

Technological Privacy of Ubiquitous RFID Systems

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Abstract

The Radio-Frequency Identification (“RFID”) tag is commercially produced for object inventory tracking in the supply chain. The tags are typically affixed to shipping labels, product packaging, animals, or implanted in human beings. Because of their size and power source-less design, they can easily be hidden, making them ubiquitous.

RFID is becoming more widespread in the industry with patents issued for tracking both inside and outside of the supply chain. In particular, companies such as IBM, the Auto-ID Center, Wal-Mart, Procter & Gamble, and Gillette have been working to make external supply chain tracking a reality. This paper argues that:

1. RFID has merits for inventory tracking in the warehouse supply chain.
2. Usage of RFID technology outside of the warehouse supply chain for inventory tracking is a serious invasion of privacy.
3. Society should listen to what artists, hackers, and activists have to say regarding RFID technology.

Introduction

The advent of the barcode in 1974¹ has enabled individual objects to be tagged for scanned data retrieval. The inherent flaws of a barcode are the proximity read range and limited storage information; companies have been upgrading their existing infrastructure to encompass a wireless object scanning system which would allow instant inventory accounting. This scanning technology has the potential to cause a serious breach of privacy for consumers.

“The person, how you are as a flesh and blood human being, is not how the tech giants view you. They view you as an object and as inventory.”² The tech giants are striving toward an object infrastructure marked by ubiquitous computer chips, known as Radio-Frequency Identification (“RFID”) tags, which are pervasive and invisible. The companies pushing this technology include IBM, Auto-ID, Wal-Mart, Procter & Gamble, and Gillette, which supply many products to consumers. These companies, and others, have been preparing for years to integrate RFID tags into every manufactured object allowing complete lifespan tracking – this is happening without public forum or discussion. Consumers need to be aware of the current and future implications for carrying RFID chipped items which can be used to identify, track, and store information.

Companies and governmental agencies are researching uses of RFID to track inventory. People should not be considered inventory. In Section II, this paper will discuss the background of RFID

¹ Fox, Margalit. "Alan Haberman, Who Ushered In the Bar Code, Dies at 81." *NYTimes.com*. 15 June 2011. Web. 23 Apr. 2012. <http://www.nytimes.com/2011/06/16/business/16haberman.html?_r=2&hp>.

² Nikolettow, Greg. “The Human Microchipping Agenda – Hypnotized into the Mainframe by the Science of Gradualism.” *The Alternative View* 3. The Grand Thistle Hotel, Bristol, UK. 14 November, 2009. Conference Presentation.

technology and how it works. Section III will discuss where RFID tags are being implemented widespread in the supply chain. Section IV will talk about RFID being used in the marketing, sales, and tracking parts of the RFID industry. Section V will discuss artists and activists projects on RFID technology usage. Lastly, Section VI concludes the paper.

RFID Background and Usage

The Radio-Frequency Identification tag came about from humble beginnings as an early electronic music instrument before transitioning into a “spychip.”³ The theremin, invented by Leon Theremin, was the product of Russian research into proximity sensors in 1920. The device consisted of two antennas which would sense the position of the player’s hands in the air and generate an amplified tone; one hand would control the frequency, the other would control the volume. The sounds produced from the instrument were eerie and wailing which lead to its use in movie soundtracks. The United States embraced Theremin and even sponsored his research in radio waves. No one suspected that he was a Russian spy secretly sending information about the United States’ military technology to Stalin. The details of his mission and sudden return to Russia in 1938 remain a mystery.

Evidence of his research work surfaced in 1952, over 6 years after a group of Russian school children honored U.S. Ambassador Averell Harriman with a beautifully carved wooden replica of the Great Seal of the United States. Contained inside the plaque was an early form of RFID technology which, through radio waves, powered an internal microphone which picked up everything within the embassy residential office. The device was discovered during a secondary bug sweep and was dubbed by the American intelligence agencies as “The Thing.”⁴ The first government usage of RFID had been used as a spying device hidden within a Trojan horse.

Today, RFID technology has taken many forms and uses. A typical RFID tag contains two elements. The first is a small silicon computer chip, or integrated circuit, which stores a unique identification number or other information within memory. The chip can be configured to utilize read only memory (ROM), volatile read/write random access memory (RAM) or write once/read many memory (WORM).⁵ The chips vary in size and can even be as small as a particle of dust (see Smartdust⁶).

The second component of the device is the antenna for communication which is attached to the microchip. The antenna is often a flat and metallic coil. To achieve the greatest antenna length, the cable is typically wrapped around flat in a rectangular fashion, similar to rings on a tree trunk; other antenna designs resemble a maze, X-shape, a long strip, or a circle.⁷ Combined with the computer chip, a completed tag can easily be affixed to a credit card blank, or attached to a surface using an adhesive – perfect for societal integration without raising an alarm.

³ Albrecht, Katherine, and Liz McIntyre. *Spychips: How Major Corporations and Government Plan to Track Your Every Purchase and Watch Your Every Move*. New York: Plume, 2006. Print.

⁴ Glinsky, Albert. *Theremin: Ether Music and Espionage*. Urbana: University of Illinois, 2005. Print.

⁵ Roberts, C. "Radio Frequency Identification (RFID)." *Computers & Security* 25.1 (2006): 18-26. Print.

⁶ Borriello, Gaetano, Keith I. Farkas, Franklin Reynolds, and Feng Zhao. "Guest Editors' Introduction: Building a Sensor-Rich World." *IEEE Pervasive Computing* 6.2 (2007): 16-19. Print.

⁷ Albrecht, Katherine, and Liz McIntyre, loc.cit.

To read the information from the RFID tag, a reader is needed which wirelessly interrogates the chip. When the RFID tag enters within a certain range, radio waves from the reader send power over the air to the tag which becomes amplified using its antenna. The amplified energy causes the chip to relay back its unique identification number, or other information, which was programmed into it. The reader then picks up the transmitted information and processes it. Tag bearing people will have the ability to become wirelessly processed as well.

RFID range varies depending on the frequency of the chip.⁸ Low frequency (100-500 kHz) works well for short to medium range applications, such as access control or animal identification, with a read range of 10-20 centimeters.⁹ Intermediate frequency (10-15 MHz) works well for short to medium range applications, such as access control, smart cards, or library control, with a read range of 10-20 centimeters.¹⁰ And finally, high frequency (850-950 MHz, 204-5.8 GHz) works well in railway monitoring, toll collection, pallet tracking, and vehicle tracking with a read range of 3 meters.¹¹

RFID technology has many advantages over its predecessor, the barcode. For example, the barcode can only be read one at a time while requiring line of sight between the scanner and label.¹² The RFID tag can be read by the hundreds at the same time, through other objects, while not requiring line of sight between the tag and reader.¹³ In addition, RFID tags can be embedded within an object, unlike barcodes, and even scanned through a variety of conditions such as snow, paint, ice, fog, and grime broadening the possibly of crowd scanning.¹⁴

RFID tags, because of their size and paper-thin thickness, have the ability to be easily hidden.¹⁵ For example, they can be pressed between packing materials of products or affixed to shipping labels on packages. The tags have been easily integrated into shipping,¹⁶ access control, and identification systems.

The shipping industry has been seen as a major benefactor of RFID technology.¹⁷ To ensure packages and products are correctly routed, the bins in which products are placed are tagged with a master inventory list. When the packages leave the warehouse, large readers next to the loading doors scan the packages while noting they have left the facility. Upon arrival at the destination, readers next to the unloading doors scan incoming packages while noting facility arrival times. This time saving feature removes the chore of opening each package to check the contents as well as quickly taking inventory of

⁸ Roberts, C. "Radio Frequency Identification (RFID)." *Computers & Security* 25.1 (2006): 18-26. Print.

⁹ Weis, Stephen A. (2007), *RFID (Radio Frequency Identification): Principles and Applications*, MIT CSAIL

¹⁰ *ibid*

¹¹ *ibid*

¹² Hodges, Steve; McFarlane, Duncan. "Radio frequency identification: technology, applications and impact." *Auto-ID Labs*. 29 May 2006 <<http://autoidlabs.org/single-view/dir/article/6/60/page.html>>

¹³ *ibid*

¹⁴ *ibid*

¹⁵ Albrecht, Katherine, and Liz McIntyre, *loc.cit.*

¹⁶ Hodges, Steve; McFarlane, Duncan, *loc.cit.*

¹⁷ Hodges, Steve; McFarlane, Duncan, *loc.cit.*

new arrivals. A system similar to this could easily be integrated at airports and public transportation hubs to take inventory of people arriving or departing.

RFID tags have been used in access control on company buildings. Employees in most companies are issued an ID card containing an RFID tag. The tag inside the card functions as an electronic key which allows entry into approved areas of a building when scanned by a door reader.

Government identification documents have even seen RFID integration. In 2005, the U.S. State Department began including RFID chips embedded in passports with the projection that by the end of 2006, all newly issued American passports will be RFID equipped.¹⁸ The memory chip, an EPC Gen2, contains the name, nationality, date of birth, and digitized photograph of each traveler. In 2008, drivers could start applying for licenses containing RFID chips, known as “Enhanced Driver’s Licenses,” which have been rolling out slowly state by state through legislation. These enhanced Government Issue documents were created to help thwart counterfeits and forgeries while also allowing them to be scanned from a distance similar to warehouse inventory.¹⁹

RFID technology is here to stay. With improvements in range and chip capacity being made every day, the cost reduction and saturation will continue to grow as these tags become further embedded into the fabric of life – but, for what purpose? The purpose is object inventory tracking. This is where the line becomes blurred as to what or who is considered an object.

RFID – Tagging shipments today, individual objects tomorrow

The vision of companies, such as the Auto-ID Center, has been to integrate RFID tags not only on shipment or product packaging, but on the items themselves. The vision is to create a “Smart World”²⁰ allowing the linking of objects, information, and people through a computer network. A system like this would have been impossible using barcodes as the information must be known before the item can be tagged.²¹ In addition, barcodes use a Universal Product Code (“UPC”) which only accounts for product type numbering, not individual product numbering.²² This problem-solution situation is perfect for use with RFID technology to create a person tracking system.

In the previous section, basic RFID tag functions were discussed as well as describing what is known as a “passive” RFID tag. A passive RFID tag operates in the absence of direct power to the unit. The power needed for the passive RFID tag is transferred through the air from the reader during

¹⁸ Holtzman, David H. *Privacy Lost: How Technology Is Endangering Your Privacy*. San Francisco: Jossey-Bass, 2006. Print.

¹⁹ Mark Baard, *RFID Driver's Licenses Debated*, WIRED NEWS, Oct. 6, 2004, <http://www.wired.com/news/privacy/0,1848,65243,00.html>

²⁰ Brock, David L., “The Electronic Product Code (EPC). A Naming Scheme for Physical Objects.” *Auto-ID Labs*. 8 April, 2006 <<http://autoidlabs.org/single-view/dir/article/6/94/page.html>>

²¹ Hodges, Steve; McFarlane, Duncan, loc.cit.

²² Brock, David L., *supra* note 20.

transmission.²³ Unlike “active” RFID tags which require a battery for power, passive tags are the cheapest to manufacture and easiest to integrate into objects at the expense of range and lack of onboard power.²⁴ This allows passive tags to be quite small in size, such as the EPC Gen2, which allows them to be inlaid into various items, such as driver’s licenses,²⁵ passports,²⁶ and packaging. The EPC Gen2 tag is the same one used in tracking boxes of razor blades, for example, and now personal government identification documents typically carried by people.

The information stored on the RFID tag’s microchip typically contains an Electronic Product Code (“EPC”). When a tag has been interrogated by a reader, the EPC is transmitted to the reader and then queried in the inventory databases.²⁷ The databases can also associate additional arbitrary data such as location and specifications, which include price, expiration date, place of assembly, color, size, weight, etc.²⁸ – perfect for item-level object and person tagging. The databases are also assumed to be secure; however, regular audit checks are necessary to ensure that the stored object and person data does not become compromised.²⁹

The adopters of RFID technology over the years have included big name companies. Companies such as Gillette in 2003 for an order of 500 million tags,³⁰ UK’s Tesco in 2004,³¹ Wal-Mart in 2005³² and 2006,³³ MasterCard in 2002,³⁴ American Express in 2003³⁵ (reviewed the decision in 2007³⁶), and Visa in 2003.³⁷ Due to the massive purchasing power of these companies and others, the cost per RFID tag has decreased drastically over the years. Currently, depending on the volume of the order, passive tags

²³ Hodges, Steve; McFarlane, Duncan, loc.cit.

²⁴ Weis, Stephen A., loc.cit.

²⁵ O’Connor, Mary C. “Washington Driver’s Licenses to Carry EPC Gen 2 Inlays.” *RFID Journal*. 30 July 2007. Web. 10 Apr. 2012. <<http://www.rfidjournal.com/article/view/3514/>>.

²⁶ Swedberg, Claire. “DHS Proposes Vicinity RFID Technology for Passport Card.” *RFID Journal*. 20 Oct. 2006. Web. 10 Apr. 2012. <<http://www.rfidjournal.com/article/view/2740/>>.

²⁷ Albrecht, Katherine. “RFID Tag – You’re It.” *Scientific American* Sept. 2008: 72-77

²⁸ Association for Automatic Identification and Mobility, Inc. (AIM), “Radio Frequency Identification – RFID: A Basic Primer” (2007), <https://www.aimglobal.org/estore/ProductDetails.aspx?productID=530>

²⁹ Davidoff, Sherri. “Death of Anonymous Travel.” Def Con 17. The Riviera Hotel & Casino, Las Vegas, NV. 31 July, 2009. Conference Presentation.

³⁰ “Gillette to Buy 500 Million EPC Tags.” *RFID Journal*. 15 Nov. 2002. Web. 4 Mar. 2012. <<http://www.rfidjournal.com/article/view/115/>>.

³¹ “Tesco Begins RFID Rollout.” *RFID Journal*. 28 Sept. 2004. Web. 2 Apr. 2012. <<http://www.rfidjournal.com/article/view/1139/>>.

³² “Wal-Mart Details RFID Requirement.” *RFID Journal*. 6 Nov. 2003. Web. 1 Apr. 2012. <<http://www.rfidjournal.com/article/view/642/>>.

³³ “Wal-Mart Shipments Get Gen 2 RFID Tags.” *RFID Journal*. 4 Jan. 2006. Web. 1 Apr. 2012. <<http://www.rfidjournal.com/article/view/2070/>>.

³⁴ “MasterCard to Test RFID Card.” *RFID Journal*. 20 Dec. 2002. Web. 5 Mar. 2012. <<http://www.rfidjournal.com/article/view/171/>>.

³⁵ “AmEx Expands RFID Payment Trial.” *RFID Journal*. 16 July 2003. Web. 2 Mar. 2012. <<http://www.rfidjournal.com/article/view/505/>>.

³⁶ Albrecht, Katherine. “American Express Addresses RFID People Tracking Plans.” *Spychips.com*. 9 Mar. 2007. Web. 2 Apr. 2012. <<http://www.spychips.com/press-releases/american-express-conference.html>>.

³⁷ “Making RFID Payments Ubiquitous.” *RFID Journal*. 2 June 2003. Web. 2 Mar. 2012. <<http://www.rfidjournal.com/article/view/444/>>.

range between \$0.07-0.15 USD for a basic 96-bit EPC inlay.³⁸ The prices will only continue to decrease as demand increases.

At the Frontline Expo 2004 conference, Checkpoint, a product labeling and anti-theft company, revealed several prototype RFID tags hidden behind clothing labels.³⁹ Unlike typical Electronic Article Surveillance (“EAS”) tags which do not contain a microchip, the labels presented by Checkpoint showed an attached microchip capable of storing an EPC or other data. Prior implementations of RFID technology only went as far as product and shipment packaging, never on the actual item. It is only fitting that a company specializing in hiding anti-theft devices in products would be implementing hidden RFID EPC solutions unbeknownst to the public.

Assigning a unique ID number to every item ever produced is a monumental task. Part of the Auto-ID Center’s vision was to tag “individual items—cans of Coke, pairs of jeans and car tires—being tracked from the moment they are made...”⁴⁰ The Electronic Product Code is a system which would enable companies to assign a unique ID to every physical object made for the next thousand years without repeats.⁴¹ The EPC embedded in an RFID tag would contain 96-bits of information, or 2^{96th} power, which is “more than sufficient for man-made physical products.”⁴² The table below illustrates how humans have been considered uniquely track-able objects to be grouped in with automobiles, computers, razor blades, and grains of rice by the Auto-ID Center system. Based on this numbering system, there is no listed difference between an object and a person – both of which can be numbered and tracked.

BITS	UNIQUE NUMBER	OBJECTS
23	6.0x10 ⁶ per annum	Automobiles
29	5.6x10 ⁸ in use	Computers
33	6.0x10 ⁹ total	Humans
34	2.0x10 ¹⁰ per annum	Razor blades
54	1.3x10 ¹⁶ per annum	Grains of rice

Source: the Auto-ID Center⁴³

Assigning a unique serial number to everyday objects would make it possible for companies to compile per-object usage history. It would be akin to giving every can of beans its own personal webpage.⁴⁴ Even if each can of beans looks identical, they could have completely different product histories.⁴⁵ This complements the Auto-ID Center’s vision “in which low-cost RFID tags are put on every manufactured item and tracked using a single, global network as they move from one company to

³⁸ "Frequently Asked Questions." *RFID Journal*. Web. 9 Apr. 2012. <<http://www.rfidjournal.com/faq/20>>.

³⁹ Albrecht, Katherine, and Liz McIntyre, loc.cit.

⁴⁰ Roberti, Mark. "Sponsors Guide," MIT Auto-ID Center, 24 June 2003.

⁴¹ Albrecht, Katherine, and Liz McIntyre, loc.cit.

⁴² Brock, David L., "The Compact Electronic Product Code. A 64-bit Representation of the Electronic Product Code." *Auto-ID Labs*. 9 April 2006 < <http://autoidlabs.org/single-view/dir/article/6/99/page.html>>

⁴³ Brock, David L., *supra* note 20.

⁴⁴ Kaye, Joseph J., "Counter Intelligence & Kitchen Sink White Paper," Massachusetts Institute of Technology website, available at <http://xenia.media.mit.edu/~jofish/writing/kwsp.1.1.pdf>, accessed 10 April 2012.

⁴⁵ Kaye, Joseph J., loc.cit.

another and one country to another.”⁴⁶ The same can be said about humans: they may look the same, but in actuality have completely different histories that can be tracked and analyzed using Auto-ID’s global network.

The ability for objects to talk to manufacturers, retailers, and each other is the forming of a new network known as the “Internet of Things.” “This new infrastructure will allow universal coordination of physical resources through remote monitoring and control by humans and machines.”⁴⁷ At present, computers remain without the ability to autonomously engage with the real world and gather information. This shortcoming is “about to change.”⁴⁸ Auto-ID’s plans will incorporate a worldwide infrastructure – built on top of the Internet – which would make it possible for computers “to identify any object anywhere in the world instantly.”⁴⁹ Based on the Auto-ID object classification table, humans would be easily located and identified in a way no different than a box of razor blades.

Presently, the supply chain ends at the point of sale for retail goods. With EPC labeled objects, the supply chain can be extended to encompass the end-of-life phase. When an object becomes discarded or recycled, the information in the networked database could aid in the disposal process by referencing information gleaned throughout the product’s lifecycle.⁵⁰ Implementing a system at the garbage disposal level would not be difficult. Currently recycling incentive programs have been springing up involving the use of RFID to track resident recycling participation.⁵¹

RFID for tracking, sales, and marketing of inventory

The tagging of individual objects does have benefits; however, outside of product shipment history tracking, what takes place between the store aisles and end-of-life phase can pose a privacy risk. One such fear is the tracking of RFID tagged items after purchase. The unique product ID (EPC) would make it easy to link the tag back to the purchaser. Conceivably, the gathered information could be used to create very detailed records about a consumer’s activities,⁵² the same way shipping inventory generates usage history and tracking data.⁵³ “As a data collection tool, the RFID tags provide better

⁴⁶ Roberti, Mark, loc.cit.

⁴⁷ Brock, David L., *supra* note 20.

⁴⁸ MIT Auto-ID Center, “The New Network: Identify Any Object Anywhere Automatically,” promotional brochure. 15 May 2002. Web. 10 March 2012.

http://web.archive.org/web/20030623034853/http://www.autoidcenter.org/new_media/brochures/factsheet.pdf

⁴⁹ MIT Auto-ID Center, loc.cit.

⁵⁰ Hodges, Steve; McFarlane, Duncan, loc.cit.

⁵¹ Rich, Sarah. “Tracking Tech Drives Dayton, Ohio’s Recycling Incentive Program.” *Government Technology: State & Local Government News Articles*. 10 Oct. 2011. Web. 7 Feb. 2012. <<http://www.govtech.com/technology/Tracking-Tech-Drives-Dayton-Ohio-Recycling-Incentive-Program.html>>.

⁵² Harper, Jim. “RFID Tags and Privacy: How Bar-Codes-On-Steroids Are Really a 98-Lb. Weakling.” *Competitive Enterprise Institute* 89 (2004). Print.

⁵³ Zaharudin, Alia A.; Wong, Chien Y.; Agarwal, Vivek; McFarlane, Duncan; Koh, Robin; Kang, Yun Y. “The Intelligent Product Driven Supply Chain.” *Auto-ID Labs*. 8 April 2006 <<http://www.autoidlabs.org/single-view/dir/article/6/87/page.html>>

information about customers—that is, the what, where, and when of each transaction.”⁵⁴ This information tracking ability is necessary for marketers to spy on unsuspecting customers.

The corporation has embraced marketing as its soul, and its operation as an instrument of social control.⁵⁵ The present day marketing strategies, post 1993, have migrated from the Four ‘P’s⁵⁶ model – focusing on the product, price, placement, and promotion – and into a more people-oriented Four ‘C’s⁵⁷ model which focuses on consumer wants and needs, cost to satisfy, convenience to buy, and communication. In order for companies to make a sale based on the Four ‘C’s model, marketers need to know everything about their customers in order to influence their buying decisions. The corporate marketer must become a friend to the customer, but without their knowledge or actual meeting. This can easily be facilitated with individual RFID tagged products which can reveal the necessary information to marketers without the wearer’s knowledge.

Gillette was the first company to test the waters using RFID tagged products in 2003. At a Tesco location in Cambridge, England, Mach3 razor blades were bundled with RFID chips. By removing a pack of the razor blades resting on a smart shelf, the customer triggered a hidden camera located below the shelf which snapped a photo of the patron.⁵⁸ At checkout, an additional photo was taken of the patron as the razor blades activated another camera. All this photography and tracking happened without customer knowledge. The system supposedly was to be used to deter shoplifters; however, the companies’ “guilty-until-proven” innocent solution caused a consumer protest outside the store as a response to this blatant invasion of privacy.⁵⁹

Taking place shortly after Gillette’s tracking test the same year, Procter & Gamble issued a similar secret RFID trial at a Wal-Mart store located in Broken Arrow, Oklahoma. Customers who purchased Lipfinity lipstick from that store between March and mid-July of 2003 did so without the knowledge of an RFID tag included in the packaging.⁶⁰ When female shoppers picked up and interacted with the lipstick product, the enclosed hidden RFID tag would trigger a video webcam. The live video feed of the women was transmitted directly to the offices of Procter & Gamble executives 750 miles away in Cincinnati. This was a “perfect illustration of how easy it is to set up a secret RFID infrastructure” for the purpose of spying on people.⁶¹

⁵⁴ Texas Instruments, “TIRIS For Automatic Recognition Of Customers.” 24 November 1998. <<http://www.ti.com/rfid/docs/manuals/pdfSpecs/arc.pdf>>.

⁵⁵ Deleuze, Gilles. "Postscript on the Societies of Control." *October*, Vol. 59. Winter 1992, MIT Press, Cambridge, MA, pp. 3-7.

⁵⁶ Banting, P. M., and R. E. Ross. "The Marketing Mix: A Canadian Perspective." *Journal of the Academy of Marketing Science* 1.1 (1973): 1-11. Print.

⁵⁷ Schultz, Don E., Stanley I. Tannenbaum, and Robert F. Lauterborn. *Integrated Marketing Communications*. Lincolnwood, Ill., USA: NTC Business, 1993. Print.

⁵⁸ Jha, Alok. "Tesco Tests Spy Chip Technology." *The Guardian*. Guardian News and Media, 19 July 2003. Web. 1 Apr. 2012. <<http://www.guardian.co.uk/business/2003/jul/19/supermarkets.uknews>>.

⁵⁹ Albrecht, Katherine, and Liz McIntyre, loc.cit.

⁶⁰ Howard Wolinsky, *P&G, Wal-Mart Store Did Secret Test of RFID*, Chi. Sun-Times, Nov. 9, 2003, at 36.

⁶¹ Albrecht, Katherine, and Liz McIntyre, loc.cit.

The Gillette and Procter & Gamble tests illustrated how companies have gone to great lengths in order to monitor potential customers without their knowledge. With plans on the horizon to individually tag products with RFID chips, companies will have the ability to determine which products customers are carrying into a store – all the more easier to encourage a future sale based on past purchase history. “[T]he widespread use of RFID tags on merchandise such as clothing would make it possible for the locations of people, animals, and objects to be tracked on a global scale—a privacy invasion of Orwellian proportions.”⁶² In the eyes of Gillette and Procter & Gamble, they considered their customers no different than one of their manufactured and tracked objects in the supply chain.

The first illustration on how companies will scan people for tagged products came in 2001. IBM’s investors filed a patent which would enable linking of an object’s unique EPC to a person.^{63, 64} The patent mentions a method for collecting RFID numbers at the cash register for storage in a consumer transaction database. Using this information, “[w]hen a person carrying or wearing items having RFID tags enters the store or other designated area, a RFID tag scanner located therein scans the RFID tags on that person and reads the RFID tag information. The RFID tag information collected from the person is correlated with transaction records stored in the transaction database according to known correlation algorithms. Based on the results of the correlation, the exact identity of the person or certain characteristics about the person can be determined. This information is used to monitor the movement of the person through the store or other areas.”⁶⁵ The concept was illustrated in an IBM commercial in 2006.⁶⁶ What becomes troubling is that a person can no longer casually enter or browse a store without becoming known to the store.

Not only could wearing RFID tags reveal an identity, but the data could also be used to uncover their age, race, gender, and income level.⁶⁷ If a person entering the store has no prior purchase records, the system can still run a scan on the individual to create an inventory of carried RFID tagged items. “The present invention assigns a tracking number to that person based on the collected RFID tag information, and the tracking number is used to track the person’s movement.”⁶⁸ The gathered data from item-level store scanning has the ability to be used for targeted⁶⁹ or personalized⁷⁰ advertising shown to the person roaming through the store. With the regarding of people as objects, the system described is marketing objects to an object.

⁶² Hind, John R., James M. Mathewson, and Marcia L. Peters. Method to Address Security and Privacy Issues of the Use of RFID Systems to Track Consumer Products. International Business Machines Corporation, assignee. Patent 20020116274. 22 Aug. 2002. Print.

⁶³ Hind, John R., James M. Mathewson, and Marcia L. Peters. Identification and Tracking of Persons Using RFID-tagged Items. Synnestvedt & Lechner LLP, assignee. Patent 20020165758. 7 Nov. 2002. Print.

⁶⁴ Hind, John R., James M. Mathewson, and Marcia L. Peters. Identification and Tracking of Persons Using RFID-tagged Items in Store Environments. International Business Machines Corporation, assignee. Patent 7076441. 11 July 2006. Print.

⁶⁵ Hind, John R., James M. Mathewson, and Marcia L. Peters, *supra* note 62.

⁶⁶ *IBM RFID Commercial - The Future Market*. YouTube. YouTube, 02 June 2006. Web. 5 Apr. 2012. <<http://www.youtube.com/watch?v=eob532iEpqk>>.

⁶⁷ Hind, John R., James M. Mathewson, and Marcia L. Peters, *supra* note 62.

⁶⁸ Hind, John R., James M. Mathewson, and Marcia L. Peters, *supra* note 62.

⁶⁹ Hind, John R., James M. Mathewson, and Marcia L. Peters, *supra* note 62.

⁷⁰ Hodges, Steve; McFarlane, Duncan, loc.cit.

Interacting with items in a store – not just wearing them – would also yield item-level tracking before purchase. Procter & Gamble (“P&G”), after prototyping a “Store of the Future” in 2000,⁷¹ filed a patent titled “Systems and Methods for Tracking Consumers in a Store Environment”⁷² in 2001. The patent application explains that P&G will utilize “tools for gathering data regarding consumer behavior in store environments and for analyzing that data to understand how different stimuli affect the behavior.”⁷³ Store patrons using shopping carts, containing RFID tags, will have their journey through the store tracked by ceiling readers situated every eight feet corresponding to a specific grid location within the store. By placing items in the shopping cart, RFID tags attached to the products would be cataloged by the cart’s sensors. The compiled customer information, sent to a central server, would provide an elaborate image of the consumer’s store behavior; this differs from item identifying at the point-of-sale. The compiled information could also include the timestamps of when objects were placed and/or removed from the cart helping companies design product packaging meant to attract a quicker sale.

Similar to Procter & Gamble, NCR also issued a patent⁷⁴ in 2003 which heightened the level of shopper monitoring described by P&G. Shopper activities would be recorded moment-by-moment making a complete recording down to split second timings of every action carried out. The purpose of this monitoring is to “collect data on customer behavior, for the benefit of the owner of the market, and the manufacturer of the items.”⁷⁵ This patent considers customers as lab rats to be studied and monitored.

With the amount inventory information being gathered on customers in an RFID pervasive world, one might wonder exactly how else the information could be used. Sales representatives, in an RFID pervasive world, would have instant access to a customer’s worn inventory as they enter the retail space. However, in order to make a complete judgment of the individual, more information is required before categorizing the person as a “barnacle”⁷⁶ – a person considered to be of low potential sales value.

Texas Instruments has a solution which would quickly aid in determining if a customer is of high sales value or not. The answer is integrating RFID tags inside current store loyalty cards. For retailers, the TIRIS will offer a unique ability to secretly know every customer and every purchase.⁷⁷ As customers pass through TI’s doorway RFID readers, they will help in “keeping track of the customers

⁷¹ Albrecht, Katherine, and Liz McIntyre, loc.cit.

⁷² Godsey, Ronald G., Marshall P. Haine, and Mary E. Scheid. Systems and Methods for Tracking Consumers in a Store Environment. Procter & Gamble, assignee. Patent 20020161651. 22 Aug. 2001. Print.

⁷³ Godsey, Ronald G., Marshall P. Haine, and Mary E. Scheid., loc.cit.

⁷⁴ Otto, Jerome A., and Dennis J. Seitz. Automated Monitoring of Activity of Shoppers in a Market. NCR Corporation, assignee. Patent 6659344. 9 Dec. 2003. Print.

⁷⁵ Otto, Jerome A., and Dennis J. Seitz., loc.cit.

⁷⁶ Kumar, V., and Werner Reinartz. "The Mismanagement of Customer Loyalty." *Harvard Business Review* 80.7 (2002): 86. Print.

⁷⁷ Texas Instruments, *supra* note 54.

walking in the door.”⁷⁸ The system can even implement readers in counters, walls, and in floors. To keep track of store inventory, the “technology can tell retailers who’s in their store at any given moment.”⁷⁹ The TI system makes it very clear that the same RFID technology used to track and monitor individual products will enable store customers to be tracked, monitored, and judged.

Patents, like any initial design, are the first step to a real world store implementation. After the 3D animated product feature tours have been planned out, for example American Eagle Outfitters,⁸⁰ it is time for a test bed to showcase RFID utilized for shopping. Enter the “real,- Future Store”⁸¹ which is composed of RFID inventions in the real world for shoppers to try out and experience firsthand. The store, operated by the METRO GROUP initially in Germany, will show customers “the dawn of a new shopping age”⁸² by trial testing features such as Smart Dressing Rooms, Smart Shelves, Smart Display Tables, instant recognition modern checkout systems, and Smart Clothes Racks using RFID technology.⁸³ The METRO GROUP industry partners making this possible include IBM, Oracle, Intermec Technologies, and Procter & Gamble⁸⁴ – some of the same companies responsible for developing systems to track and monitor people through RFID.

Bringing RFID tagged items home further extends the product lifecycle history and usage into private lives. In the home of the future, appliances – such as the TV set, refrigerator, etc.⁸⁵ – will communicate with RFID tagged objects. Items placed inside the refrigerator will be scanned into an inventory and when supply is low, a shopping list can automatically be generated.^{86, 87, 88, 89} When needed, the personal shopping list can be forwarded to a mobile device⁹⁰ across a wireless network,

⁷⁸ Texas Instruments, “Customer Loyalty Mechanism with TI*RFID,” originally available on Texas Instruments website at <http://ti.com/tiris/docs/solutions/pos/loyalty.shtml>. This reference has been removed from TI’s website and is now archived at

<http://web.archive.org/web/20040205161015/http://www.ti.com/tiris/docs/solutions/pos/loyalty.shtml>

⁷⁹ Texas Instruments, *supra* note 76.

⁸⁰ Albrecht, Katherine. “AMERICAN EAGLE OUTFITTERS DENIES RFID USE.” *Spychips.com*. 9 Aug. 2006. Web. 3 Apr. 2012. <<http://www.spychips.com/press-releases/american-eagle-denies-rfid.html>>.

⁸¹ METRO GROUP Future Store Initiative. Web. 3 Mar. 2012. <<http://www.future-store.org/fsi-internet/html/en/459/index.html>>.

⁸² METRO GROUP Future Store Initiative. Web. 3 Mar. 2012. <<http://www.future-store.org/fsi-internet/html/en/1613/index.html>>.

⁸³ METRO Group. “WISSB_Publikationen_Broschueren_RFID-Innovation-Center_E.” 10 Oct. 2007. Web. 15 Mar. 2012. <http://www.future-store.org/fsi-internet/get/documents/FSI/multimedia/pdfs/broschueren/WISSB_Publikationen_Broschueren_RFID-Innovation-Center_E.pdf>.

⁸⁴ “METRO GROUP Future Store Initiative Presents the Future of Logistics.” *METRO GROUP Future Store Initiative*. 17 Oct. 2007. Web. 25 Mar. 2012. <<http://www.future-store.org/fsi-internet/html/en/3189/index.html>>.

⁸⁵ Matsuoka K. Aware home understanding life activities. Towards a human-friendly assistive environment. In: ICOST’2004. Proceedings of the international conference on smart homes and health telematics. IOS Press; 2004. p. 186–193.

⁸⁶ METRO Group, loc.cit.

⁸⁷ Zaharudin, Alia A.; Wong, Chien Y.; Agarwal, Vivek; McFarlane, Duncan; Koh, Robin; Kang, Yun Y., loc.cit.

⁸⁸ Albrecht, Katherine, and Liz McIntyre, loc.cit.

⁸⁹ Hodges, Steve; McFarlane, Duncan, loc.cit.

⁹⁰ “My House Is Smart.” *RFID Newsletter 01* (19 Feb. 2007): 6. *METRO GROUP Future Store Initiative*. 19 Feb. 2007. Web. 2 Apr. 2012. <<http://www.future-store.org/fsi->

such as AT&T,⁹¹ for ease in replenishing the inventory while shopping.⁹² Using the inventory gathered in the refrigerator, tailored advertisements can be played on the house TV set⁹³ concerning what was entered or what is needed. The stored inventory data from the refrigerator and other automatically scanned objects can be reported periodically to the manufacturer – even including the Department of Homeland Security – for data mining, submission of performance related issues in conjunction with product life-cycle management (“PLM”), and automatic home delivery of needed items.^{94, 95, 96} Sensors embedded in the home can identify and track tagged residents.⁹⁷ This fully networked home of the future will make it “possible to run households more efficiently and transparently.”⁹⁸ Exactly how transparent it will be for companies to monitor people is a cause for concern.

RFID tagged identification badges have seen usage in access control for company employees, but the same technology is now appearing in schools. RFID tagged student identification cards are used to log boarding and exit times on school busses, school attendance, and location monitoring on the school grounds in real time via saturated tag readers – all of this to keep students safe.^{99, 100, 101} The setup works like an inventory system,¹⁰² already used for object tracking in the supply chain, which opens the door to the world of human inventory control.¹⁰³ Students responding to RFID tracking systems feel like a “piece of supermarket produce”¹⁰⁴ or like an “animal.”¹⁰⁵

Currently in South Korea, the city of New Songdo issues residents a “Smart Card” which, for example, can be used as a keyless house entry system and a ticket for the subway, park, and movie

internet/get/documents/FSI/multimedia/pdfs/rfidnewsletter/RFID-Newsletter-01-2007-engl-neu.pdf;jsessionid=a48b283c30d6c970b92c62ac4d8e9e188805e1b53a94>.

⁹¹ "NSA Spying FAQ." *Electronic Frontier Foundation*. EFF. Web. 12 Apr. 2012. <<https://www.eff.org/nsa/faq>>.

⁹² "The Mobile Phone as a Shopping List." *METRO GROUP Future Store Initiative*. 28 May 2009. Web. 5 Apr. 2012. <<http://www.future-store.org/fsi-internet/html/en/24825/index.html;jsessionid=a48b283c30d6bb332f5944b04b799afdda71bcb92518.e38MaxqSaNiKci0La390>>.

⁹³ Albrecht, Katherine, and Liz McIntyre, loc.cit.

⁹⁴ Giaccherini, Thomas N. Inventory & Location System. Patent 20030214387. 20 Nov. 2003. Print.

⁹⁵ Inaba, Tatsuya. "At-Home Product Life-Cycle Management." *RFID Journal* (2011): 39. Print.

⁹⁶ Seifert, Jeffrey W. "Data Mining and Homeland Security: An Overview." *CRS Report for Congress* (2007). Print.

⁹⁷ Chan, Marie, Eric Campo, Daniel Estève, and Jean-Yves Fourniols. "Smart Homes — Current Features and Future Perspectives." *Maturitas* 64.2 (2009): 90-97. Print.

⁹⁸ METRO Group, loc.cit.

⁹⁹ Richtel, Matt. "In Texas, 28,000 Students Test an Electronic Eye." *The New York Times*. 11 Nov. 2004. Web. 1 Apr. 2012. <http://www.nytimes.com/2004/11/17/technology/17tag.html?_r=1>.

¹⁰⁰ Pritchett, Ken. "RICHMOND: Preschool Students Get Tracking Devices To Ease Teacher Burden [Ken Pritchett]." *RICHMOND: Preschool Students Get Tracking Devices To Ease...* 18 Aug. 2010. Web. 10 Apr. 2012. <<http://www.ktvu.com/videos/news/richmond-preschool-students-get-tracking-devices/vC4mP/>>.

¹⁰¹ Kadir, Herdawatie Bt Abdul, Siti Nurul Aqmariah Bt Mohd Kanafiah, and Mohd Helmy Abd. Wahab. "Boarding school students monitoring systems (E-ID) using radio frequency identification." *Journal of Social Sciences* July 2009: 206+. General OneFile. Web. 2 Apr. 2012.

¹⁰² Pritchett, Ken, loc.cit.

¹⁰³ "Human Inventory Control." *Scientific American* May 2005: 8. Print.

¹⁰⁴ "Human Inventory Control." *Scientific American* May 2005: 8. Print.

¹⁰⁵ Richtel, Matt, loc.cit.

¹⁰⁵ Richtel, Matt, loc.cit.

theaters.¹⁰⁶ The main problem that can occur with a Smart Card system, as well as a student ID card, is the human error factor.¹⁰⁷ With the high value that a single card has to access multiple features in the world, losing or forgetting the card can be disastrous, especially with cashless digital currency systems being developed.¹⁰⁸ This is the beginning of multiple systems being consolidated to more efficiently monitor and track people using RFID technology.

One solution to ensure a person never loses their RFID Smart Card is in the form of an implanted microchip. The VeriChip, the first device to meet this need, was approved by the FDA for human implantation in 2002.¹⁰⁹ The chip was designed by the VeriChip Corporation (now PositiveID Corporation), which is owned by Applied Digital Solutions Inc., funded by IBM Credit, LLC,¹¹⁰ and manufactured by Department of Defense contractor Raytheon.¹¹¹ Since the Jacobs family became the first humans implanted with the VeriChip in 2002,¹¹² the chip has seen uses in healthcare,¹¹³ security,¹¹⁴ and even as a VIP access and payment system for nightclub patrons.¹¹⁵ Further applications of the VeriChip would be created through satellite development,¹¹⁶ potentially enabling chip-bearers to be monitored from low-orbit satellites.

The problems associated with the VeriChip surfaced over the years. With the implanted chip being used as an authentication tool, it was discovered that it possessed few security measures against wireless hacking.¹¹⁷ Even if the device was secured properly, it is an implanted tamper-proof chip;¹¹⁸ the implications of bodily harm to the implanted individual would be more than simply losing a finger.¹¹⁹ In

¹⁰⁶ "My House Is Smart," loc.cit.

¹⁰⁷ Richtel, Matt, loc.cit.

¹⁰⁸ Matonis, Jon. "MintChip Misses the Point of Digital Currency." *Forbes*. Forbes Magazine, 12 Apr. 2012. Web. 12 Apr. 2012. <<http://www.forbes.com/sites/jonmatonis/2012/04/12/mintchip-misses-the-point-of-digital-currency/>>.

¹⁰⁹ Scheeres, Julia. "Implantable Chip, On Sale Now." *Wired.com*. Conde Nast Digital, 25 Oct. 2002. Web. 15 Apr. 2012. <<http://www.wired.com/politics/security/news/2002/10/55999>>.

¹¹⁰ "APPLIED DIGITAL SOLUTIONS INC - 10-Q Quarterly Report." *GetFilings.com*. 31 Mar. 2004. Web. 15 Apr. 2012. <<http://www.getfilings.com/o0001068800-04-000317.html>>.

¹¹¹ "VeriChip Corporation Selects Raytheon Microelectronics España to Manufacture Its Products." *Reuters*. 5 Oct. 2009. Web. 5 Apr. 2012. <<http://www.reuters.com/article/2009/10/05/idUS105267+05-Oct-2009+BW20091005>>.

¹¹² "US Family Gets Health Implants." *BBC News*. BBC, 05 Nov. 2002. Web. 15 Apr. 2012. <<http://news.bbc.co.uk/2/hi/health/1981026.stm>>.

¹¹³ Halamka, J., A. Juels, A. Stubblefield, and J. Westhues. "The Security Implications of VeriChip Cloning." *Journal of the American Medical Informatics Association* 13.6 (2006): 601-07. Print.

¹¹⁴ Feder, Barnaby, and Tom Zeller. "Identity Badge Worn Under Skin Approved for Use in Health Care." *The New York Times*. 14 Oct. 2004. Web. 19 Apr. 2012. <<http://www.nytimes.com/2004/10/14/technology/14implant.html>>.

¹¹⁵ Morton, Simon. "Barcelona Clubbers Get Chipped." *BBC News*. BBC, 29 Sept. 2004. Web. 15 Apr. 2012. <<http://news.bbc.co.uk/2/hi/technology/3697940.stm>>.

¹¹⁶ "ORBCOMM Announces Application Development Agreement with VeriChip Corporation." *MSP News*. 15 Dec. 2004. Web. 5 Jan. 2012. <<http://www.mspnews.com/news/2004/Dec/1102184.htm>>.

¹¹⁷ Halamka, J., A. Juels, A. Stubblefield, and J. Westhues, loc.cit.

¹¹⁸ Mesenbrink, John. "Shoppin for RFID." *Security* Oct. 2002: 10-16. Print.

¹¹⁹ Kent, Jonathan. "Malaysia Car Thieves Steal Finger." *BBC News*. BBC, 31 Mar. 2005. Web. 19 Apr. 2012. <<http://news.bbc.co.uk/2/hi/asia-pacific/4396831.stm>>.

addition, a link was discovered between implanted RFID chips and cancer in laboratory rodents and dogs.¹²⁰ Cancer and wireless data theft are the end results for people having a chip implanted.

In summary, given the marketing shift into more personalized advertising, allowing RFID chips to function outside of the supply chain invites unwanted snooping and tracking by companies and governmental agencies.¹²¹ Therefore, it would not be unrealistic to suggest that RFID tags are tracking cookies for the real world.¹²²

Artist, hacker, and activist projects in response to RFID

From a societal standpoint, it is hard to imagine how something as pervasive as RFID technology could be viewed or used for anything other than what its designers intended. This is what is so fascinating about people who start using – or abusing – this technology by integrating it into their everyday lives and creative practices.

In *The Catalogue*,¹²³ Chris Oakley presents the viewer with a transparent shopping world of the future, reminiscent of plans described by IBM to track and inventory people. From the perspective of security cameras, shoppers in a mall are unknowingly watched as they go about their routine. Overlaid and tracked on top of each person is their unique EPC ID pulled from an RFID tag; this illustrates that people in this world are viewed as track-able objects and as such, inventory within the shopping mall. In addition, complete purchase inventories for each person are able to be sorted and listed graphically next to each person in the store from the camera's view; this degrades each person to a level of transparency suitable for companies to profile their spending habits in order to project future sales.

In the reality shown by Chris Oakley, no one can escape the power of the camera's prying eye in the lives of people. The nature of the overseer is both present and not. "His presence, which is also an absence, is in his gaze alone."¹²⁴ The watcher's presence is invisible and opaque; the watcher can only observe, not be observed. The RFID tags worn by those under the observer's gaze enable the wearers to become undressed by visual observation. Not one detail is left to the imagination – every spending detail and personal identity is known and freely available.

In the short sci-fi film *Smart Card*,¹²⁵ Robert Sharpe discovers that his perfect automated life is not his to control, but the corporation that established the system. His existence is solely dependent upon the use of his "Smart Card" to control his life, which it does. It is only when his "Smart Card" is stolen that he realizes how much he relies on it to survive – without it he is nothing, and with it he is a

¹²⁰ Albrecht, Katherine. "Microchip-Induced Tumors in Laboratory Rodents and Dogs: A Review of the Literature 1990–2006." *AntiChips*. 19 Nov. 2007. Web. 2 Apr. 2012. <<http://www.antichips.com/cancer/index.html>>.

¹²¹ "Tom Rice Is Presented Airport Security Solution." *CompEx Inc*. 25 May 2003. Web. 15 Apr. 2012. <http://www.compexinc.com/index.php?_core_cnt_SetActiveContent=938>.

¹²² Dew, Nicholas. "Cookies For The Real World: Assessing The Potential Of Rfid For Contractor Monitoring." *Journal Of Public Procurement* 8.1 (2008): 98-129. *Business Source Complete*. Web. 19 Apr. 2012.

¹²³ *The Catalogue*. By Chris Oakley. 2004. Single-channel Video.

¹²⁴ Whitaker, Reginald. *The End of Privacy: How Total Surveillance Is Becoming a Reality*. New York: New, 1999. Print.

¹²⁵ *Smart Card*. Dir. James Oxford. By Joseph Anaya. Perf. David Kriegel, Bret Roberts, and Bill A. Jones. 2005.

slave of the system. The solution to ensuring his card is never lost or stolen again is to merge the system with the slave in the form of an embedded microchip. It is only at the end of the film that he realizes the system cannot protect him, thus the system is fallible through the separation of his right hand and, the microchip that controls his life. This short film echoes a warning into the future detailing a possible scenario in the developing city of New Songdo with the reliance of a resident Smart Card.

Chris Paget's 2010 presentation¹²⁶ at Def Con, following up on his 2009 presentation,¹²⁷ demonstrated that EPC Gen2 RFID tags can be read at distances greater than 20 feet – contrary to claims made by the Department of Homeland Security.¹²⁸ In the presentation, he disclosed the results of his extreme range RFID tracking test which resulted in the reading of an EPC Gen2 tag at 217 feet; this is deeply troubling since the tags have “Barbie doll security” and are found in everything from razor blade boxes to government identification documents. Plans were also discussed with the possibility of reading the tags at distances up to 50 miles;¹²⁹ this further illustrates the ease in which people can be inventoried on a mass scale.

At the end of the presentation, Chris listed 10 privacy impacts the EPC Gen2 tags can have on society. One of the 10 listed stuck out the most from the list. The “Ultimate Stag Prank” stated that since Gen2 tags can be purchased easily in bulk (\$100 for 1500 tags on eBay), if someone had advance knowledge that a “vehicle would soon be crossing the US border (such as for a vacation or business trip), a bulk order of tags can be pre-programmed with ID numbers from known EDL and PASS ranges.”¹³⁰ The border guards might be curious to know why someone has 1500 passports in his car trunk. People should be curious as to why the government would need an inventory gathering system of car occupants.

Preemptive Media is a group of artists, activists, and technologists who incorporate emerging technologies and policies into their work. *Zapped!*¹³¹ is a project which takes a close look at RFID deployment in the world. At the time the project was created, mass implementation of RFID tags was just taking place. The project goal was to educate people about the dangers of RFID tracking. One such device they created was an RFID reader keychain that would detect RFID reading devices that are interrogating the airwaves. With project devices like this one and others, Preemptive Media hopes to create new opportunities for public discussion and discourse on the closed world of technology research and development. The more the public becomes aware of the risks involved in RFID tracking and inventory scanning, the better prepared society will be in its resistance.

¹²⁶ Paget, Chris. “Extreme-range RFID tracking.” Def Con 18. The Riviera Hotel & Casino, Las Vegas, NV. 31 July, 2010. Conference Presentation.

¹²⁷ Paget, Chris. “RFID MythBusting.” Def Con 17. The Riviera Hotel & Casino, Las Vegas, NV. 1 August, 2010. Conference Presentation.

¹²⁸ O'Connor, Mary C., loc.cit.

¹²⁹ Paget, Chris, *supra* note 126.

¹³⁰ Paget, Chris. “Extreme-Range RFID.” 28 July 2010. Web. 21 Apr. 2012. <http://www.tombom.co.uk/extreme_rfid.pdf>.

¹³¹ “Zapped!” *Preemptive Media*. 2005. Web. 3 Apr. 2012. <<http://www.preemptivemedia.net/zapped/devices.html>>.

Straightjacket Embrace,¹³² created by Karen Lancel and Hermen Maat, is an interactive video and RFID installation demonstrating the “fear and desire for the other in contemporary public space.” Utilizing a hanging straightjacket in the center of a gallery space, it becomes a device controlling projected video images of the participant from multiple camera angles utilizing RFID tags. By manipulating the RFID tags in the straightjacket, the cameras can be manipulated creating a self-imposed surveillance system – projected images of participant are displayed in another part of the gallery where people can watch and vice versa. In this installation, RFID tags are not used as a means of tracking, but as a means of control for the user. Each tag, when moved in the correct way, activates audio information or controls the video projections in the room. The tags become a mode of controlling self-surveillance, not a means for the surveillance of people as inventory.

In summary, the projects discussed remind us that RFID technology can and should be used for purposes other than tracking and person inventorying. RFID began as a musical instrument, and it can still be an avenue for artistic and creative forms of expression: not as a means of tracking and inventorying people.

Conclusion

This paper has highlighted the ability for companies to design systems allowing people to be treated as objects and tracked as inventory. With a little knowledge, individuals other than companies can have the ability to track and monitor tag-wearing people – the consequences of this are serious. The forced mandate of EPC Gen2 tags in all passports and enhanced driver’s licenses was poorly calculated and has consequently opened the door for privacy abuse.

Due to the privacy implications and people tracking abilities RFID tags possess, it would be unwise to continue integrating this technology for use outside of normal warehouse shipment tracking. RFID technology has greatly improved shipping logistics while at the same time rolling up the veil of individual privacy. RFID is not capable of properly being used to protect privacy in its current state.

In order for RFID technology to be used outside of shipment inventory tracking, there needs to be assurances from major companies that its use will not track people. With very little public discussion on the repercussions of mass RFID use, it would be wise to include public input on any future plans. Until further public discussion happens, it will be up to the technology developers to design RFID systems to prevent the tracking and monitoring of humans as inventory, and for artists and hackers to educate the public on the vulnerabilities of carrying RFID tags. Developers, hackers, and artists are the key to ensuring an individual’s privacy is protected not only from company or government abuse, but also from criminal abuse through development and education.

The items we carry reveal details about our lifestyle and purchase choices. This information, if gathered unknowingly through RFID, can be used to track us as object inventory. In the absence of RFID regulation, consumers must seek recourse through their local elected officials to prevent their personal

¹³² Lancel, Karen. Maat, Hermen. *Straightjacket Embrace*. 2007. London.

privacy from being eroded. Consumers will risk losing the race if they fail to stand up for their rights as people – not objects.