DOD) is currently using augmented reality eyewear referred to as heads-up displays or HUDs, which creates an augmented reality, showing their environment and new information on their troops, enemies, and other targets.¹⁸ In 2012, the DOD contracted Innovega to create a contact technology that would allow for a wider field of vision.

The challenge for scientists is how difficult it is for eyes to focus on objects close to the eye.¹⁹ For this reason, Innovega has created contact lenses that allow the wearer to focus on objects both near and distant simultaneously.²⁰ The glasses themselves have miniature projectors to display the interactive portion of augmented reality. Worn in tandem, the contacts and glasses allow the viewer to have a more enhanced augmented reality experience. The company Meta has created augmented reality eyewear they call space glasses that use similar technology, which give the wearer the capability to easily use technology such as laptops or cellphones, without them being physically present and instead using a hologram.²¹ CNN has compared Meta's augmented reality glasses to Tony Stark's technology in the *Iron Man* films that allow him to manipulate technology and 3-D images being shown as a hologram.²²

5-7 Year Outlook

Jang-Ung Park at Uslan National Institute of Science and Technology is currently working towards creating contact lenses that have the same abilities as a computer, including the capability to take photos and scan images.²³ Facebook firmly believes that this technology will become commonplace at some point in the future and has recently spent \$2 billion to buy Oculus VR, a maker of augmented reality eyewear.²⁴ Facebook's Mark Zuckerberg has stated that he sees augmented reality as the future of communication. On April 16th, Paul Saffo, a Stanford University professor, wrote that these current Google Glass devices will soon become "eBay collectible[s]," as development will lead to normal-looking glasses with greater features. He states that the process is similar to how large desktop computers "shrank into laptops and

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disappeared into our backpacks and briefcases,” ultimately predicting that wearable technology will soon “be in constant communication with cyberspace and real-time information systems.”²⁵



Real-Time Translation

The Trend

Real-time translation is the ability to translate speech or text instantly. In the past this task was performed by a trained human operator who physically translated the speech to text or orally repeated it. Throughout the 1990s and into the early 2000s, software started replacing the human operator. In 2001, Google began providing online translation services to and from English in eight languages. The method of translation used during this time was called machine translation, and simply translated the words from one language to another, but had a hard time translating whole phrases or idioms. By 2006 Google came up with a new method called statistical machine translation, which involved analyzing billions of words of text both in the target language and human translations between the languages. Recently, statistical learning algorithms have been applied to validate linguistic rules between the languages.²⁶ The trend is to develop devices that translate quickly, more accurately and are smaller and easier to carry or conceal.

Implications for the IC

The advantages of instantaneous translation are obvious. One of the main advantages is speeding up the intelligence cycle by improving the analyst's processing task. Integrated with Google Glass, case officers will also no longer need to be able to fully understand the language. The combination of Google's conversation mode and Docomo's augmented reality would give case officers the ability to fully understand the language in visual and auditory environments. That is, a case officer could potentially immediately read a document in a foreign language.

BBN's Broadcast Monitoring system could be used at the back end to provide an instant dossier of the individual's text and speech patterns, allowing analysts to instantaneously track what targeted individuals are saying across the web.

Current State of Affairs

Google Translate currently translates 81 languages and offers several modes including text-to-text, voice-to-text, and voice-to-voice translations. They are also beta testing "Google Conversation Mode," which will allow for close to real-time translation. Another device is being created by the Japanese company Docomo and uses augmented reality to visually translate text in a real world environment into your desired language. The current technology uses special smart glasses that constantly scan the environment for text in a particular language and within a few seconds display the translated text. Their goal is to perfect this technology by 2020 for the Tokyo Olympics.²⁷

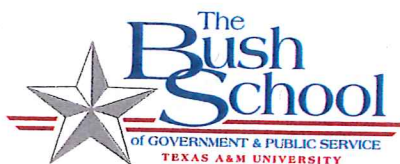
Another translation service has focused on capturing media broadcasts is BBN's Broadcast Monitoring System, an autonomous system that translates and stores foreign media broadcasts. In addition, the system can translate text from webpages and can be set up to store them in an archive.

5-7 Year Outlook

Real-time translation is nearing perfection now, but all aspects of translation have not been implemented into one device. The next step in the future will be to combine Docomo's augmented reality for the foreign text translation we see in our everyday lives with voice-to-

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voice translation of Google Conversation Mode. The technology for BBN's Broadcast Monitoring system could also eventually be setup to create instant dossiers of individuals on their text and speech patterns, all of which could be immediately accessed via Google Glass or other wearable devices. Additionally, one must also consider the fact that, although many in the world have learning English as a universal language, if this technology became available soon it could potentially reduce the impetus to learn English and other foreign languages



Facial Recognition

The Trend

Facial recognition and other methods of biometric identification have become extremely advanced in recent years, although they are not nearly as fast or accurate as generally portrayed in the media. But new technology and matching algorithms will allow it to move from solely large surveillance systems reliant on law enforcement databases to mobile devices that can match against the de facto databases of social media networks, and powerful new technology has made identifying obstructed and angled images of faces increasingly more accurate, something of great value to the IC. This will augment existing surveillance and identifying capabilities and allow for a more portable, unobtrusive, and accurate series of devices that will be ideal for field use in the future.

Implications for the IC

This is an area of extreme importance to the IC, as it allows for much quicker and more accurate identification of subjects. The relatively inconspicuous nature of the Mobile Offender Recognition and Information System (MORIS) detailed below would make rapid image capture and subsequent identification of a subject feasible in a field environment, and in terms of providing timely intelligence, the ability to confirm the identity of a subject on the spot could be greatly enhanced.

Additionally, programs like Facebook's new DeepFace facial recognition technology, explained in the following section, while developed ostensibly to help social media users more quickly and efficiently identify and tag friends in photos, could be harnessed to great effect by

the IC. With so many users on social media sites, the IC could now reach beyond criminal databases to identify subjects, as many individuals it will want to identify might not have existing or searchable criminal records to draw from. Were a database of social media identities to be integrated with a mobile device similar to MORIS, the IC would have the ability to identify a large number of people with great reliability in a field setting. Naturally, this can also be used against our intelligence operatives, as maintaining a cover will only become increasingly difficult to do as advanced tools like this make preserving anonymity harder and harder to accomplish.

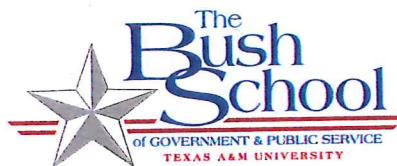
Current State of Affairs

The ability to match faces with identities is only as good as the database and algorithm for matching being used. There are two parts to the process: investigational mode, which pares down the whole database of faces to a dozen or more possibilities, and identification mode, which applies the matching algorithm to the smaller list.²⁸ With the most accurate of these algorithms, an unidentified subject searched against a database of 1.6 million people could be identified with 92% accuracy, which increased to 97% when subjected to additional examination by trained experts.²⁹ Historically, there have been issues when trying to integrate this technology with a mobile platform. While standard mobile phones have the ability to recognize faces, they often lack the processing power to do so with extreme accuracy, and the additional burden of running an on-the-spot identification algorithm is extremely taxing on the device.³⁰ Other problems with mobile devices include the low quality of the images they take and insufficient memory to account for an optimized matching algorithm.³¹

However, new technology has been recently developed to ameliorate this problem. The company BI2 Technologies has a device called MORIS,³² which fits a small biometric processing device onto the back of standard cell phone, with versions already operational for iPhone and Android-brand devices.³³ The device, which consists of a biometric capture model, a CPU, a power source, and a short-range wireless communication receiver, sends the image it captures to an external server for analysis and potential identification, and then displays the results on the phone in a period as quick as five seconds or less.³⁴ By effectively moving the processing element off-site, the most taxing elements for a mobile device are eliminated, and all of its processing power can be diverted to capturing the highest possible image quality. MORIS can also conduct iris scans and match identities based on fingerprints; pictures for identification can be taken from five feet away, while iris scans must be six inches or closer.³⁵ MORIS can potentially be integrated with any database, from criminal records to health care provider files.³⁶

A powerful new database is also emerging: social media. Facebook recently rolled out new software called "DeepFace," which breaks images of people down into layers, identifying 67 points on the face and creating an advanced 3D model of a forward-looking face, allowing photographs from angles other than head-on to be used reliably.³⁷ From there, each separate area of the face is filtered and compared to database images using different information and criteria to determine if there is a match.³⁸ Based on a test run of 4 million images of over 4,000 people, the results were a staggering 97.25% success rate,³⁹ compared to the 97.53% success rate of the average human for the same type of activity⁴⁰.

5-7 Year Outlook



literature, the Xaver products could logically be used for the same purpose, as they are also able to translate subject movement visually.

The device being developed by Project Tango offers a different capability. Though one would have to gain access to a structure for it to be effective, it provides incredible mapping capabilities once within. Using special processors, a camera, and a visual sensor, the device would basically serve as a standard smartphone that could map rooms with incredible fidelity. Press releases and promotional videos from Google suggest that the device could provide a full layout of a room and provide the dimensions as well.⁵⁰ For an intelligence operative that might only have a brief period of time to access a structure, this could provide much more detail about it in less time than traditional photographing or measuring. This would be extremely useful for the purposes of gathering information on the makeup of the structure, which could then be used for tasks like returning later for the installation of covert listening or surveillance devices.

Current State of Affairs

Decreased size and lower costs are the primary innovations of Wi-Vi; it would be possible to employ it on an everyday cell phone (as the technology is based on standard 2.4GHz Wi-Fi radios) as opposed to the large, power-hungry devices typically required for sonar.⁵¹ Wi-Vi is successful in “seeing” through walls and opaque objects of standard thickness by bouncing two Wi-Fi signals through the objects and into the room. The signals cancel out on immobile objects, but detect any movement. As such, Wi-Vi does not give a picture of the room, but rather any movement within it, including relatively minute gesturing. In its most basic form, the prototype Wi-Vi device consists of three antennas close together, and the device must be

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target structure. In terms of covert action, each device has its own advantages, though Wi-Vi benefits from using existing technology. Given the proliferation of devices with Wi-Fi signals in the average building, imagine if one were able to remotely gain control of them and turn them into essentially a Wi-Vi device, which in turn would be able to give a fairly accurate picture of what parts of the building were occupied and by how many people. Any counterintelligence and countersurveillance teams that might be monitoring sensitive structures for signs of tampering would see only the existing Wi-Fi signals, which would not be suspicious. By contrast, Xaver's more accurate UWB technology can provide very detailed 3D images that display rough elements of targets' size, movement, and positioning within the room, though the Xaver 400⁴⁶ and 800⁴⁷ models sacrifice compact size and rely on radar waves that would presumably be detected by countersurveillance measures. However, the Xaver 100 is a small, handheld device that can still be unobtrusively used to determine whether a room contains people and the direction they are moving, though it does not provide as advanced a picture as the other products in the line.⁴⁸

For Wi-Vi, an additional report by the device's inventors also highlights its potential to communicate via gestures, opening up possibilities as a new method of covert communication. Wi-Vi encodes movement as "positive" or "negative" based on the subject's movement towards or away from it, so a simple code can be created off of this.⁴⁹ Furthermore, the ability to monitor a subject's movement and body language can provide a more accurate picture of the individual's habits. This might seem far-fetched now, but as the technology improves, Wi-Vi holds many interesting possibilities. Though Camero does not highlight this ability in its promotional



Room Surveillance and Mapping

The Trend

With technology like Forward Looking Infrared (FLIR), we have had the ability to see through opaque objects and get a better picture of what lies behind them to some degree. However, several new technologies have the potential to supplement this capability and make it easier to gain a better idea of what might be happening behind the walls of room, in particular Wi-Vi, Camero's Xaver devices, and even Google's new Project Tango environment mapping system. The concept for Wi-Vi is not dissimilar to sonar technology, but it is much more compact and uses the standard Wi-Fi signals we rely on so often today.⁴² The three different products in the Xaver line⁴³ all rely on some form of Ultra Wide-Band (UWB) imaging technology and "micro-power pulse radar" to provide 3D representations of people and objects it detects behind solid structures.⁴⁴ The Project Tango device is somewhat different, requiring access to the interior of a structure to be effective, but once it is within, it uses sensors on smartphone to take over 250,000 3D measurements per second to create vividly detailed 3D maps of its surroundings.⁴⁵

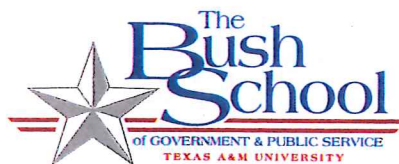
Implications for the IC

In the case of Wi-Vi and Xaver, the primary benefit of these products from an intelligence standpoint would be that they provide hardware that can augment existing infrared capabilities and allow an individual to track the movement of others within a structure. From an intelligence perspective, this would provide not only more accurate pattern of life, but also could be useful for figuring out the most ideal time to attempt to send a team to gain access to the

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In the next 5-7 years, this technology can only be expected to improve and become more widespread. MORIS was first tested by law enforcement in 2010, and is currently available to law enforcement agencies now.⁴¹ DeepFace is still in research and development mode, but the access to vast amounts of test images that its researches have will only likely serve to make it more refined in the future. Within this timeframe, it is very likely that mobile facial recognition tools and the database of identities that the continued rise in the popularity of social media has created will soon be much more closely tied together, and identities of subjects can be obtained from more than just criminal databases.

However, as this technology becomes more prevalent, there is the possibility that individuals may become more conscious of it and seek to defeat it. The result is that people may wear more disguises in public and may even consider falsifying or disguising images of themselves on Facebook or when taking pictures for identification documents like drivers licenses.



5-7 Year Outlook

Within the next five to seven years, there will be significant advancement in hardware, algorithms, and visualization of movement on the Wi-Vi device. Similarly, Camero's Xaver products have only been in development for a few years, and will only become more accurate and advanced as UWB technology improves. An initial timeline for Project Tango indicated that Google expected to release prototypes of its device to a group of 200 developers for additional testing and use by March 14th, 2014, so it can be expected that there will be new developments in practical applications of the product in the near future.⁶⁰ One potential development could occur once these technologies are miniaturized, opening up the possibility of incorporating them into technology like Google Glass. Currently these devices are far too large, but the ability to have a highly portable and wearable device that can "see" through walls has obvious implications.

stationary in order to work. It cannot penetrate concrete walls over eight inches thick, and metal objects like faraday cages will block its signal, though analog-to-digital converters and more antennas can potentially extend the penetrative capabilities of the signal.⁵²

As mentioned previously, the Xaver product line consists of the Xaver 100, 400, and 800, all of which operate on UWB technology. According to official specifications, all three products have a detection range of up to 20 meters and can penetrate “standard building materials” like brick, adobe, and reinforced concrete.^{53, 54, 55} While the Xaver 100 is handheld, it can only ascertain the “presence, movement direction, and distance” of an individual in a room,⁵⁶ while the most advanced device, the Xaver 800, can show both 3D and 2D representations of subjects, the presence of static, nonliving objects and estimations of distance between potential targets.⁵⁷

Project Tango is a much newer technology, having been announced only in February of 2014. The most important element of its new smartphone design is a chip called the Myriad 1, a vision processor that is able to provide formidable new capabilities while still consuming a low enough level of power to be usable on a mobile device.⁵⁸ Previously, the sheer power consumption of 3D sensing chips had made them untenable for use on phones, but technical advances let the Myriad 1 perform tasks like “motion detection and tracking, depth mapping, recording and interpreting spatial and motion data” while still operating on the platform of a standard smartphone. A demonstration of the device from Google showed it mapping a room and the objects within it, as well as providing distance measurement, ultimately creating a 3D rendering that resembled something like a highly complex blueprint of a room.⁵⁹

Jumping the Air Gap with badBIOS

The Trend

Recent studies have found that it is possible to hack into computers that are not linked to any type of Internet connection. The term “air gap” refers to the physical space between computers protecting them from other computers.⁶¹ The term has now been expanded to refer to being separate from Wi-Fi and other forms of connection and communication. Using audio technology that was initially created for underwater communication, a form of jumping the air gap popularly known as badBIOS has been developed.⁶² Using badBIOS, computers are ultimately defenseless against a committed hacker who is not physically or virtually linked in any way to their machines. In order to receive information using this technology, the computer must first be infected with malware in order to use the sound waves to transmit information. The badBIOS technology could be used to take information from a non-networked computer and send it through a networked technology to ultimately be sent via e-mail. As the hacker would not be required to be physically located near the computer it is virtually impossible for the process to be noticed.

There has been some controversy over the legitimacy of badBIOS,⁶³ with concerns that it stretches to the limits of technical plausibility, if it is indeed a real possibility at all. It has also been expressed that, even if badBIOS were real, the incidences that it has been used for have been incredibly isolated given the level effort that the technology requires. However, many believe that the technology is in existence and it would have huge implications.

Implications for the IC

Retired US Navy Captain Mark Hagerott is concerned that the new technology allowing hackers to jump the air gap could threaten the United States' military status.⁶⁴ When discussing other forms of jumping the air gap, Hagerott noted that if the naval computer systems were infected and then hacked, ships could be stopped in their tracks or surveillance and weapons computer systems could also be hacked. The same concern could also be applied to aircraft and ground forces. The new technology makes it very difficult to determine who exactly is gaining unauthorized access to the computer.⁶⁵

In the intelligence community, badBIOS could alter how information is accessed. An agent or officer could receive information from an infected unconnected computer without the user realizing. It would provide for accurate crosschecking or the discovery of new information from another party.

While the studies on jumping the air gap with badBIOS focus on using sound, other sensory devices could also transmit information in a similar manner. This includes not only microphones and speakers but also sensors such as cameras and LEDs. Thus, devices such as smartphones are incredibly vulnerable as they have multiple sensors.

Current State of Affairs

Using almost ultrasonic sounds that are inaudible to humans, information can be covertly sent through the air from one computer to another.⁶⁶ The sounds are sent and received using microphones and speakers that are already built in to computers.⁶⁷ This technology could be used to send information such as key logs and other data over the air gap. Using this type of hacking, most technology used today to protect computers would not be programmed to stop the audio

transitions. Currently, audio signals can transmit 20 bits of information per second over 19.7 meters.⁶⁸

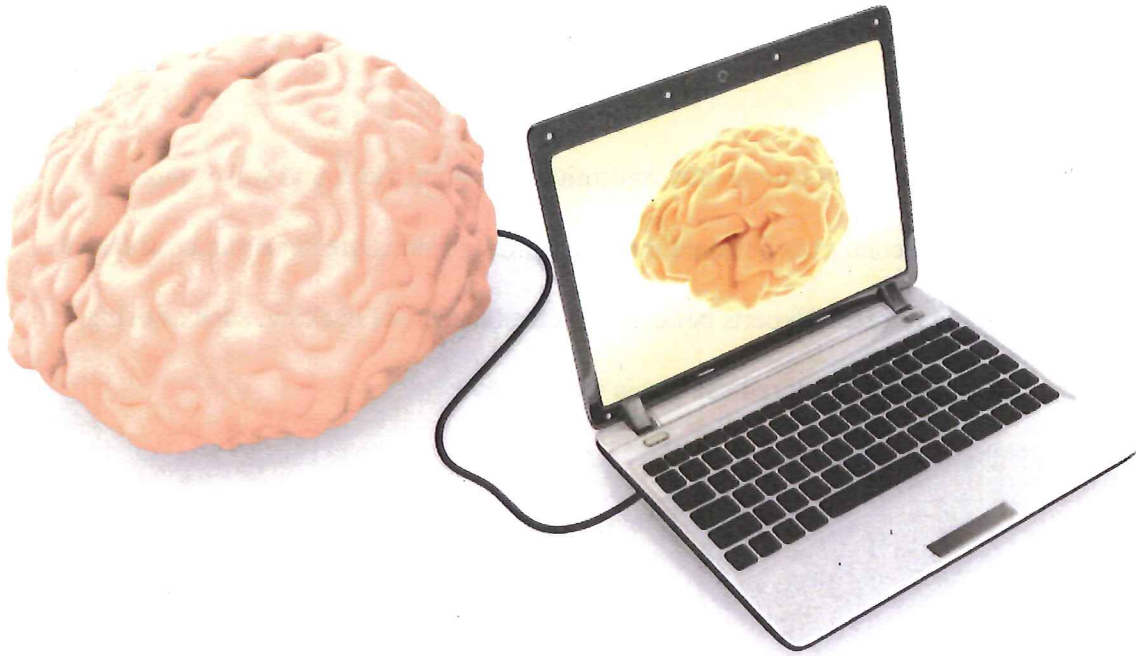
At the moment, badBIOS technology requires that the computer sending out material be configured to transmit and receive the information.⁶⁹ Experts have found that the software can be installed via malware or through a backdoor into the computer. Once installed, the software is very difficult to discover and remove.⁷⁰ Therefore, once a computer is infected, it can continuously send out information without having to connect to a network.

5-7 Year Outlook

In closer proximity, badBIOS can already transmit information via sound waves more quickly than 20 bits per second. It is believed that transmitting from a greater distance at faster speeds is possible in the future.⁷¹ Experts believe that other aspects of hacking, such as using encrypted data, will be further explored using this technology.⁷²

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Enhanced Verification Techniques



Brain-Computer Interface

The Trend

Brain-Computer Interface (BCI) is the process of integrating the brain to an external device like a computer through the brain's signals (EEG). Future capabilities expand from human-to-machine to human-to-human communication, access to and manipulation of memory and learning processes, and even the ability to transfer the human psyche.⁷³ BCI is considered such a top priority that in 2013, President Obama launched the *Brain Initiative*, a \$100 million dollar research effort to better understand and treat neurological disorders and injuries.⁷⁴ This program may have the potential to advance BCI with an effect similar to *The Human Genome Project*, which returned \$141 in positive investment for each of its \$3.8 billion spent over the course of 15 years.

Implications for the IC

Harnessing the power of the brain is the next frontier and holds great potential for the intelligence community. BCI can help prevent intelligence leaks by supplementing interrogations during security clearance processing or while verifying the legitimacy of a source. However, these capabilities could put case officers in danger of being uncovered and make it more difficult for counter intelligence operations to supply disinformation plants.

In addition, BCI could be used to condition neurological responses to specific stimuli in personnel.⁷⁵ This could aid in the training of operatives by reducing anxieties associated with operating in the field as well as increasing sensitivity and alertness to compromising conditions like the increased presence of surveillance cues.

An additional impact is the potential proliferation of BCI in the populace at-large and their risk of being manipulated through it. An internally planted BCI device, like those used in medical treatment, can be hacked and redirected without great difficulty through an external signal similar to Bluetooth, ultimately stimulating the different parts of the brain that influence behavior. In essence, this would allow the person to be influenced to feel emotions of depression, pleasure, and even risk-taking. The risk-taking element is especially disconcerting as it includes inclinations towards thrill-seeking, drug use, gambling, or even espionage itself.⁷⁶ If this procedure was used to influence an intelligence target that uses an internal BCI towards risk-taking behavior, it would make him or her more susceptible to traditional recruitment strategies (MICE),⁷⁷ as that person seeks to feed the newfound lifestyle. This presents a threat to personnel working in the intelligence community and sheds light on the need to provide a means of securing our own employees against internal BCI manipulation.

Current State of Affairs

BCI is a broad field that currently is relegated to research. Its development is focused on a range of consumer products, from video games to medical devices for treatment of neurological disorders. Current use involves the placement of electrodes either on the exterior of the head or inside the brain through an invasive medical procedure, though each method has pros and cons. The external method allows for ease in use and mobility by only requiring an electrode cap, electrode gel, and a device to read and decode the signals such as an iPhone.⁷⁸ While this does allow for great flexibility in where the procedure can take place, the downside is that accuracy can suffer as a result of current sensors lacking the sophistication to read through the

skull without also receiving electrical interference from nearby devices or movement from the subject, even something as simple as chewing gum. This means that proper time must be taken to prepare an electronically quiet location and that the subject must cooperate by refraining from actions that will interfere with the signal.

The internal method requires a surgical procedure where a device or electrode is implanted inside the subject's brain. While much more invasive, this method provides a clearer, more reliable signal. A similar technique is being developed for use as a treatment for Parkinson's disease. The downsides to this method are long-term reliability of internal sensors, and the possibility for sensors to be interfered with by an external signal – potentially causing psychological damage, or corruption of the device, thus influencing the subject's emotional state. Current leaders in BCI include the U.S., Germany, China, Austria, Italy, and Spain.

5 -7 Year Outlook

Much of the research geared towards the next five to seven years is focused on enhancing BCI into a more robust product that can be made available for public consumption.

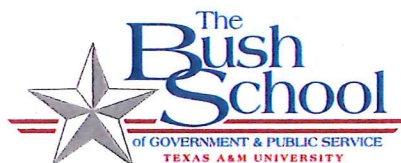
Technological advancements will allow for the reduction in size of devices, the improvement in safety and reliability, an increase in the amount and quality of data that can be transmitted, and the capability of wireless, rechargeable devices. These products are mainly geared towards connecting people to computers, or smart devices, and ultimately, the Internet. Given the cost and invasive nature of neurosurgery, much of the research for this time frame is focused on external BCI development with a major emphasis on developing electrode algorithm design to provide more sophisticated sensitivity.⁷⁹

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In five to seven years, technological advancements combined with increased experience operating BCI will provide a number of new BCI capabilities. One such capability is external BCI and is a means of identifying a subject's familiarity to stimuli presented to him or her without the subject being able to manipulate or control his or her own response. There is also a possibility for very simple forms of communication, for example, basic directional inputs for land-navigation from a satellite source.

The ultimate evolution of BCI and its widespread use will have enormous implications for human intelligence collection and dissemination of intelligence products. For example, eventually, after long-term development, the memory of an intelligence source could be scanned for real-time recollections of a conversation or event; field officers could prepare for new assignments in their sleep by downloading a new language; hatred in extremists could be manipulated into a desire for cooperation, and intelligence reports could be telepathically disseminated to policymakers. In such an environment, our intelligence efforts should see the same type of collection advantage we've enjoyed during the digital revolution. Unfortunately, we can also expect to encounter similar controversies such as a debate over intellectual privacy rights, and threats to operational security as our own thoughts or knowledge become an intelligence liability.

While progress has been made towards these futuristic capabilities,⁸⁰ BCI experts view them as ultimate achievements of the field laying at least a half-century ahead, with major hurdles to overcome, e.g., increased sophistication of electrode sensors and the ability to encode information in the brain's own language.⁸¹



Combined Enhanced Verification Techniques

The Trend

Lie Detectors have been around for many years and are most commonly associated with the traditional polygraphs that measure heart rate, respiration, blood pressure, and skin galvanization. However, scientists in recent years have been working hard on other measurements which they are certain are associated with truthfulness.

Implications for the IC

The implications for the IC are obvious, as it is fundamental that the government will want to determine the truthfulness of a potential intelligence officer, a source, or even a foreign leader if he or she can be assessed from a distance. The actual applications of these scientific tests depend on whether those being tested are doing so voluntarily, such as a source who walks in off of the street and who must be vetted for truthfulness, or involuntary, as often occurs when officers conduct interviews with sources in the field.

Current State of Affairs

Recent scientific studies have shown that monitoring the movement of a person's eyes combined with sophisticated computer software can gauge the truthfulness of a subject. This technology is different than polygraph testing, which measures emotional response to lying, as instead it measures the cognitive reaction. By analyzing pupil dilation, eye movement, and response time, the Utah-based company Converus claims it can predict lying with 85% accuracy.⁸² Another newly enhanced method of lie detection is voice analysis, which has been

greatly enhanced through computer technology. The technology monitors micro-muscle tremors (MMT), which occur when a person is under stress and can be picked up in their speech.

Analyzing these tremors allows the operator to detect deception or truthfulness in the subject.⁸³

Another computer technology analyzes subject's micro expressions, which are involuntary facial expressions caused by emotional reactions, occurring when a person is trying to hide how they are feeling. New systems such as "Silent Talker" can pick up these micro expressions in real-time through its software. Additionally, there are products that enhance the capability for humans to see blood flow and blood oxygen concentrations through the skin, changes in which have some correlation with stress and lying. Though designed primarily for medical purposes, these glasses (called O2Amps) could also be used for unobtrusively detecting mood and deception in individuals, as it can amplify factors such as flushed faces and changes in oxygenation that might come with lying.⁸⁴ There are currently three types of glasses, allowing the viewing of blood oxygenation, blood concentration, and a combination of both⁸⁵. Considering that 93% of all human communication is nonverbal, accurately understanding these expressions is of great importance.⁸⁶

There is also the theoretical potential of using fMRI as well. Cephos Corporation and University of Texas neuroscientist Andrew Kozel believe that the key areas of the brain that activate during deception can be measured. Others seriously dispute their conclusions, though University of California neuroscientist Richard Haier has studied fMRI and believes that the technology is "rudimentary...but worth studying." The drawbacks right now are that the subject would have to remain perfectly still and the device may not be able to overcome physical and mental resistance, and it may take decades for this technology to reach its full potential. As noted

above with BCI, some scientists believe that by placing electrodes on the skull, they can accurately determine whether or not a subject recognizes a picture of a face or place, as areas of the brain light up with activity when exposed to recognized items.

5-7 Year Outlook

The key for the future is combination. No one seriously contends that blood pressure or heart rate alone can determine truthfulness, but for over forty years law enforcement and the intelligence community have made extensive use of a machine that combines only blood pressure, heart rate, skin galvanization, and respiration to make judgments as to whether a subject is being truthful. The limitations are obvious and the accuracy of the current polygraph is highly controversial. In the last few years, with the aid of computer technology, scientists have identified a number of new factors that they believe have positive correlation with truthfulness. As with blood pressure or heart rate, none of these alone are dispositive, but combined they can have a practical use. Accordingly, it is likely that in the next five to seven years the technologies of pupil dilation, eye movement, MMT, voice stress, oxygen levels, and, with much more research, fMRI and BCI, could be combined with the four current factors to create a much effective device for verifying truthfulness. With a non-voluntary subject some of these measurements could be problematic, as it is likely that only a few of these traits could be quickly measured, but with a voluntary subject, all tools could potentially be effectively employed.

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Global Internet Provision



Alternative Internet Options

The Trend

At the present time only roughly one-third of the global population has access to the Internet, which has prompted multiple groups to seek alternative ways to connect to it. Though Internet is currently available through various commercial providers using satellites, several groups are working on other options. Significant players include Google, Facebook, and Thales Alenia Space.

Implications for the IC

Creating Internet access for currently unconnected countries means an increase in opportunities to educate other populations as well as communicate with those on the ground. Increased access will also provide more information on how people think and feel based on online posts and activity. Operationally, some of these drone/balloon-based projects may allow officers overseas to utilize online communication technology more effectively, especially where satellite phones are not an option. Lastly, it may also be feasible for surveillance and reconnaissance devices (such as cameras) to be attached to the devices in order to capture images from a much closer distance than that at which satellites currently orbit (approximately 20 kilometers versus 300 kilometers for a low-flying satellite). Indeed, the Stratobus is already including surveillance as a primary purpose.

Current State of Affairs

Google's Project Loon, the most developed venture, investigates the possibility of providing inexpensive, reliable Internet to unconnected parts of the world (presently 5 billion people) via chains of weather balloons.⁸⁷ These leak-proof polyethylene plastic balloons are 12 meters tall by 15 meters wide when fully inflated, and have a surface area of 500 square meters.⁸⁸ Once launched to 20 kilometers above ground, they circle the globe three times, for 100 days, providing connection to a 40-kilometer radius on the ground at 3G-comparable speeds by passing along internet signals from ground stations to other Project Loon balloons, creating a daisy chain of connectivity. Using wind and weather data from the National Oceanic and Atmospheric Association and internal sensors, it is possible to control a balloon's location by determining which wind currents balloons follow, which is done by opening and closing a valve to release helium.⁸⁹ This ensures that the chain of balloons remains unbroken and the Internet connection remains stable. A pump can be activated to raise the balloon's altitude and each balloon houses an insulated lithium ion battery, a variety of sensors, and the receiver itself. The battery pack runs exclusively off of solar power. Sensors collect 184 types of meteorological and weather information that is used to best direct the balloon. Red antennas are affixed to houses and community hot spots on the ground, which receive the signal from the balloons. These ball-shaped ground antennas, made of a radio in the lower section of the sphere and the antenna in the upper section, are dual-polarized to fix the issue of cross-polarization and also provide twice as much bandwidth. Waves are caught off of a reflector plate and directly from the balloon itself.

Facebook's Connectivity Lab, launched in March 2014 and staffed by former-NASA aerospace gurus and British drone experts, will investigate other types of Internet provision,

5-7 Year Outlook

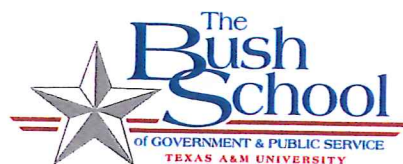
As none of these projects is functional yet, the legal issues for these companies and projects are still unclear, though the regulations will have to be set forth soon, as a bill passed in 2012 requires that the Federal Aviation Administration create drone regulations by November 2015.⁹⁵ Free balloons, on the other hand, are governed under Title 14 Part 101 of the federal code. The United Nations codes are also unclear. Many legal questions are unanswered, such as national airspace and who governs the stratosphere, whether these balloons may be brought down or interfered with, and to what jurisdictions these devices are subject.⁹⁶ Depending on the system, countries may still be able to censor the Internet content their citizens can access, though it may be possible to find a way around these restrictions. On a more practical level, it may be necessary for the global community to come to a consensus on a number of technical issues, such as which parts of the spectrum will be used.

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including the use of solar-powered high-altitude drones in suburban areas and low-orbiting satellites in rural areas.⁹⁰ The Lab will also attempt to use invisible infrared laser beams to ensure high-speed connections. Facebook hopes that its drones will remain functional for years, outlasting Google's balloons significantly.

Finally, a consortium led by France's Thales Alenia Space is working on an autonomous airship called the Stratobus that can be launched like a blimp but can also hover in a stationary fashion.⁹¹ The device is considered a cross between a satellite and a drone, and can carry a 91-kilogram payload. Though one function of the Stratobus will be internet provision, it will also have many more possible applications, including border and maritime surveillance, observation, security, telecommunications, broadcasting, and navigation.

Though the groups are all at different stages of development, no device is operational yet. Project Loon launched its first pilot test in Christchurch, New Zealand, the summer of 2013. Fifty residents of rural New Zealand without access to reliable Internet participated in the test, which was largely successful. The pilot test has continued, and a ring of 300 weather balloons around the 40th parallel is currently being established.⁹² As of December 2013 Project Loon was looking for pilot testers in rural California, and Google will continue to test and improve their designs, expecting to be operational by 2020.⁹³ Facebook's lab is only in its nascent stages, and though it appears some research has been started, there is much left to do before any designs are released. Thales Alenia Space's Stratobus is also still in the design phase, though a prototype is expected in the next five years.⁹⁴



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Women in Intelligence



Women in Intelligence

The Trend

Women in emerging markets—most notably those of Brazil, Russia, India, China, and the UAE—are significantly increasing their representation in terms of females earning tertiary degrees and participating in the global workforce. It is significant that these women are working in important positions of power, often at rates higher than the United States. While more women in the U.S. have been receiving college degrees at all levels and do well on lower rungs of the career ladder, American women continue to be significantly under-represented in top-level business and political positions.⁹⁷ Among other things, the lack of child care options pose one of the greatest barriers to women obtaining powerful position in business and politics, issues that are not as prevalent in these emerging markets.⁹⁸

Implications for the IC

The increased amount of women working and holding positions of power in emerging markets will make women in the U.S. intelligence community an increasingly valuable asset. When collecting HUMINT in these countries, more women in positions of power mean that more women will need to be recruited as agents. Therefore, the IC will require more female case officers, to both better fit the changing demographic of these countries' workforces and to accommodate the increasing number of female agents recruited. However, this means that in these areas it will be harder for female case officers to utilize being underestimated by those in positions of power, who have historically been predominantly male. Put simply, it will be harder for women to gain information by "playing dumb."⁹⁹

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There are other important reasons the IC should hire more women. For instance, women possess incredible leadership skills. Research spanning thirty years and over seven thousand leaders has shown that “at every level, more women were rated by their peers, bosses, their direct reports, and their other associates as better overall leaders than their male counterparts—and the higher the level, the wider the gap grows... At all levels, women were rated higher in fully 12 of the 16 competencies that go into outstanding leadership. And two of the traits where women outscored men to the highest degree—taking initiative and driving for results—have long been thought of as particularly male strengths.”¹⁰⁰

The FBI even notes that the presence of female Special Agents can be extremely useful, writing that they have “different skills, approaches, and talents often spell the difference between success and failure on a case or investigation. We have found that investigative teams composed of a blend of female and male Special Agents are much more effective at bringing complex investigations to a speedy and successful resolution.”¹⁰¹ This is on par with research demonstrating that groups have a higher collective intelligence when they include women. In fact, there is not a correlation between the individual IQs of group members and the group’s collective intelligence. Though, the more women present in a group, the higher the group’s collective intelligence.¹⁰²

While some of the differences between men and women are sociological, neuroscientists have found that while men’s brains overall are “optimized for motor skills,” women’s brains are “optimized for combining analytical and intuitive thinking.”¹⁰³ Michael Scheuer, who led the unit that found Osama bin Laden, publicly highlighted women’s talent at analysis when he stated the women in the unit were “extraordinarily adept at both mastering the kind of detailed



information that's key to counterterrorism, but also very, very insightful in mapping out relationships... I would have been happy to put up a sign outside my office that read, 'No men need apply.'"¹⁰⁴

Current State of Affairs

The percentage of women participating in the American workforce has remained stagnant since 1990, with 74% of American women participating.¹⁰⁵ As of 2011, 46% of CIA employees are women, and while this may look like women are reaching parity within the Agency, only one out of five female officers are promoted to the Senior Intelligence Service.¹⁰⁶ This means the IC is not utilizing women to its full potential. Like other organizations and corporations, this lack of representation at higher ranks is in part due to lack of available and affordable healthcare.¹⁰⁷ For instance, not only is the U.S. the only industrialized country to not mandate paid maternity leave, it is one of only four countries in the entire world.¹⁰⁸

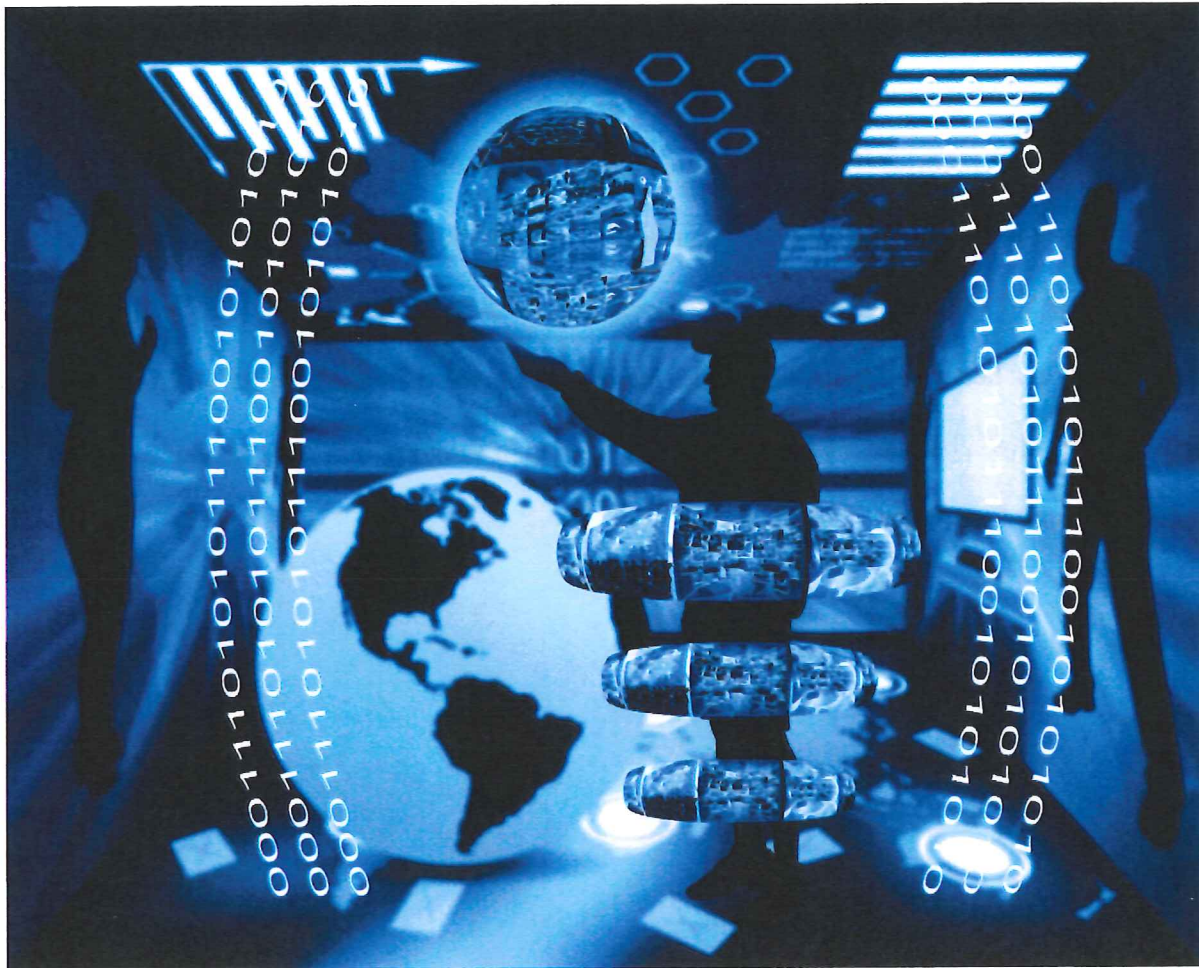
Additionally, in the U.S., only 3% of CEOs are women. However, women represent 11% of India's CEO's and 12% of Brazil's.¹⁰⁹ Within the BRIC countries, women control two-thirds of consumer spending as their earnings are growing at twice the rate of their male counterparts.¹¹⁰ These numbers will continue to rise, since women in BRIC countries and UAE are also remarkably ambitious—between fifty and sixty percent more than their U.S. counterparts.¹¹¹

5-7 Year Outlook

While the ambitious women in emerging markets will continue to acquire positions of power within business and politics, American women overall are increasing their education but not workforce participation or positions of power. As long as structural barriers like lack of childcare and an latent sexual prejudice exist, the IC will continue to miss out on the various benefits increased women in the IC may offer. The IC could also face difficulties collecting HUMINT in these countries if there are not enough qualified female case officers applying to the IC or remaining in the IC after they start families. It is our belief, however, as well as our hope, that in the next 5-7 years there will be more recognition of the greater need for women in the IC. This is based on a better understanding of the increase in the role of women in BRIC countries and the studies cited above related to the value of women in analysis, targeting, group performance, and leadership.

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Rampant Technology Reliance



Generation Z

The Trend

Innovations in technology increase at an exponential rate. This means that each new generation faces dramatically different scientific advancements than its predecessors. While these improvements provide us with numerous advantages to make our lives easier and our work more efficient, technology is not exclusively beneficial and there are always tradeoffs. Threats and vulnerabilities arise when technology becomes so pervasive that its users become reliant on it. This makes for an interesting question of how our most recent generation, a generation that has grown up with far more exposure to technology at a much younger age than any other, will affect the intelligence community?

Implications for the IC

This generation, referred to as Generation Z and its members as Zeds, consists of those born in the year 2000 and later, and will have various distinguishing qualities due to their reliance on technology that will overall negatively affect their potential as future case officers.

For instance, while Zeds get plenty of practice chatting online and through text messages, they are less adept at social interaction.¹¹² Social skills are imperative for gathering intelligence, recruiting agents, and conveying information to policymakers, but they diminish as communication occurs increasingly through virtual means instead of face-to-face interaction. This leads to decreased emotional intelligence, a necessity to master the arts of manipulation and deception.

Zeds' prominently virtual social lives will have other implications. Generation Z is very active in social networking sites, even as children. This means they will have an enormous digital footprint, which will inhibit their ability to maintain aliases while operating covertly.

The current epidemic of childhood obesity¹¹³ will also likely follow Zeds into adulthood, meaning Generation Z will face many health issues.¹¹⁴ Research has also demonstrated a negative correlation between obesity and cognitive function.

Zeds may also be more impatient and forgetful with their shorter attention spans. While this has obvious negative implications for them as analysts, their higher propensity for ADD¹¹⁵ could actually enhance one aspect of their effectiveness as case officers, since those with ADD are more attune to their surroundings and tend to notice things in their environment others may overlook.¹¹⁶

While being tech-savvy may make a person distinguishable in the present, Generation Z is so accustomed to using technology that this will be their trademark and they will be individually unremarkable in this respect. In fact, Zeds may be increasingly less resourceful. For example, when you grow up with devices telling you how to get everywhere you need to go, navigating in unfamiliar areas may prove impossible with only an old-fashioned map and compass.

Current State of Affairs

These are just a few examples of how the distinctive qualities of Generation Z will impact the next generation of analysts and case-officers. Some may question how Zeds differ from millenials, those from Generation Y. Though Generation Y can also be characterized as

increasingly tech-reliant and little separates those born near either side of the transitioning millennia, the amount of technology surrounding the youngest children of Generation Z stands in stark contrast to that of the oldest of Generation Y. Millennials, after all, remember a time when cassette tapes, floppy disks, and fax machines were considered high-tech.

5-7 Year Outlook

In the next five to seven years, Zeds will begin to enter college and finally the work force, increasing their influence. There will be more research and analysis available at this time regarding this generation and their potential implications for the IC. Data collected in the present should be compared with future research to gain a firmer understanding of how technology usage impacts children and adolescents. The cliché “children are our future” is especially applicable to the intelligence community in this respect.

“Internet of Things”

The Trend

Since the invention of the first Internet-capable refrigerator by LG in 1999, “smart appliances”—appliances connected to the Internet—have become more and more popular.¹¹⁷ Costing \$20,000, LG’s refrigerator was largely ignored by consumers, who considered it too expensive and unnecessary. However, a decade and a half later, smart appliances in the home are slowly becoming the norm, with most major manufacturers carrying a line of connected devices that can be controlled remotely via smartphone application. As these devices proliferate, a higher level of connectivity between them has emerged, ultimately combining into what has been coined the “Internet of Things.”

Implications for the IC

Cybercriminals are planting mobile malware and hacking into smart appliances, as earlier this year fridges were used to send spam emails.¹¹⁸ Many smart devices are not equipped with the same anti-virus and anti-malware protection that computers and laptops have, so this will likely continue to be a problem. Webcams and microphones, ostensibly embedded in products for voice command and video chat purposes, may be hacked for video and audio surveillance and interception. Even without cameras, accessing these devices will help build a reliable pattern of life, as they would record when a person is frequently home or away and what his or her habits are once inside. Many of these products can be controlled from outside the home via smartphone application, and could be used to provide real-time warnings to officers, such as an air-conditioner being turned on in preparation for an occupant’s arrival. Hacking these appliances

can be used to target a subject psychologically, from starting a kitchen fire by turning the oven on, to continuously flickering the lights and sounds of the house, instilling nervousness or fear. Of course, these capabilities can easily be employed against us, so the intelligence community would have to live in such a way that these structural changes did not make them vulnerable as well.

Current State of Affairs

Currently, Whirlpool offers smart dishwashers, refrigerators, and a washer/dryer line that all feature the 6th Sense Live Technology, allowing users to remotely access temperature settings, energy usage, and a power switch.¹¹⁹ GE's line of Brillion-enabled ovens can be turned on and off remotely, can alert users to maintenance needs, and can signal cooking statuses.¹²⁰ Samsung rolled out its first touchscreen-enabled refrigerator in 2011, running applications such as Pandora and Google email.¹²¹ An air conditioner currently sold in South Korea can check the weather and adjust the temperature and humidity accordingly. Equipped with video cameras, it also acts as a home monitoring system.¹²²

Innovation extends beyond the products themselves, as manufacturers have now come out with appliances that "talk" to each other: a refrigerator can alert the television that the refrigerator door has been left open or a washer can transfer settings to a dryer when a load is ready to switch. Automation hubs that control multiple appliances and systems are also being produced, and major retailers such as Staples and Lowe's are working on integrating with these.¹²³ Google recently purchased Nest, a company that produces smart thermostats and smoke detectors.¹²⁴ Nest's products learn from human behavior by tracking data to automatically

program settings, and can also communicate with other Nest devices throughout the country to create a bigger aggregate picture of consumer usage.

5-7 Year Outlook

Because home appliances are usually only purchased to replace an older, often broken model, the proliferation of smart appliances is not expected to occur completely in an immediate fashion. However, this kind of connectedness, also called the “Internet of Things,” has already become a well-established trend, particularly for wealthier or more tech-savvy groups, and so it is not unwise to expect the rest of the population to follow. Defined as “the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment,” the Internet of Things moves beyond home appliances and smartphones.¹²⁵ It includes everything from wireless cardiac monitors, sensors used on cattle to give farmers bovine fertility information, and alarm clocks connected to a specified train schedule for real-time alerts.¹²⁶ This kind of integration will ultimately increase our reliance on technology and may completely change our patterns of living as a society.

Increased Use of Domestic UAVs

The Trend

Unmanned Aerial Vehicles (UAVs) are becoming commonplace in everyday lives. Militarily, UAVs are beginning to make up a larger portion of modern forces. They are used consistently for surveillance, defensive, and offensive purposes by the government and within the international arena. However, federal, state, and local law enforcement; foreign nations; and now domestic companies, such as Amazon, are experimenting with UAV package delivery systems.¹²⁷ This could result in a vast proliferation of UAVs across the globe.

Implications for the Intelligence Community

Security concerns arise in the form of hacking and undetectable surveillance, as drones could potentially become common and relatively inconspicuous in the skies. Hacking these non-lethal drones can lead to varying degrees of threats, from simple information theft to shipment hijacking. The latter threat could lead to events similar to 9/11, depending on the size of the drone. Additionally, as drones become more prevalent, they will also become more discreet. This would allow them to become virtually undetectable while in plain sight, collecting data or hacking computers and cell phones. The implications here go two ways: first, the gathering of intelligence may become easier and, second, operatives and case officers must become increasingly aware that drones are becoming increasingly available to enemies. The intelligence community must expect that foreign nations will send drones over US targets to supplement or replace satellite surveillance.¹²⁸ Specifically, the intelligence community could equip drones with

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Wi-Vi, Xaver, infrared, and other technologies mentioned in this report and use the drones to perform overhead surveillance that might see through the roofs and walls of a target.

Current State of Affairs

As stated previously, federal, state, and local officials are using drones, and Amazon recently announced that they are looking at UAV package delivery. Although FedEx CEO Fred Smith disagrees, many other private companies are likely to follow suit.¹²⁹ At a recent conference related to an ongoing study of drones conducted by Texas A&M-Corpus Christi, approximately 150 private employers expressed an interest in the technology. There have also been numerous reports of foreign nations using drones.

Currently, security expert Todd Humphreys announced that that he could hack into military drones relative ease, following up this claim by grounding an \$80,000 drone during a demonstration for the Department of Homeland Security. The grounding was merely an example to raise awareness about drone susceptibility to cyber-attacks. However, this gives way to further implications as cyber security is increasingly threatened. In an interview, Humphreys claimed that it was his greatest fear that a teenager could simply download an app and redirect UAV traffic in the near future.¹³⁰ Furthermore, researchers Glenn Wilkinson and Daniel Cuthbert have successfully tested Snoopy: drone technology that will autonomously hack into Wi-Fi-capable devices and gather information from it.¹³¹

5-7 Year Outlook

As UAV technology advances, the prospect for increased domestic non-lethal UAV usage is not only probable, but also inevitable. The sky may be full of small drones in the next ten years, and their potential usage could span from product delivery to police surveillance.¹³² The experimentation and investment by private companies with small UAVs, such as Amazon, reveal that this trend of increased UAV usage is already occurring. The American Civil Liberties Union and other organizations are working to establish numerous laws to govern the usage of domestic UAVs. This legal trend shows that governmental and private agencies both agree that the prevalence of future UAV traffic is unavoidable. The FAA, as of this date, has not caught up in regulating drones, although it is expected some legal guidance may be implemented in the future.¹³³

Bibliography

- ¹ Healthier Dewey-Hagborg, "Stranger Visions," CNN, 7 September 2013. Press Release. deweyhagborg.com/strangervisions/press_release.pdf.
- ² Ibid. Dewey-Hagborg, 2013.
- ³ 2014. Forensic DNA Ethics "About Forensic DNA Phenotyping," forensicednaethics.org/about/about-fdp/.
- ⁴ Herper, Matthew "Artist Creates Portraits From People's DNA. Scientists Say 'That's Impossible'" 31 March 2013. www.forbes.com/sites/matthewherper/2013/05/31/turning-found-dna-into-portraits-what-an-imagination/.
- ⁵ Angley, Natalie "Artist creates faces from DNA left in public," CNN Tech. 4 September, 2013. www.cnn.com/2013/09/04/tech/innovation/dna-face-sculptures/
- ⁶ Claes, Peter., Liberton, Denise., Matthes Kerri., et. all. 2014. "Modeling 3D Facial Shape from DNA" *PLoS Genetics*.
- ⁷ Kooops, Bert-Jaap. Schellekens, Maurice. 2008. "Science and Technology Law Review." *The Columbia* p.165.
- ⁸ Ibid. Kooops, Schellekens. 2008.
- ⁹ Healthier Dewey-Hagborg, Telephone Conversation, Interview, 31 March 2014.
- ¹⁰ Arthur, Charles. 2010. "Augmented Reality: its like real life, but better." *The Guardian*. March 20. <http://www.theguardian.com/technology/2010/mar/21/augmented-reality-iphone-advertising>. (April 20, 2014).
- ¹¹ Nguyen, Tuan. 2014. "Will These Augmented-Reality Contact Lenses Replace Your Smartphone?." January 14. <http://www.smithsonianmag.com/innovation/will-these-augmented-reality-contact-lenses-replace-your-smartphone-180949342/?no-ist>. (March 20, 2014).
- ¹² Rickwood, Lee. 2014. "Forget Google's Glasses – Try Space Glasses, From Canadian Inventor Steve Mann, the Father of Augmented Reality." March 1. <http://whatsyourtech.ca/2014/03/01/forget-googles-glasses-try-space-glasses-from-canadian-inventor-steve-mann-the-father-of-augmented-reality/> (March 20, 2014).
- ¹³ Thomas, Emily. 2014. "Night-Vision Contact Lenses That Use Infrared Technology May Soon Be Possible, Researchers Say." *Huffington Post*. March 20. http://www.huffingtonpost.com/2014/03/20/night-vision-contact-lenses_n_4992829.html. (Accessed March 20, 2014).
- ¹⁴ Google. "Glass Help." <http://www.google.com/glass/help/>. (April 4, 2014).
- ¹⁵ *fraunhofer.de*. "Data glasses controlled by eye movement." <http://www.fraunhofer.de/en/research-topics/information-communication/display-projection-technologies/data-glasses-controlled-by-eye-movements.html>. (April 4, 2014).
- ¹⁶ CBS News. 2014. "Google contact lens may have integrated camera, report says." April 16. <http://www.cbsnews.com/news/google-contact-lens-may-have-integrated-camera-report-says/>. (Accessed April 16, 2014).
- ¹⁷ Coldeway, Devin. 2014. "Google applies for patent on contact lens camera." CNBC. April 16. <http://www.cnbc.com/id/101588595>. (Accessed April 17, 2014).
- ¹⁸ Tofel, Kevin C. 2012. "Forget Google Glasses; check these dual-focus contact lenses." *Gigaom*. April 13. <http://gigaom.com/2012/04/13/forget-google-glasses-check-these-dual-focus-contact-lenses/>. (Accessed March 20, 2014)
- ¹⁹ 2014. Innovega Inc. – Product. <http://innovega-inc.com/new-architecture.php>. (February, 17, 2014).
- ²⁰ Kelly, Samantha Murphy. 2014. "Smart Contact Lenses Will Give You Superhuman Vision." Mashable. January 8. <http://mashable.com/2014/01/08/smart-contact-lenses/>. (Accessed April 12, 2014).
- ²¹ 2013. "Meta-SpaceGlasses." <https://www.spaceglasses.com/>. (March 20, 2014).
- ²² Angley, Natalie. 2013. "Glasses to make you a real-life Tony Stark." CNN. October 31. <http://www.cnn.com/2013/10/31/tech/innovation/meta-augmented-reality-glasses/>. (Accessed March 20, 2014).
- ²³ Daily Mail Reporter. 2013. "Mission Impossible-style contact lenses that can take pictures and scan data are a step closer to reality as scientists developed LED soft lenses." *Daily Mail*. May 31. <http://www.dailymail.co.uk/news/article-2334257/Mission-Impossible-style-contact-lenses-pictures-scan-data-step-closer-reality-scientists-develop-LED-soft-lenses.html>. (Accessed March 20, 2014)

- ²⁴ Hof, Robert. 2014. "Why is Facebook Acquiring the Maker of a Virtual Reality Headset You Can't Even Buy Yet?." *Forbes*. March 24. <http://www.forbes.com/sites/roberthof/2014/03/25/why-is-facebook-buying-the-maker-of-a-nonexistent-virtual-reality-headset/>. (Accessed March 25, 2014)
- ²⁵ Saffo, Paul. 2014. "Google Glass Signals a Wearables Revolution." April 16th. *CNN Opinion*. <http://www.cnn.com/2014/04/16/opinion/saffo-google-glass/>.> Accessed April 17th, 2014).
- ²⁶ Och, Franz. 2012. "Breaking down the language barrier—six years in." April 2012. Accessed: March 27, 2014. <<http://googletranslate.blogspot.com/2012/04/breaking-down-language-barriersix-years.html>>.
- ²⁷ Dorrier, Jason. 2013. "DOCOMO SHOWS GLASSES THAT TRANSLATE FOREIGN LANGUAGES RIGHT IN FRONT OF YOUR EYES." October 2013. Accessed: March 27, 2014. <<http://singularityhub.com/2013/10/28/docomo-shows-glasses-that-translate-foreign-languages-right-in-front-of-your-eyes/>>.
- ²⁸ Grother, Patrick J., George P. Quinn, and P. Jonathon Phillips. 2011. "Report on the Evaluation of 2D Still-Image Face Recognition Algorithms." *National Institute of Standards and Technology*. 2.
- ²⁹ Ibid, 2.
- ³⁰ Kumar, Shishir, Priyank Singh, and Vivek Kumar. 2010. "Architecture for Mobile Based Face Detection/Recognition." *International Journal on Computer Science and Engineering* 2 (3): 889-894. 889.
- ³¹ Choi, Kwontaeg, Kar-Ann Toh, and Hyeran Byun, 2011. "Realtime Training on Mobile Devices for Face Recognition Applications." *Pattern Recognition* 44L 386-400. 386-87.
- ³² BI2 Technologies, 2009. "Mobile, Wireless, and Hand Held Offender Recognition and Information System." Accessed: March 20, 2014. <<http://www.bi2technologies.com/sites/default/files/documents/MORIS-Brochure.pdf>>
- ³³ Mullin, Sean G. 2012. "Mobile, Wireless, Hand-Held Biometric Capture, Processing, and Communication System and Method for Biometric Identification." *United States Patent Application Publishing*, US 2012/0102332. 1.
- ³⁴ Ibid., 2.
- ³⁵ Lochner, Sabrina A. 2013. "Saving Face: Regulating Law Enforcement's Use of Mobile Facial Recognition Technology & Iris Scans." *Arizona Law Review* 55: 201-203. 208.
- ³⁶ Mullin, 2.
- ³⁷ Taigman, Yaniv, Ming Yang, Marc Aurelio Ranzato, and Lior Wolf. 2013. "DeepFace: Closing the Gap to Human-Level Performance in Face Verification." 2-4.
- ³⁸ Ibid, 4.
- ³⁹ Ibid, 1.
- ⁴⁰ Simonite, Tom. 2014. "Facebook Creates Software That Matches Faces Almost as Well as You Do." *MIT Technology Review*. March 17th. <http://www.technologyreview.com/news/525586/facebook-creates-software-that-matches-faces-almost-as-well-as-you-do/> (Accessed April 10th, 2014).
- ⁴¹ Lochner, 207.
- ⁴² Knight, Helen. 2013. "New System Uses Low-Power Wi-Fi Signal to Track Moving Humans- Even behind Walls." *MIT News*. June 28. <<http://newsoffice.mit.edu/2013/new-system-uses-low-power-wi-fi-signal-to-track-moving-humans-0628>> (Accessed February 10th, 2014).
- ⁴³ Camero. "Xaver Products: Product Line." <http://www.camero-tech.com/products.php> (April 17th, 2014).
- ⁴⁴ Camero. "Technology: General." <http://www.camero-tech.com/technology.php?ID=14> (Accessed April 17th, 2014).
- ⁴⁵ BBC News. 2014. "Google Unveils Smartphone With 3D Sensors." February 20th. <http://www.bbc.com/news/technology-26284210> (Accessed April 17th, 2014).
- ⁴⁶ Camero. "Xaver Products: Xaver 400." <http://www.camero-tech.com/product.php?ID=39> (Accessed April 18th, 2014).
- ⁴⁷ Camero. "Xaver Products: Xaver 800." <http://www.camero-tech.com/product.php?ID=40> (Accessed April 18th, 2014).
- ⁴⁸ Camero. "Xaver Products: Xaver 100." <http://www.camero-tech.com/product.php?ID=38> (Accessed April 18th, 2014).
- ⁴⁹ Adib and Katabi, 7.

⁵⁰ Lardinois, Frederic. 2014. "Google Launches Project Tango Smartphone to Experiment With Computer Vision and 3D Sensors." February 20th. <http://techcrunch.com/2014/02/20/google-launches-project-tango/> (Accessed April 18th, 2014).

⁵¹ Adib, Fadel and Dina Katabi. 2013. "See Through Walls with Wi-Fi!" *Massachusetts Institute of Technology*. <http://people.csail.mit.edu/fadel/papers/wivi-paper.pdf>, 1.

⁵² Gollakota, Shyamnath, Fadel Adib, Dina Katabi, and Srinivasan Seshan. "Clearing the RF Smog: Making 802.11 Robust to Cross-Technology Interference." *Massachusetts Institute of Technology and Carnegie Mellon University*. <http://people.csail.mit.edu/fadel/papers/timo-paper.pdf>, 8.

⁵³ Camero. "Xaver 100: Handheld, Through-Wall Life Detector." http://www.camero-tech.com/files/files/Xaver100_web.pdf (Accessed April 18th, 2014).

⁵⁴ Camero. "Xaver 400: Compact, Tactical Through-Wall Imaging System." <http://www.camero-tech.com/files/files/Xaver400.pdf> (Accessed April 18th, 2014).

⁵⁵ Camero. "Xaver 800: High Performance ISR Portable Through-Wall Imagine System." <http://www.camero-tech.com/files/files/Xaver800.pdf> (Accessed April 18th, 2014).

⁵⁶ Camero. "Xaver 100: Handheld, Through-Wall Life Detector."

⁵⁷ Camero. Xaver 800. "Xaver 800: High Performance ISR Portable Through-Wall Imagine System."

⁵⁸ Panzarino, Matthew. 2014. "Inside the Revolutionary Computer Vision Chip at the Heart of Google's Project Tango Phone." February 20th. <http://techcrunch.com/2014/02/20/inside-the-revolutionary-3d-vision-chip-at-the-heart-of-googles-project-tango-phone/> (Accessed April 18th, 2014).

⁵⁹ Google. 2014. "ATAP Project Tango." <https://www.google.com/atap/projecttango/> (Accessed April 18, 2014).

⁶⁰ Lardinois, 2014.

⁶¹ Halfacree, Gareth. 2013. "BadBIOS malware claimed to defeat air-gaps." November 1. <http://www.bit-tech.net/news/bits/2013/11/01/badbios/1>. (Accessed April 4, 2014).

⁶² *pcworld.com*. 2013. "Researchers create malware that communicates via silent sound, no network needed." December 3. <http://www.pcworld.com/article/2068525/researchers-create-malware-that-communicates-via-sound-no-network-needed.html>. (Accessed March 3, 2014)

⁶³ *infoworld.com*. 2013. "4 reasons BadBIOS Isn't real." November 12. <http://www.infoworld.com/d/security/4-reasons-badbios-isnt-real-230636>. (Accessed April 16, 2014).

⁶⁴ *businessinsider.com*. 2013. "US NAVY: Hackers 'Jumping the Air Gap' Would 'Disrupt the World Balance Of Power.'" November 19. <http://www.businessinsider.com/navy-acoustic-hackers-could-halt-fleets-2013-11>. (Accessed February 28, 2014).

⁶⁵ *arstechnica.com*. 2013. "Scientists-developed malware prototype covertly jumps air gaps using inaudible sound." December 2. <http://arstechnica.com/security/2013/12/scientist-developed-malware-covertly-jumps-air-gaps-using-inaudible-sound/>. (Accessed February 4, 2014).

⁶⁶ Hanspach, Michael and Goetz, Michael. 2013. "On Covert Acoustical Mesh Networks in Air." *Journal of Communications*. November. <http://www.jocm.us/uploadfile/2013/1125/20131125103803901.pdf>. March 12, 2014.

⁶⁷ 2013. "Computers can covertly communicate via audio signals." <http://www.fkie.fraunhofer.de/de/presse/pressemitteilungen-2013/covert-communication-via-audio.html>. March 7, 2014.

⁶⁸ Hanspach, Michael and Goetz, Michael. 2013. "On Covert Acoustical Mesh Networks in Air." *Journal of Communications*. November. <http://www.jocm.us/uploadfile/2013/1125/20131125103803901.pdf>. March 12, 2014.

⁶⁹ Hanspach, Michael and Goetz, Michael. 2013. "On Covert Acoustical Mesh Networks in Air." *Journal of Communications*. November. <http://www.jocm.us/uploadfile/2013/1125/20131125103803901.pdf>. March 12, 2014.

⁷⁰ Halfacree, Gareth. 2013. "BadBIOS malware claimed to defeat air-gaps." November 1. <http://www.bit-tech.net/news/bits/2013/11/01/badbios/1>. (Accessed April 4, 2014).

⁷¹ Interview with Michael Hanspach

⁷² Interview with Michael Hanspach

⁷³ Interview Dr. Eric Leuthardt

⁷⁴ <http://www.whitehouse.gov/share/brain-initiative>

⁷⁵ Interview Dr. Gerwin Schalk

⁷⁶ Interview Dr. Eric Leuthardt

- ⁷⁷ Money; Ideology; Coercion; Ego
- ⁷⁸ See BrainCopter app by Neurologic
- ⁷⁹ Interview with Dr. Gerwin Schalk
- ⁸⁰ Rat and money experiments
- ⁸¹ Interview, Dr. Gerwin Schalk
- ⁸² Converus. 2014. "The Deception Detection Technology of Tomorrow Has Arrived." Accessed: March 27, 2014. <<http://converus.com/features-benefits/>>.
- ⁸³ Hopkins, Clifford. 2005. "Evaluation of Voice Stress Analysis Technology." Lockheed Martin IT and Air Force Research Laboratory. Accessed: March 27, 2014. <<http://www.secintel.com/media/pdf/FV-VSASTUDY.pdf>>.
- ⁸⁴ Clark, Liat. 2012. "Filtered Glasses Highlight Blood Vessels Under the Skin." *Wired UK*. Accessed 13 February 2014. <<http://www.wired.co.uk/news/archive/2012-06/20/glasses-highlight-blood>>.
- ⁸⁵ 2AI Labs. 2014. O2Amp Selector Card. Accessed 13 February 2014. <<http://o2amp.com/pdfs/oxyamp.pdf>>.
- ⁸⁶ Manchester Metropolitan University (MMU). 2003. "Intelligent lie-detector." January 2003. Accessed: March 27, 2013. <<http://www.mmu.ac.uk/news/articles/77/>>.
- ⁸⁷ Google. 2014. "Project Loon." <http://www.google.com/loon/>
- ⁸⁸ YouTube. 2014. "Project Loon." <https://www.youtube.com/user/ProjectLoon>
- ⁸⁹ Levy, Steven. 2013. "The Untold Story of Google's Quest to Bring the Internet Everywhere—By Balloon." 13 August. <http://www.wired.com/2013/08/googlex-project-loon/>
- ⁹⁰ Kelly, Heather. 2014. "Facebook looks to drones, lasers and satellites for Internet access." 28 March. <http://www.cnn.com/2014/03/27/tech/innovation/facebook-drones-lasers-connectivity/>
- ⁹¹ Thales Group. 2014. "Stratobus—Halfway between drone and satellite." 10 March. <https://www.thalesgroup.com/en/worldwide/space/case-study/stratobus-halfway-between-drone-and-satellite>
- ⁹² Williams, Owen. 2014. "Track Google's Project Loon Internet balloons in real time as they travel the world." 1 March. <http://thenextweb.com/google/2014/03/01/track-googles-project-loon-balloons-travel-world/#!AKSaw>
- ⁹³ Zisengwe, Melissa. 2013. "Project Loon: Google's balloon-powered internet." 18 October. <http://www.grocotts.co.za/content/mymakana/mystory/project-loon-googles-balloon-powered-internet-18-10-2013-0>
- ⁹⁴ Thales Group. 2014. "Stratobus—Halfway between drone and satellite." 10 March. <https://www.thalesgroup.com/en/worldwide/space/case-study/stratobus-halfway-between-drone-and-satellite>
- ⁹⁵ Butler, Will. 2013. "Can we trust Google with the Stratosphere?" 20 August. <http://www.theatlantic.com/technology/archive/2013/08/can-we-trust-google-with-the-stratosphere/278797/>
- ⁹⁶ Worstall, Tim. 2013. "Google's Project Loon Problem: International Bureaucracy." 23 June. <http://www.forbes.com/sites/timworstall/2013/06/23/googles-project-loon-problem-international-bureaucracy/>
- ⁹⁷ NPR Staff. 2013. "Want More Gender Equality at Work? Go to an Emerging Market." April 22. <http://www.npr.org/2013/04/22/177511506/want-more-gender-equality-at-work-go-to-an-emerging-market>
- ⁹⁸ Ibid., NPR Staff, 2013; Hewlett, Sylvia Ann and Ripa Rashid. 2010. "The Globe: The Battle for Female Talent in Emerging Markets." *Harvard Business Review*. May. <http://hbr.org/2010/05/the-globe-the-battle-for-female-talent-in-emerging-markets/ar/1>; Hana R. Alberts. 2010. "The Potential of Women in Emerging Markets." *Forbes*. April 22. <http://www.forbes.com/2010/04/22/women-talent-workplace-china-india-brazil-forbes-woman-emerging-markets.html>.
- ⁹⁹ Raja, Tasneem. 2013. "The Secret History of CIA Women." *Mother Jones*. November 4. <http://www.motherjones.com/politics/2013/10/women-cia-history-sexism>. Coccozza, Paul. 2014. "Female spies are 'bloody good' – and it's partly because of sexism." *The Guardian*. March 31. <http://www.theguardian.com/world/shortcuts/2014/mar/31/women-really-do-make-bloody-good-spies>. Interview with Bush School professor who served over twenty-five years in the Directorate of Operations of the CIA and was the Chief of Counterintelligence at CIA headquarters. These sources all explained that, especially in more sexist and chauvinistic societies, women are able to use being underestimated to their advantage as case officers to gain information.
- ¹⁰⁰ Williams, Ray B. 2012. "Why Women May Be Better Leaders Than Men." *Psychology Today*. December 15. <http://www.psychologytoday.com/blog/wired-success/2012/12/why-women-may-be-better-leaders-men>
- ¹⁰¹ Federal Bureau of Investigation. "Female Special Agents." <https://www.fbijobs.gov/115.asp>

- ¹⁰² Woolley, Anita and Thomas Malone. 2011. "Defend Your Research: What Makes a Team Smarter? More Women." *Harvard Business Review*. June. <http://hbr.org/2011/06/defend-your-research-what-makes-a-team-smarter-more-women/ar/1>
- ¹⁰³ Lewis, Tanya and LiveScience. 2013. "How Men's Brains are Wired Differently than Women's." *Scientific American*. December 2. <http://www.scientificamerican.com/article/how-mens-brains-are-wired-differently-than-women/>
- ¹⁰⁴ Ibid., Raja, 2013.
- ¹⁰⁵ Kurtz, Annalyn. 2013. "Why 26 percent of women still choose not to work." *CNN Money*. August 13. <http://money.cnn.com/2013/08/13/news/economy/women-work-force/>
- ¹⁰⁶ Ibid., Raja, 2013.
- ¹⁰⁷ Ibid., Raja, 2013.
- ¹⁰⁸ *The Huffington Post*. 2014. "Paid Parental Leave: U.S. vs. The World." February 4. http://www.huffingtonpost.com/2013/02/04/maternity-leave-paid-parental-leave-_n_2617284.html
- ¹⁰⁹ Ibid., NPR Staff. 2013.
- ¹¹⁰ Hewlett, Sylvia Ann. 2013. "Winning the War for Talent in Emerging Markets: Why Women are the Solution." *Harvard Business Review*. <http://www.harvardbusiness.org/virtual-seminars/winning-war-talent-emerging-markets-why-women-are-solution>
- ¹¹¹ Ibid., Hewlett, Sylvia Ann and Ripa Rashid. 2010.
- ¹¹² JWT. 2012. "Gen Z: Digital in Their DNA." April. http://www.jwtintelligence.com/wp-content/uploads/2012/04/F_INTERNAL_Gen_Z_0418122.pdf
- ¹¹³ Rowan, Cris. 2014. "10 Reasons Why Handheld Devices Should be Banned for Children Under the Age of 12." *The Huffington Post*. March 06. http://www.huffingtonpost.com/cris-rowan/10-reasons-why-handheld-devices-should-be-banned_b_4899218.html
- ¹¹⁴ Centers for Disease Control and Prevention. 2014. "Childhood Obesity Facts." February 27. <http://www.cdc.gov/healthyyouth/obesity/facts.htm>
- ¹¹⁵ Stulberg, Brad. 2014. "Increase in ADHD Runs Parallel with Decrease in Physical Activity." *The Huffington Post*. February 26. http://www.huffingtonpost.com/brad-stulberg/adhd-exercise_b_4835640.html
- ¹¹⁶ Stein, Jeff. 2009. "CIA-Approved Psychiatrist Treats Cloak and Dagger Set's Woes." *The Huffington Post*. March 21. http://www.huffingtonpost.com/jeff-stein/cia-approved-psychiatrist_b_177671.html
- ¹¹⁷ LG. 2014. "History." <http://www.lg.com/global/about-lg/corporate-information/at-a-glance/history>
- ¹¹⁸ BBC. 2014. "Fridge sends spam emails as attack hits smart gadgets." 17 January. <http://www.bbc.com/news/technology-25780908>
- ¹¹⁹ Whirlpool. 2014. <http://www.whirlpool.com/smart-appliances/>
- ¹²⁰ GE. 2014. <http://www.geappliances.com/connected-home-smart-appliances/>
- ¹²¹ Samsung. 2014. <http://www.samsung.com/us/home-appliances/>
- ¹²² Finnamore, Chris. 2013. 15 August. "Samsung- Smart appliances are the future." <http://www.expertreviews.co.uk/general/1301596/samsung-smart-home-appliances-are-the-future>
- ¹²³ Wollerton, Megan. 2014. "Smart appliances, connect homes at CES 2014." 10 January. <http://www.cnet.com/news/smart-appliances-connected-homes-at-ces-2014/>
- ¹²⁴ Wohlsen, Marcus. 2014. "What Google Really Gets Out of Buying Nest for \$3.2 Billion." 14 January. <http://www.wired.com/2014/01/googles-3-billion-nest-buy-finally-make-internet-things-real-us/>
- ¹²⁵ Gartner. 2013. "Internet of Things." <http://www.gartner.com/it-glossary/internet-of-things/>
- ¹²⁶ Cisco. 2014. "Internet of Things." <http://share.cisco.com/internet-of-things.html>
- ¹²⁷ The Guardian. 2012. "Drones by country: who has all the UAVs?." August 3, 2012. <http://www.theguardian.com/news/datablog/2012/aug/03/drone-stocks-by-country>. April 1, 2014.
- ¹²⁸ UPI.com. 2012. "China increases naval UAV use." April 9, 2012. http://www.upi.com/Top_News/Special/2012/04/09/China-increases-naval-UAV-use/UPI-87321333977162. April 1, 2014.
- Defense News. 2014. "Russian Defense Ministry Unveils \$9B UAV Program." February 19, 2014. <http://www.defensenews.com/article/20140219/DEFREG01/302190031/Russian-Defense-Ministry-Unveils-9B-UAV-Program>. April 10, 2014.

¹²⁹ Huffington Post. 2013. "FedEx CEO Finds Delivery Drones 'Almost Amusing'." December 18, 2013.

http://www.huffingtonpost.com/2013/12/19/fedex-ceo-drones_n_4468218.html. April 1, 2014.

Wired. 2014. "Jeff Bezos Says Amazon Is Seriously Serious About Drone Deliveries." April 11, 2014.

<http://www.wired.com/2014/04/amazon-delivery-drones>. March 28, 2014.

DIY Drones. 2009. "Fred Smith: FedEx wants UAVs." February 12, 2009. <http://diydrones.com/profiles/blogs/fred-smith-fedex-wants-uavs>. April 1, 2014.

¹³⁰ Popular Mechanics. 2013. "What If They Try to Hack Amazon's Drones?." December 11, 2013.

<http://www.popularmechanics.com/technology/aviation/news/what-if-they-try-to-hack-amazons-drones-16256483>.
March 17, 2014

¹³¹ CNN Money. 2014. "This drone can steal what's on your phone." March 20, 2014.

<http://money.cnn.com/2014/03/20/technology/security/drone-phone/>. April 10, 2014

¹³² USA Today. 2013. "Concerns rise about growing use of domestic drones." July 18, 2013.

<http://www.usatoday.com/story/tech/2013/07/18/drone-concerns-rules-regulations/2552999>. April 10, 2014.

¹³³ American Civil Liberties Union. "Domestic Drones." <https://www.aclu.org/blog/tag/domestic-drones>. March 27, 2014.

