TWITTER, FACEBOOK, AND TEN RED BALLOONS: SOCIAL NETWORK PROBLEM SOLVING AND HOMELAND SECURITY

INTRODUCTION

On December 6, 2009, the Defense Advanced Research Projects Agency (DARPA) held a competition designed to, in their words, "explore the role the Internet and social networking plays in the timely communication, wide area team-building and urgent mobilization required to solve broad scope, time-critical problems."[1] The competition required participating teams/individuals to find "10 8-foot balloons moored at 10 fixed locations in the continental United States."[2] Just before the competition opened, the balloons were surreptitiously floated at random locations in nine states, including: California, Tennessee, Florida, Delaware, Texas, Virginia, Arizona, Oregon, and Georgia.[3]

The winning team, comprised of five students from M.I.T., found all ten balloons in less than nine hours. Their performance roundly beat the other 4,000 participants in the challenge and shocked DARPA, who had scheduled the competition for two weeks. Incredibly, the team learned of the competition only four days before it started, and in less than two days they had a plan, a website, and more than 5,000 signed up to help them.[4] They then applied that network to an extraordinarily complex problem spanning the United States. The results were shockingly accurate and swift. The significance and potential application of their system is remarkable. In a period of less than one week, five students constructed a productive, precise, layered, networked enterprise involving thousands of citizens. This paper proposes that the U.S. federal government apply the techniques developed by the M.I.T. team into a nation-wide program designed to address discrete security issues.

THE "NEW" MODELS: SOCIAL NETWORK PROBLEM SOLVING

Naturally, the system developed for the DARPA challenge does not perfectly correlate with all homeland security challenges. For example, the system would do little to physically capture a wanted individual. The system could, however, be used to locate a wanted person. It could also be applied to assist in securing physical sites, boarders, cyberspace and infrastructure. The team leader, Dr. Riley Crane, speculated on a broad range of possible applications:

> Can we use this technology we've developed to find missing children or something along those lines where there's an incentive for people to really participate and help out? Often, the police will offer a reward for finding a missing child. Can we restructure that in a way that we tap the vast resources of this network? . . . Or during an emergency, maybe we need to find 10 people in a region who can operate heavy machinery, maybe a building collapsed.[5]

Plainly, this approach to problem solving is both revolutionary and expansive. Indeed, the tool is so broad and powerful, that it is difficult to pigeonhole individual uses. Suffice to say, the potential application extends to any defined, discrete issue/problem.

At the core of the system is its incentive structure, which was structured to encourage the development of a large network of interested persons. DARPA offered a total of $40,000 in prize money. The M.I.T. team allocated this evenly between each of the 10 balloons, giving each a "value" of $4,000. They gave $2,000 for the person who found each balloon. This was hardly unique, most other participating teams offered some sort of reward for finding balloons. What set the M.I.T. team apart is that they then gave a $1,000 to the person that referred the balloon finder to their website (assuming there was a referral—if there was no referral, the finder received $2,000 and the other $2,000 went to charity). Then they gave $500 to the person who referred the referrer, $250 to the person that referred them, and so on. This diffuse incentive structure essentially propagated itself over existing social networks: people were incentivized to get as many friends working for the M.I.T. team as possible—almost like a pyramid scheme. The speed with which this propagated itself is remarkable. Each of the five members of the team sent out an e-mail explaining the competition and the incentive structure. Within 48 hours, they had 5,000 people signed up to assist them.

Another interesting modern illustration is the "Vanish Competition" presented in an article in the August, 2009 edition of *Wired Magazine.*[6] The competition accompanied an article by Evan Ratliff, which examined instances in which people had attempted to make themselves disappear. The competition had Ratliff go into hiding for thirty days. During that time, he traveled around the United States in disguise, not making contact with family, friends or editors. He ditched his cell phone, credit cards, and online accounts. He used physical disguises, and masked his movement and communications online using various technical tools.[7] A $5,000 prize was to the first person to identify Rafliff, take his picture, and say the word "fluke".

Almost instantly, thousands of people became actively involved in the hunt. The participants self-organized into dozens of teams, pooling resources to find Ratliff. The teams and individual participants extensively used social networking tools such as Facebook and Twitter to connect and share information. It took twenty-five days for a team to track Ratliff down to a street in New Orleans—more than 2,000 miles from where he started. Throughout his time on the run, Ratliff continuously checked up on the social networking sites to track the trackers. He was eventually caught by team members who were able to identify him online and hack through the measures he had set up to protect his identity. Other team members physically located in New Orleans approached him and ended the contest.[8]

The "Vanish Competition" provides several lessons which affirm the lessons learned from the DARPA challenge. First, thousands of individuals can be incentivized with a fairly small monetary incentive. Though the incentive function is slightly different in the competitions, both rely on social network mechanisms. In the DARPA challenge, the incentive structure was self-propagating. In the "Vanish Challenge", the monetary incentive sparked the creation of teams and social networking groups. Once sparked, the teams developed a strong social cohesion—individuals became interested in participating and assisting because they wanted to help the group. For the technically oriented members of the team, professional pride became a strong motivating factor. One member would come up with a clever way to track Ratliff's movements through FaceBook, and another would respond by improving the tool. This highlights another important lesson learned. Not only did teams naturally form, but an extremely efficient division of labor naturally developed. In both challenges, existing social networks were

used extensively to share information towards the completion of the challenge. Finally, the winning team was able to find Ratliff despite abundant misinformation provided by both other teams and Ratliff himself. The team devised a way to vet information and team members, thereby guaranteeing the accuracy of information received from team members.

The DARPA and Vanish challenges incorporate many of the mechanisms seen in popular "crowd-sourced" projects. The term "crowd-sourced" is a generic term applied to describe projects whose design and construction are implemented by a community of people rather than a single corporation. The internet is replete with websites dedicated to crowd-sourcing individual items or services. The concept has been successfully applied to the design and sale of t-shirts (Threadless[9]), cars (Local Motors[10]), and small consumer products (Quirky[11]). It has also been used to write computer programs (Linux[12]) and make loans (Kiva[13]), and a host of other applications.

For instance, at Quirky, individuals submit inventions that they would like to see developed. The members of the Quirky community vote on each project. Then, aspects of the project are completed by experts in their respective fields (e.g., a professional graphic artist does the graphics, a mechanical engineer designs the item's mechanics, etc.). The incentive structure for participation—at Quirky and other crowd sourcing sites—is monetary and social.

Inventors receive a percentage of all sales, as do members that worked on a given project. Further, individual members are publically recognized when the product comes to market. The Quirky online store shows a breakdown of which members get how much of the money spent on the item.

THE "OLD" MODELS

To fully understand the startling efficiently of the new social media models, it's useful to look at traditional systems that seek to employ broad public support towards a single public goal. Perhaps the most well known mechanism is the F.B.I.'s Most Wanted List. The list was created in 1950 as a mechanism for enlisting the public's help in capturing the most dangerous fugitives.[14] Over sixty years, 494 fugitives have been listed.[15] Of those, 463 have been captured—an impressive statistic.[16] However, of those captured, only 152 (or 32%) where captured as the result of direct public cooperation.[17] This is hardly a commendable success rate given the fact that the list is perpetually displayed in more than 30,000 post office locations throughout the country, online, and integrated in radio and television campaigns.

One of those campaigns has been to integrate the Most Wanted List with another traditional mechanism for applying public participation to solve a public safety problem: the television show *America's Most Wanted.*[18] The show has resulted in the capture of approximately 1,100 wanted persons.[19] While undoubtedly commendable, the mechanism is not terribly efficient. The show has aired 1,000 episodes. Thus, roughly speaking, each episode has resulted in the capture of one person. On its face, this seems like a respectable result rate. However, given the fact that the show (recently at least) averages six million viewers per episode, the efficiency of the system must be questioned. Contrast this model with the model presented by the Vanish Challenge, where a team of a few dozen members were able to track a

well-funded, educated, and motivated individual, located more than 2,000 miles from where he disappeared. The differences are obvious. Though popular, *American's Most Wanted* is "old media". People watch the show, but they are not *vested* in the show.

The show has made efforts to establish itself in the social network universe. Their efforts have not been successful: their Facebook group has approximately 10,000 members, or .001% of their viewing audience. The Tweet feed for the show has less than 2,000 followers.[20] The reasons for this anemic success are not clear. Plainly, a certain percentage of the viewership is simply watching for entertainment. Another percentage is not inclined or technically capable of engaging online. Finally, it may be that the show is seen as a product of the "old media" and efforts to appeal to social network users—generally younger generations—appear artificial and forced. To borrow a term from the environmental movement, they are seen to be "cyberwashing" their product—trying to make a staid product "cool" by associating with trendy web applications.

NATIONAL SECURITY APPLICATION

The Balloon Challenge and Vanish Challenge prove that with little funding, *de minimis* incentive, and a strong social cohesive element, individuals can create efficient, layered, and accurate organizations that are able to accomplish complex objectives. Applying these systems to homeland security is a natural development.

Critics of the social networking approach would argue the system could be easily corrupted. Individuals targeted by the system could manipulate the system by providing false information. This critique presumes the targeted individual would be aware that they (or their activities) are being publically hunted. This is a large presumption. As an initial matter, individuals may never realize they are being sought. They are simply not paying attention, or they don't realize they are part of the enterprise being targeted. Or, just as likely, sought individuals may be recalcitrant to corrupt the system because they are concerned about digitally revealing their location. Indeed, this is precisely what led to the discovery of author Evan Ratliff.

The M.I.T. anticipated the issue of system corruption and developed a tool to allow them to quickly cull through tremendous amounts of information and a great deal of misinformation (intentional and unintentional). During the first hours of the competition, many of the 4,000 teams engaged in misinformation campaigns designed to obfuscate and confuse their opponents. The M.I.T. team employed a mechanism which allowed them to identify fact from fiction. At this point in time, the team has declined to disclose the mechanism they employed. Regardless of how they did it, they created an extremely efficient tool to manage and verify information. This tool was undoubtedly critical to the overall success of their system, and indeed could be a valuable tool on its own. The teams participating in the Vanish Challenge also developed several tools which allowed them to successfully "weed out" corrupt information.

The DARPA and Vanish Challenge both illustrate the power of the social networks when applied to discrete problems. When properly constructed, tools can harness the power of social networks towards a singular goal. They have proven that they can do this with alarming

efficiency and speed. Socially networked problem solving is not (for the most part) purely altruistic. There must be some incentive in place to facilitate involvement and action. The incentive may be monetary or social (e.g., earning respect from your cyber peers), or a combination of the two. The incentives need not be robust; both DARPA and Vanish demonstrate that complex goals can be accomplished with only the smallest of incentives. The most powerful incentives combine social and monetary elements, and are structured such that they self-propagate.

The U.S. government can, and should, apply the principles underlying these programs to a homeland security paradigm. Most obviously, these models could be used to locate wanted individuals—criminals, witnesses, persons of interest, individuals with particular skills, etc. This functionality, however, barely scratches the proverbial surface of the myriad of homeland security applications, both physical and cyber. For instance, a challenge could be issued to find the security flaws in a given government website. Or, programmers could be issued a challenge to build a website for a particular function.

The modern models created for the challenges can be successfully adapted by the government: *if* adapted properly. The models share three commonalities which contribute to their success. First, they are simple programs utilizing existing technologies (e.g., simple webpages, Twitter, Facebook, etc.). Second, the models are structured to answer a single discrete question (e.g., where are the balloons?). Third, the models are fueled by their powerful incentive structures. Indeed, a government program would further benefit from another equally powerful incentive: patriotism.

A simple website, integrated with social networking sites, issuing discrete challenges, and offering small cash rewards. In short, a properly structured program has the potential to solve an array of discrete problems using a vast and powerful enterprise of active, engaged, and networked citizens.

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[1] Defense Advanced Research Projects Agency (DARPA), "DARPA Network Challenge," https://networkchallenge.darpa.mil/Default.aspx.

[2] Ibid.

[3] Ibid.

[4] Lance Whitney, "MIT Floats Ideas in DARPA Ballon Challenge," *CNET News* (December 8, 2009), http://news.cnet.com/8301-1023_3-10411211-93.html?tag=mncol;title.

[5] Ibid.

[6] Evan Ratliff, "Author Evan Ratliff is on the Lam. Locate Him and Win $5,000," *Wired Magazine*, August 2009.

[7] Evan Ratliff, "Writer Evan Ratliff Tried to Vanish: Here's What Happened," *Wired Magazine*, November 2009.

[8] Ibid.

[9] Threadless, http://www.threadless.com, (accessed January 30, 2010).

[10] Local Motors, http://www.local-motors.com, (accessed January 30, 2010).

[11] Quirky, http://www.quirky.com, (accessed January 30, 2010).

[12] Linux, http://www.linux.org, (accessed January 30, 2010).

[13] Kiva, http://www.kiva.org, (accessed January 30, 2010).

[14] Federal Bureau of Investigation (FBI), "The FBI's Ten Most Wanted Fugitives Q&A," http://www.fbi.gov/wanted/topten/tenfaq.htm#11 (accessed January 26, 2010).

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] Ibid.

[19] America's Most Wanted, http://www.amw.com/, (accessed January 26, 2010).

[20] Twitter, http://twitter.com/1800crimetv (accessed January 26, 2010).