

# Science Fiction Prototyping, the Broader Content, and Computer Security

## Science Fiction Prototyping Project Announcement

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## Introduction to the Project

One of the most important (if not the most important) skills to learn in this computer security course is how to *think* about the adversary and the broader context surrounding computer security. What are the realistic threats? What are the ways security systems might fail, or might not address the "real" problem? How do security systems (or the absence of security systems) interact with the surrounding ecosystem of people, governments, other technologies, and so on? How might the world evolve around a technology and create unanticipated deployment scenarios?

The goal of this project is to develop a deeper understanding of how these broader contextual issues relate to the security and privacy of future-generation technologies. We will do so using new techniques from the budding field of "science fiction prototyping." It's a great pleasure to announce that one of the pioneers in this field -- Brian David Johnson -- will be working with us through this process.

To bootstrap this project, Brian David Johnson will be giving us a guest lecture on science fiction prototyping on Friday, January 22. He will then return for a working session during the quiz sections on Thursday, February 18. The guest lecture will describe the ideas behind science fiction prototyping in more depth. The essence of science fiction prototyping is the following: (1) identify a proposed new technology or research direction with potentially complex broader contextual issues; (2) use the science fiction writing process to dive deeply into, explore, and understand the future implications of those technologies; (3) feed the results of (1) and (2) back into the design of improved technologies.

We will be doing all three steps in this course: The Topic, The Outline and The Result.

## 1. The Topic

We are very flexible in the topics you choose for (1). There are several potential resources for helping you select your topic, though you should not feel restricted to only leveraging these resources:

- This year's course forum (<https://catalysttools.washington.edu/gopost/board/kohno/14597/>) and the course blog (<http://cubist.cs.washington.edu/Security/>) from previous years are both excellent resources.

You might consider using any technology explored in a current events article or security review.

- You might look at new technologies proposed in the various top research conferences. There are many things you could do with these technologies. You might, for example, explore security issues that aren't present with today's versions of these technologies, but that might be present in future embodiments with these technologies.

There are countless venues to look at. If you're interested in robots, you might start by reading the titles in the upcoming conference on human-robot interaction (HRI 2010, <http://hri2010.org/>), or the titles of papers from previous years. For “ubiquitous” devices entering our environments, consider looking at recent papers at UbiComp (here's a link to the 2009 list of papers, <http://www.ubicomp.org/ubicomp2009/programsPaper.shtml>). If you're interested in new ways in which computers might interact with people, consider looking at recent papers from CHI (here's a link to the 2009 list of papers, <http://www.chi2009.org/Attending/AdvanceProgram/monday.html>). If you're interested in accessibility technologies, you might consider looking at recent papers from ASSETS (here's a link to the 2009 list of papers, <http://www.sigaccess.org/assets09/accepted/>). There are great quality research conferences on almost all topics; please ask us or use a search engine to find them.

You might also consider technologies introduced at forward-looking industry events, such as CSE (<http://www.cesweb.org/>).

- You might also consider technologies discussed in research papers at top computer security conferences, including USENIX Security, the IEEE Symposium on Security and Privacy, the ACM Conference on Computer and Communications Security (CCS), USENIX Workshop on Hot Topics in Security (HotSec), and the Network & Distributed System Security Conference (NDSS).

As a starting point, here are some papers we've written on security for emerging technologies:

- medical devices, including neural devices (<http://thejns.org/doi/abs/10.3171/2009.4.FOCUS0985>), pacemakers and

implantable defibrillators (<http://www.secure-medicine.org/icd-study/icd-study.pdf>), other medical devices (<http://www.cs.washington.edu/homes/yoshi/papers/IMD/>), and some defenses

(<http://www.cs.washington.edu/homes/yoshi/papers/HotSec2008/cloaker-hotsec08.pdf>)

- robots ([http://www.cs.washington.edu/homes/yoshi/papers/robots/ubicomp09\\_robots.pdf](http://www.cs.washington.edu/homes/yoshi/papers/robots/ubicomp09_robots.pdf))
  - emerging UbiComp devices, like the Nike+iPod Sport Kit (<http://www.cs.washington.edu/research/security/usenix07devices.html>)
  - wireless RFID weaknesses and defense (<http://www.cs.washington.edu/homes/yoshi/papers/RFID/ccs280-koscher.pdf>, <http://www.cs.washington.edu/homes/yoshi/papers/RFID/rfid-secrethandshake-ccs2008.pdf>)
  - graphical authentication schemes (<http://www.cs.washington.edu/homes/yoshi/papers/passwords/chi2009-graphicalpasswords.pdf>),
  - anonymous network communications ([http://www.cs.washington.edu/homes/yoshi/papers/Tor/PETS2008\\_37.pdf](http://www.cs.washington.edu/homes/yoshi/papers/Tor/PETS2008_37.pdf))
  - wireless anonymity (<http://www.cs.washington.edu/homes/yoshi/papers/wireless/wireless.pdf>)
  - network forensics vs privacy ([http://cseweb.ucsd.edu/Dienst/Repository/2.0/Body/ncstrl.ucsd\\_cse/CS2009-0940/postscript](http://cseweb.ucsd.edu/Dienst/Repository/2.0/Body/ncstrl.ucsd_cse/CS2009-0940/postscript))
  - electronic voting (<http://www.cs.washington.edu/homes/yoshi/papers/eVoting/>)
  - self-destructing data systems (<http://vanish.cs.washington.edu/pubs/usenixsec09-geambasu.pdf>)
- Step back and ponder other types of technologies that might raise interesting and complex security and privacy issues in the future.

When you select your topic, try to find one “without easy answers”. Pick a topic that potentially has complicated implications for the future – implications that you will study in your story.

## 2. The Outline

### *What is the Idea and what is the Plot*

After identifying a topic, you will prepare an outline of a story. The outline of the story is where your ideas and reflections on the broader contextual issues will really get explored. The outline will force you to think about the science and technology in a

realistic setting of people and society, without forcing you to actually become a science fiction writer (though there will be non-required opportunities to flesh your outlines into complete stories, if you so desire).

The purpose of the outline is the capture the *idea* behind the story and put it into a *plot*. Alan Moore the legendary comic book writer and creator of *The Watchmen*, *V* for *Vendetta* and the *Sandman* series describes the distinction between the *idea* and the *plot* in this way:

The idea is what the story is about; not the plot of the story, or the unfolding of the events within the story, but what the story is essentially about. As an example from my own work (not because it's a particularly good example but because I can speak about the work with more authority about it than I can the work of other people) I would cite issue #40 of *Swamp Thing*, "The Curse".



The story was about the difficulties endured by women in masculine societies; using the common taboo of menstruation as a central motif. This was not the plot of the story—the plot concerned a young married woman moving into a new home built upon the site of an old Indian lodge and finding herself possessed by the dominating spirit that still resided there, turning her into a form of a werewolf. (Alan Moore. *Alan Moore's Writing for Comics*. 2008. Avatar Press)

Moore gives us a great way of looking at the difference between the *idea* and the *plot*. When we start to think about constructing our science fiction prototype the *idea* of the story will come from the scientific or technology that you picked above. The *plot* of the story is what you will contract with your outline.

Let's quickly look at another example from an actual science fiction prototype. In the story *Nebulous Mechanisms* (Johnson), the *idea* of the story comes from the paper *Using Multiple Personas in Service Robots to Improve Exploration Strategies when Mapping new Environments* (Egerton, Callaghan, Clarke). The paper explores the benefits of building irrationality into the artificial intelligence of domestic robots to improve their ability to adapt to complex environments. The plot of the story revolves around Dr Simon Egerton's investigation of why the robots from the Ceres mine have started going to church on Sundays.

In **Nebulous Mechanisms**, the *idea* is why the story is being told, it is the idea and the theory that is being worked out in the fiction. The *plot* is what actually happens in the narrative. It is a linear set of events involving characters, locations and situations where we can explore the implications of the idea. We can put the idea into a real world setting and see how it plays out and better understand the idea's affect on both the characters and the locations.

### ***Planning your Story***

When planning your story, you should begin by considering future versions of the technology you've selected to explore from you topic. You can begin by asking yourself some basic and entertaining questions:

- What are the implications of the mass adoption of the technology?
- What is the worst thing that could go wrong and how would it affect the people and locations in the story?
- What's the best thing that could happen and how would it better the lives of the people and locations of the story?
- If this technology was in an average home how would it actually work?

Obviously, given that this is a computer security course, there must be an element of computer security in (at least some of) the questions that you explore. But we will take a fairly broad and liberal definition of security.

Once you've started getting some ideas from these questions you can begin to brainstorm one or more potential broader contextual issues raised by the technology in question. As you imagine the plot of your story it's important to remember that you are placing your topic or idea in a real world. Now, granted we are talking about science fiction or your real world might be far into the future but regardless the world must feel real. It is still governed by the laws and logic of science. It's also important to remember that this world that you are creating needs to be populated by real people. These real people will have real problems that have nothing to do with your topic. In the future people will still not want to go to a boring job. In the future people will still fall in love and some will have their hearts broken. In the future we still will feel too lazy to take out the trash.

The setting for most science fiction prototypes need to be the near-future. As we extrapolate out the scientific topics the goal is to place them in a world that we know and one that will be useful to study and explore the affects of the technology. Creating a realistic background for the near-future is essential.

Dean R. Koontz is a powerhouse writer. He's been on the best selling fiction lists for over thirty years and twenty-four of his titles have reached the number one spot. So it's pretty easy to say that Koontz knows quite a lot about how to put together a story. What many people don't know is that back in 1981 Koontz wrote a book on writing called: *How to Write Best Selling Fiction*. It's a very practical book that discusses Koontz's ideas on writing, story construction and the professional literary marketplace. Even a best seller like Dean R. Koontz recognized that creating a plausible near future was not an easy task.

Because most science fiction takes place in the future, the backgrounds are largely products of the writers' imaginations. The future can be researched only to a limited extent, for when it comes to saying exactly what the years ahead hold for us, even the most well-informed scientists can offer only conjecture. The SF (science fiction) writer's vision of the future must be detailed and believable, or ultimately the reader will not believe *anything* about the story—not the characters, the motivation, or the plot.

The *near future*. Structuring a story background of near future—twenty, thirty, or forty years from now—is in some way more difficult than creating an entire alien planet in some impossibly distant age, for the near-future background cannot be *wholly* a product of the imagination. The writer must conduct extensive research to discover what engineer and scientists project for every aspect of future life. From that data, the author then *extrapolates* a possible world of tomorrow, one which might logically rise

out of the base of the future which we are building today.  
(Koontz. How to Write Best Selling Fiction. 1981. Writer's Digest Books)

This is good news! As Koontz points out it is important that the writer of a near-future story understands what engineers and scientists are working on and projecting for the future. In the case of science fiction prototypes much of this is accomplished when the topic has been selected. The fictional near-future world of the story/prototype is dictated by the actual science of the topic.

### ***Writing the Outline***

In his book Dean Koontz describes science fiction plots (he calls them category fiction or genre fiction) as being a little different than other kinds of writing.

The plot is usually the skeleton and the tendons and the vital organs and the muscle...a strong plot—one that is based on an ever worsening series of complications—is essential. (Koontz. How to Write Best Selling Fiction. 1981. Writer's Digest Books)

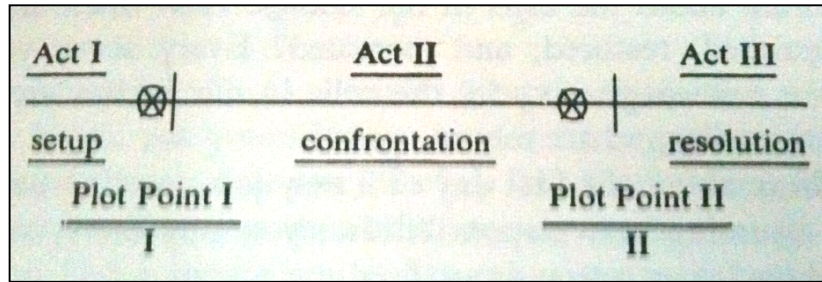
For your prototype you will outline the plot and explore the implications of your topic. A story outline is as Koontz describes it, *the skeleton*, of the story. The outline provides a step-by-step description of what happens in the story. In most cases the outline is not written in prose like a story. For our purposes a list of events and description will serve to describe the action in your fictional world. To help things along I've provided a rough structure for your outline below.

Syd Field is a legend in the screenwriting business. His book *Screenplay*, written in 1979 has been required reading for all screenwriters and many storytellers ever since. Field's book is a no nonsense approach to story telling and plot construction that can help us build our science fiction prototype outline.

Field describes plot, story telling and dramatic structure in a unique way:

A linear arrangement of related incidents, episodes or events leading to a dramatic resolution. (Field. *Screenplay*. 1979. Dell)

To illustrate his approach Field came up with the following diagram of a typical movie structure. For our purposes this same structure not only works for movies but stories and science fiction prototypes as well. We can use Field's diagram to give us our skeleton or outline to fill in the linear events of our story.



(Field. Screenplay. 1979. Dell)

### **Act I:**

Act I is where you set up the world of your story and introduce us to the people and locations. You can answer very simple questions like who are the main characters and where will the action take place. You will also want to begin to explore an explanation of the technology in your topic.

### **Plot Point I:**

Syd Field describes a plot point as “*an incident or event that ‘hooks’ into the action and spins it around into another direction. It moves the story forward*” (Field. Screenplay. 1979. Dell)

For us the plot point is the implication of your topic on the world in your story. Typically this is how the science affects the people and locations in your story in a way that is unexpected or surprising.

### **Act II:**

Act II is where you will explore the implications of Plot Point I on your world. What affect does the technology have? How does it change people lives? Does it create a new danger? What needs to be done to fix the problem?

### **Plot Point II:**

Plot Point II is what we have learned from seeing the technology of our topic placed in the real world. What needed to happen to fix the problem? Does the technology need to be modified? Is there a new area for experimentation or research?

### **Act III:**

Act III allows us to explore the possible implications and areas for exploration from Plot Point II.

### ***Writing the Outline: An Example***

It illustrate this process let’s use an example. As we discussed above: in the story *Nebulous Mechanisms* (Johnson), the *idea* of the story comes from the paper *Using Multiple Personas in Service Robots to Improve Exploration Strategies when Mapping new Environments* (Egerton, Callaghan, Clarke). The paper explores the benefits of



building irrationality into the artificial intelligence of domestic robots to improve their ability to adapt to complex environments. The plot of the story revolves around Dr Simon Egerton's investigation of why the robots from the Ceres mine have started going to church on Sundays.

Here's the outline:

**Act I:**

- Dr. Simon Egerton, a university researcher and roboticist, is called into a meeting on a near Earth space station for a mysterious job.
- XienCheng, a mid-level administrator, tells Egerton that there is trouble at their asteroid mine Ceres 1. They are losing money and they want Egerton to figure out why it is happening.
- Egerton learns that the robots are going to church

**Plot Point I:**

- The robots are going to church on Sunday and no one knows why

**Act II:**

- Egerton departs for the mine with a bodyguard, Kempwright. They only have two days to figure out the mystery
- At the mine the men discover that all of the humans are gone and that the mine is running normal
- At the end of their tour of the mine, their menacing robot guide explains that the frighteningly clean building in the distance is the robots *church*.
- That night Egerton is awakened by Sue Kenyon, the last human employee of the mine
- Kenyon tells Egerton that her ex-partner was killed by the bots when he went snooping around and that Kempwright has disappeared
- Kenyon must get drunk and pass out because the nano-bots in her pace maker will not work on Sunday and if she isn't passed out she will die.
- Egerton wakes up to find Kempwright murdered by the bots (crucified) in his room
- Egerton races to the shuttle pick up to escape any further violence but finds the mine deserted and all the robots in the church
- Egerton investigates the church

**Plot Point II:**

- In the church the robots are not holding service or praying or doing anything at all. They are simply going to church. It is an irrational behavior they have adopted to help them cope with the mine's complex environment and dangerous conditions

**Act III:**

- Egerton returns to the near Earth satellite to deliver his report to XienCheng

- The irrational behavior of the bots allows them to cope with the complex environment of the mine. It is precisely because it is irrational and doesn't make logical sense that they have adopted it. They now need it to operate.
- Egerton tells XienCheng that he needs to get used to this irrational behavior, the robots on the company's moon base are building an amusement park—engaging in another “irrational” behavior – riding roller coasters.

### 3. The Result

The final step in the science fiction prototyping process is to reflect on what you have learned from taking your *topic* through the *outline* and generating a new way of thinking about the science of that topic (*result*).

One example result from the *Nebulous Mechanisms* science fiction prototype is that even though irrationality may allow artificial intelligence and domestic robots to adapt to complex environments it is also important to bound this irrationality so that it doesn't harm humans (as with the Sue Kenyon example) or decrease productivity (church and roller coasters). We also ask new questions about the science:

- Can we put bounds on irrationality?
- Are there different levels of irrationality that are appropriate for different systems and robots?
- Can we build safety mechanisms into AIs and systems to safeguard from unexpected consequences of more complex computing environments?

### Timeline and Instructions:

You should work in groups of 2 to 4 people for this project (ideally 3). Discussing these ideas in groups is an important part of the learning process for this project. Please contact us if you believe that there are extenuating circumstances that warrant group sizes of 1.

- *Part 1.* Identify topic. February 12. (Friday.)

By this date you should pick the topic that you will explore. You should submit to Catalyst:

- A short description (at most one paragraph) of the technology that you will explore. Give background references, e.g., link to motivating forum post or citation to the motivating research paper.
- A short (one paragraph) description of the broader contextual issue that you will explore with that technology.
- A short (one paragraph) synopsis of your envisioned story.

As always, please include the names of all your group members on the top of the first page of your submission (in PDF format).

- Working session with Brian David Johnson. (February 18, during quiz section.)
- *Part 2.* Final product. February 26. (Friday.)

You should submit:

- Short description of the technology that you explored. Give background references, e.g., link to motivating forum post or citation to the motivating research paper. (This may be identical to what you submitted when you identified the topic – the first deadline above. Or it may be revised based on your work toward the outline.)
- Final outline.
- A short (between two and three page) discussion of the original security issue that you based the outline on and a discussion of how your understanding of those security issues evolved through the science fiction prototyping process. For example, how did this process expand your understanding of the issue? What issues were raised that you didn't see before? Also include in your write-up a discussion of how you would design future technologies to address the issues that you uncovered while preparing your short story.

You could submit this in two ways. First, submit the above to the class's "broader context" forum. Second, a PDF version should be submitted to Catalyst (with all the group members listed at the top of the first page).

Our use of the forum for these outlines, just as with the current events and security reviews, is to encourage broader discussion about the topics in question. (Please speak with us if you believe there are extenuating circumstances for which you would prefer not to post to the forum, e.g., because you wish to do something else with your story after the quarter is over. In general we think that the forum and the resulting discussion would be beneficial for most things you might plan for the story afterwards, e.g., publication, but we would still be happy to talk with you about your specific case.)

- *Part 3. (Extra Credit.)* March 12. (Friday.)

Turn your outline into a complete short story and submit it to Catalyst. You are also encouraged to submit to the Forum, but that's not required for the extra credit.

## **Required Reading/Viewing**

- *Science Fiction Prototypes Or: How I Learned to Stop Worrying about the Future and Love Science Fiction*. Johnson, BD. 2009.
- *Nebulous Mechanisms*. Johnson, BD. 2009
- *Runaround*. Asimov, I. 1942
  - <http://en.wikipedia.org/wiki/Runaround>
- *OPTIONAL* - I, Robot. The Movie.



## Going Further

If you're interested in taking your outline further, there are at least a couple of conferences where you could submit completed works for peer review and publication. There will be a workshop and conference (Intelligent Environments in July 2010) that will have a complete track about science fiction prototypes. Papers for this conference are due relatively soon, however (Feb 22). Please see this website for additional information about the Intelligent Environments conference: <http://intelligentenvironments.org/conferences/ie10/>. Also there is going to be an entire conference devoted to Science Fiction prototyping in January 2011 (details forthcoming).