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University College London

Masters Project

Onboarding a Web-Based Information Security Simulation

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This report is submitted as part requirement for the MSc Computer Science degree at UCL. It is substantially the result of my own work except where explicitly indicated in the text.

The report may be freely copied and distributed provided the source is explicitly acknowledged.
I’d like to thank my family for being who they are. Macho Papi, saba que podras. Macha Mami que siempre nos reuniremos. Macha aa que sigues siendo a quien ms admiro. Macho Loti, nunca te des por vencido. Macha Cami, que no sabes en la que te metiste con nosotros. Y como siempre, gracias a las ahora Tres Estrellas que me miran y acompanan.

To my flatmates, past and present. I remain convinced we were meant to be at that this year. There is no way such an eclectic group came together by coincidence. Thanks for the late nights, the early mornings, the complaints, the food. I couldn’t ask for better or more entertaining people to live with.

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Abstract

The following report covers the development of an onboarding extension to UCL’s existing Information Security web-based simulation (Security Policy Risk Simulator - SPRKS) as well as the addition of a tutorial for the simulation at large. Languages used included HTML, CSS, JavaScript, jQuery, JSON, AJAX and Python; other utilities included Apache Server and a MySQL database. Primarily, the goal was to deliver a working end product that would introduce new information security signings to the simulation as part of a company’s onboarding processes. The sheer complexity of the SPRKS system, both its back-end and its thematic content, would represent the biggest challenge in this task.

An iterative and incremental approach was used during this project. Every iteration moved through the process of planning, requirements gathering, analysis and design, implementation, testing, evaluation. Only once most of the debugging was finished and the design finalised was the extension fully integrated onto the simulation. Testing of the on-boarding extension was done through a series of expert run-throughs and interviews. Results were mostly positive and helped in planning for further iterations.
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Introduction

1.1 Information Security and Web Onboarding

Does the average employee truly read through their employer’s security policies before agreeing to them? An exact figure may not be as important as the bigger issue: noncompliance. Causes and reasons are plentiful[1], but there appears to be an almost blatant apathy towards information security amongst users. While users could, and most definitely do, protect their passwords and other means of identifying themselves to the technological world at large, the measures taken by employers to ensure the security of their information is often seen by employees as more of a hassle than a necessity[1].

However, the target audience for this project’s final product consists of newly recruited junior security officers who need to be brought up to speed with their employer’s information security procedures. Use of the tool allows new recruits to experience scenarios that put their skills to the test and shows what security issues related to compliance can arise.

UCL’s Security Policy Risk Simulator (SPRKS) is an exploratory web-based game simulation that aims to teach and explore the workings of information security by putting the user in charge of a fictional company’s policies. As it is an ongoing project, there are various versions of the simulator on its home repository. The simulations’ features and software architecture are partially documented by a wiki[2].

The main challenge for this project lied in the simulation’s complexity.
While there are explanations for the simulations’ different parts on the repository wiki, the simulation itself does a poor job in letting a user know what each policy does or what he or she is meant to do to make progress in the game. The final product would have to build on top of the existing code and architecture to deliver a user onboarding experience that is both informative and entertaining to the user. Onboarding can therefore be defined as the mechanism that will allow users to become familiar with the simulation.

### 1.2 Aims and Goals

The SPRKS simulation contains many moving parts that work together. The primary aim for this project was to understand how these parts interacted with each other. More specifically, the inner workings of the simulation use HTML, CSS, JavaScript, jQuery, JSON, AJAX, MySQL, and Python; making the primary aim the learning and use of these languages to deliver a working product. A clear secondary aim established during the creation of this report was to learn and effectively use the \LaTeX tool.

The primary goal was to deliver a solution that would properly introduce the “average” target user to the complexities of a company’s information security processes. To that point, the final product would need to instruct the user on how the simulation works, explaining its features and how they work together. The final product would also include a narrative that would ease the user onto the more advanced features of the system. In essence, the final product would serve as a tutorial to the simulation at large.
1.3 Project Management

Due to the complexity of the SPRKS system, this project took an iterative and incremental approach. Features were designed to work with the system before being broken down into progressively smaller parts and fine tuned into completion before implementation.

Narrative was almost nonexistent on the given simulation. Users were given a two paragraph introduction to the simulation and what they were meant to do, but nothing more. Likewise, the user was never given an introduction to what they were seeing. No explanation was given to button functions or to the significance of graphics (such as the graphical depictions of employees). Events triggered without warning and the user was given little advice as to what to do once they occurred.

The final product would implement a linear narrative that takes the user through the mechanics of the simulation in a manageable manner. A tutorial mode would instruct the user on how the interface elements function and how they can be best used. These two facets also help manage the incremental introduction of new contexts (such as a new set of policies to be defined or new characters to manage) to the simulation, an area that was sorely lacking in the starting version as all contexts are available from the start.

1.4 Report Overview

The rest of this report is structured as follows:

– Chapter 2: Context covers literature review and research. Included
in this chapter will be a look into related projects, a breakdown of the SPRKS system and utilities employed during the course of the project.

– Chapter 3: Requirements and Analysis details the final problem statement. The requirements gathering and problem analysis section further fleshes out the problem and possible solutions.

– Chapter 4: Design and Implementation covers the implementation of the final product in chronological order by sprints taken.

– Chapter 5: Testing covers the processes taken to test out the product on users and experts alike.

– Chapter 6: Conclusion brings the report to a close by evaluating the test results and offering suggestions for future work to be done on the simulation as well as final thoughts on the project overall.

Context

2.1 Literature Review

For individuals, the loss of information can be a painful experience. For corporations and larger entities, the mishandling of information security poses a greater threat. The use of policies mitigates the possibility of exposure by structuring the company’s attitudes and behaviors towards the use of information[3]. However, as research dives further into this topic, the studying of the “human error” and non-compliance has come to the forefront[1, 3, 4].

Onboarding, in this larger context, refers to the time period when a
new hire is introduced to his/her employer’s processes of “learning, networking, resource allocating, goal-setting and strategizing”[5]. These introductions make use of various forms of delivery; from printouts to checkpoints throughout an extended period of time[6]. The SPRKS simulator is a tool that would complement an employer’s onboarding processes with the hopes of readying junior information security officers at a faster pace.

The lack of onboarding, it could be said, is preferable to poorly executed onboarding. Acclimating recruits to different, perhaps brand new, ways of working is only the primary goal of going through onboarding. A secondary, at times inadvertent but no less important, goal is to build organizational commitment to the company right from the start[7]. Good onboarding experiences should offer a sense of camaraderie and in general a good vibe from the working environment, easing an employee onto a position where they can grow to “love” their job[7]. Conversely, bad experiences may turn the new hire apathetic towards the company as a whole. With the need for onboarding in mind, this project meant to produce a proper introduction of the SPRKS simulator to its users. Given SPRKS’s inherent game-like environment and thematic value, research turned to the area of of game design and game tutorials.

A major trait of the “gaming experience” is the ability to immerse a player onto a virtual reality. Nearly all related literature[8, 9, 10, 11] point to this factor as an advantage to be exploited, while others[12, 13] provide means of quantifying a player’s immersion in-game. Having the player learn real-world skills as they progress through a game is an as-
pect of serious games that companies are keen to make use of[11].

For game tutorials, research turned to a psychological point of view. As the SPRKS simulator aims to teach fairly complex material, its mechanisms need to walk users through most of their interactions while persuading them to behave in a way that minimizes negative impacts to the company (in this case, by setting the best possible security policy in the least amount of time). B. J. Fogg’s concept of captology[14] lays a solid framework for implementing a system that does so. In particular, his Principles of Reduction (p. 33), Tunneling (p. 36), Tailoring (p. 38), Attractiveness (p. 93), and Similarity (p. 99) give insights on how to get and hold a player’s attention as they go through the simulation. Overall, the tutorials follow a design that was, as Isbister, et. al [10] put it, less end result, and more based in quality of experience.

2.2 Related Projects

Useronboard’s teardowns[15] provides a hub where the onboarding experiences of tools as diverse as Trello and Snapchat can be accessed and studied. By offering a step by step breakdown of a tool’s introduction, this website quickly points out what works and what doesn’t in terms of design and function choices. Of particular interest are the teardowns for Shopify and Evernote. Shopify’s UI offers insights onto design choices like consistent color schemes, significant feedback options, and timeline management. Evernote shows how Fogg’s Reduction and Tunneling Principles can be applied to maintain a user’s focus on what’s important by streamlining the onboarding processes.
The mechanics of both SPRKS versions, discussed in the next section, can be simplified as being either real time or turn based. When searching for examples of game tutorials, the strategy genre was deemed the most suitable one as there is an extra layer of teaching in these games; players must learn both how the game works and the best way to go about winning it.

For real time strategy, Plants vs. Zombies 2’s tutorial levels[16] had an effect on the overall feel of the tutorials. In this game, players are introduced to no more than two game mechanics one “day” at a time. For instance, on the first day only the concept of planting and defending is shown. The second day increments the playing field’s context by adding two more lanes where plants and zombies can come into play. Along the way, the game highlights important elements and gives the player textual hints. It is also of interest that this game offers return players (those that played the first iteration of the game) the option to skip the tutorials entirely.

Similarly, the turn based strategy game Advance Wars introduced contexts over several “field training missions[17].” Due to it’s more relaxed style of playing, there are missions where multiple contexts are introduced or expanded upon within one of these missions. It should be noted that this game also gives players the choice of whether or not to take the tutorials. It does this by setting the tutorials on their own game mode instead of making it part of the “campaign” mode as Plants vs. Zombies. However, these training missions have their own stories that tie to the broader narrative of the game.
2.3 The SPRKS System

Since its initial commit on May 31st, 2013, SPRKS’s Git repository[18] has grown to include different branches, housing different sets of working models. Discussion of the differences among these models is beyond the scope of this report; what is of interest is how all eight branches, including the one that houses this project’s assets, deal with two versions of the simulation. Versions that have come to be called “static” and “dynamic” SPRKS.

The “demonstator-1july” branch houses a working version of static SPRKS. This is a more simplified take on the simulation’s workings. The simulation website is implemented across several HTML views with a RESTful API. Passwords are its only authentication mechanism context and it introduces three characters. Game progress can be simulated by playing through one full round of policy settings.

The master branch houses the latest version of dynamic SPRKS. The dynamic version is further developed than its static counterpart, but it is unstable. In this version, the simulation is implemented as a Single Page Application retaining a RESTful API. Three sets of policies related to different authentication mechanisms (passwords, passfaces and biometrics) are introduced, as are three work locations (home, public and office), three devices (laptops, desktops and handhelds), and a total of nine characters. A simulated timeline controls game progress.
Both versions of SPRKS have convoluted inner workings. For persistency reasons, Python code handles port forwarding to either (a) a web server hosting a MySQL database previously setup or (b) a CherryPy server if there is no web server available. HTML defines the web application as a single page or multiple views. A customized version of the Bootstrap CSS infrastructure styles all sites accessed. Communication with the server is done through AJAX calls using JSON structures. Throughout the code, JavaScript and jQuery are used for everything from CSS style changes to server communication calls.

In contrast, SPRKS’s user interface is relatively simple. Upon accessing either version of the web application, users will encounter a brief description of the system. They will then be asked for their credentials or prompted to create new ones. The home screen for both variants can be seen in Figure 1.

The dynamic version employs a timeline controller for its simulation. The different buttons control the speed at which time passes by. As time passes, characters in the background move to different locations and certain events (called Incidents in-game) are triggered. As there is no clear end to the timeline’s logic, the dynamic version can run for as long as the user desires. The static version contains enough logic for only one round (which can be repeated again and again) and as such, there is little room for in-game events other than the one brought on by the policies set.

Note that both versions use the same side menu for navigation. The
Figure 1: Home screens for Dynamic (Top) and Static (Bottom) SPRKS buttons control the flow of the game. Figure 2 shows a UML activity diagram of the interaction between these buttons.

Introduction shows the user the “narrative” for the simulation. Policy shows the different forms a user can fill in order to set a working security policy. The dynamic version contains various contexts to choose from (employee types, devices used, and authentication mechanisms) while
the static version only implements one context. The given policy’s risk and cost are estimated by the Support Vector Machines Classifier machine learning algorithm[19], these factors along with a relevant incident are shown under the Consequences button. Finally, Score tallies the user’s current policy factors (such as risk and cost) and compares them to theirs and other users’ previous attempts, producing a ranking.

Due to unforeseen circumstances, discussed in the Design and Implementation chapter, the final product is derived from a reduced working set. This set was comprised of static SPRKS as its foundation with dynamic
SPRKS serving as an “inspiration” for the final product. Common assets between the two versions, such as the narrative and design, were built upon and expanded while assets from the dynamic version, such as contexts and characters, could be used if needed.

2.4 Utilities

Python 2.7.7[20] is used throughout the project; the IDLE code editor was used for the first two weeks of project work. At this point the chosen editor for HTML, CSS and JavaScript was Sublime Text 2[21]. Due to the SPRKS system’s dependencies, particularly concerning Python libraries, PyCharm Community Edition[22] replaced IDLE as it offered a clearer view of debugging Python code. This editor was also used for all other required languages as it provided a multi platform interface for Git.

The Python packages needed before the system can be run are web.py, mysql-python, scikit-learn (and it’s dependencies: numpy, scipy, matplotlib, setuptools, libatlas), pydot, py.test, and mock. Initial compatibility issues with the mysql-python library forced a change of operating system, from Mac OS X Lion to Windows 7; a second change was needed after the Windows 7 virtual machine ceased to function entirely. The final operating system was a Virtual Machine running Linux 14.04 TrustyTahr. Version control in this environment was done through Git[23]. This added two more goals to the project as the use of a Linux environment and command line Git was a new experience.

The addition of three JavaScript libraries: Intro.js[24], Impress.js[25] and Anno.js[26] proved crucial as they are the basis of how the tutorials
function. Towards the end of the coding stages of the project, the inclusion of graphics was necessary. The tools used for this purpose were a Wacom Bamboo CTH-460 drawing tablet and the GIMP[27] graphics editor software.

Requirements and Analysis

3.1 Problem Statement

Given the reduced working set, the final problem statement can be stated as such:

*Develop a narrative for the Global Sparks Utilities company within the existing Security Policy Risk Simulator (SPRKS) system. Implement an interactive story to facilitate the learning of information security policies within the simulation. Implement a set of introductory tutorials for the different stages of the simulation. Provide a viable onboarding resource for employees to familiarise themselves with information security best practices and policies.*

3.2 Requirements

Working off the finalised problem statement, the state of the relevant code, and weekly meetings with the project supervisor who acted as product owner, a set of requirements was extracted and given MoSCoW criteria. The final product:

- **Must:** Implement the tutorials as a guide to the simulation.
- **Should:** Implement the story in a way that eases a user onto the
narrative.
– *Could:* Expand the narrative to create believable scenarios.
– *Would:* Ensure the viability and usability of the final product in a real world setting.

Meeting the requirements for the project posed a number of challenges.

The narrative had to be created from the ground up. This required a better knowledge of the simulations’ existing documentation regarding scenarios and characters. Dynamic SPRKS added further contexts with no explanation, the narrative had to find an explanation for this and make it relatable to the user. The development of the narrative must flesh out what Global Sparks as a utility company was within the micro world represented in the SPRKS simulation.

The story should, therefore, explore this micro world. It should explain why events are happening and give the user appropriate feedback given certain inputs. For instance, explaining why a context has been introduced or why setting this value for this policy results in this incident. The timing of introducing contexts and characters had to fit in with what the story is trying to tell; as the starting architecture did not include a timeline mechanism like the dynamic version, a way to introduce the passage of time was also needed. The story should do all these things without overwhelming or boring the user.

The tutorials took the bulk of project coding as there was not much to work with. To not complicate the simulation any further, the tutorials had to be implemented with one of the languages already in use and
needed to work with all other existing architecture. Explaining the user interface in a clear and concise manner was a must.

3.3 Analysis

While coding, as one would expect, the focus will lie on meeting the must have requirements. Only once these must haves are ready and fully deployed will development move on to the other requirements. Because the final product will essentially be user oriented, self validating the requirements is not enough. To fully validate whether requirements were met, the tool needs to go through some form of user testing.

It should be mentioned that the way the requirements are structured, self validation can be done with simple checking of the tool. For instance, it can be said that developing a narrative that introduces one of the contexts by mentioning in the story and reflecting this change in functionality meets the must have requirement for narrative expanding. However, the implementation of the narrative and story carries with it a certain bias. A story cannot be judged fairly by its creator, but by its readers. Similarly, the onboarding aspects of the simulation will have to be exposed to users to be able to assert with any confidence whether the onboarding does what its meant to do.

A set of questions, both closed and open ended, along with other insights from users will be used to validate how requirements were met. Towards the end of development, a study was conducted for this purpose. Due to study limitations including lack of funding for recruiting, access to a limited pool of experts, an approaching deadline, and the difficulty
of objectively measuring usability, a convenience sample was used for testing.

### Design and Implementation

#### 4.1 Dynamic SPRKS

As mentioned previously, the simulation does a poor job instructing the user on how to operate it. Users of either version are given only two a two paragraph introduction as to what they are meant to do. As users progress through dynamic SPRKS, the simulation displays a pop up window to inform that an event has taken place. Characters appear to move randomly between three locations and speaking to them (as instructed by the introduction) reveals only the character’s professional background. With this knowledge, the first steps taken would deal with how to expand the narrative. As the simulation was not yet running on the development machine due to a library conflict, this was purely a brainstorming and designing phase.

Initial discussion with the product owner regarding how the story could be presented resulted in two possible routes: “cutscenes” that would mimic the visual style of 32-bit video game introductory scenes, or a PowerPoint-like delivery. While the chance to recreate old style visuals was enticing, a streamlined presentation was chosen as it allows for more coding time. This would be accomplished with the use of Impress.js.

Impress.js is a JavaScript library that expands on the idea behind pre-
presentation software like Prezi[28]. It uses CSS to emulate and manipulate a 3D-like environment within a defined web page. Figure 3 shows snippets of an Impress-rich page and the CSS styling for the slide class.

A container element with the id “impress” within the body tags signals the start of content for the presentation. Elements of the class “step slide” hold an individual slide. Values for data-x, data-y, data-z, and data-rotate control the positioning of each slide on Impress’ 3D space. The styling of the “.slide” class on the embedded CSS file defines the look of each slide and the logic of the library animates the presentation with the included impress().init(); script call. The result of this language interaction can be seen in Figure 4.

Impress slide show presentations are controlled with the keyboard arrows. Although there can be more than one active presentation at a time, no presentations can be destroyed. Impress’ structure allowed for faster coding in comparison to cinematics, making it a solid choice for delivering the narrative.

Tutorials, when implemented, will be toggled with a switch. The existing color scheme would be used for most design decisions to maintain a sense of integrity. As this toggle switch meant to catch the users’ eye, an ellipsoid design was chosen for the switch instead of the rectangular shape of the menu buttons, where the switch would be placed upon implementation. Following an interaction design approach when it came to visuals, sketches first got the design right and then got the right design[29]. These sketches can be found in Appendix B.
On its bid to expand internationally ... US West Coast

This rapid expansion invites fragmentation within the company

To prevent further damage ... along the way

---

Figure 3: Impress-rich Hello World! HTML and CSS
Adapting the dynamic timeline controller to work with the addition of Impress would prove time consuming. As such, the final product was reworked to be a turn based simulation instead of real time based. At this point, it was clear that the Mac OSX environment was not suited for development as the mysql-python library was incompatible. Problems with code stability and library conflicts forced the move to static SPRKS and a Windows environment.

4.2 Static SPRKS

More than anything, the move to this version offered a better way to structure development. Work took the form of sprints. Each of these started with coding to meet the must have requirements, followed by
integration onto the system, and finished with a debugging session.

4.2.1 First Sprint

The move to this version offered a clean slate to work with. To briefly summarize, working with the dynamic version meant finding a way to make all pieces of the simulation work with code and libraries introduced; while working with the static version meant those pieces could be implemented one at a time while new architecture was being added. This proved especially helpful as it removed the dynamic timeline and additional contexts.

But the first step was to include the now expanded Impress presentations. The nature of the library did not allow destroying presentations, and as the pseudo 3D environment was superimposed on top of all other content, once the presentation started, it took over the entire browser window. Expanding the Impress.js library to include these methods was out of project scope. In the end, the Impress slides use an iframe element within the appropriate HTML view for integration; navigating away from the Introduction page (where the presentation plays) effectively ends the presentation. An interesting side effect of this decision happened when running the entire simulation as users were forced to click on the iframe before being able to control the slides with the keyboard. A workaround was possible with the addition of a JavaScript call that places focus on the iframe automatically.

While Impress uses a Prezi-like presentation to deliver the narrative, the tutorials employ a spotlighting feature with the use of Intro.js. This
library takes a series of browser elements and highlights them one at a time while displaying a relevant tooltip; this “tour” can be controlled with the buttons provided or with the keyboard. Figure 5 shows the user’s perspective of an Intro tour.

Figure 5: Intro.js tour example.

Intro’s API allows for multiple customization options as well as on event callbacks. CSS controls what is highlighted by constructing two overlays: the first one for the relevant object, the second one for its tooltip, and obscuring the rest of the browser window. This highlighting feature would prove to be finicky as it often clashed with other CSS styles, calling for numerous debugging sessions.

One of the CSS elements that clashed the most with Intro’s logic was the toggle switch. Implementation of the switch was easier with an online tool that took the initial sketching phase and put it online as an interactive application[30]. To test the functionality of the switch, a script
was added to the underlying checkbox element that would run a simple three step Intro tour when clicked.

Controlling both Impress and Intro with the keyboard was a departure from the simulation’s workings, as all actions were taken via mouse clicks or were automatic. To maintain integrity, Intro’s keyboard navigation function was disabled (via one of its API functions) and Impress was given an autoplay feature with a script found online[31]. The addition of this script threw Intro’s functionality off as it would no longer highlight elements as needed. Debugging found the cause in Impress’ iframe gaining focus automatically. As keyboard navigation was no longer needed, deleting the focus script solved this quite annoying and unnecessarily time-consuming problem.

To better serve the tutorial functions, a small Intro script points users to the toggle switch a few seconds after entering the simulation, letting users decide if and when the tours start. Calling two JavaScript functions directly with setTimeout did not produce the desired effect, as the Intro stopped immediately after starting even after the second setTimeout was called at a much later time. This bug was fixed by having the functions that controlled the Intro called from anonymous functions. As it was only shown for a short time, this Intro tour was stripped of its higher functionalities and only allowed for a callback on exit.

Introducing all previous code as well as constant use of print statements to Google Chrome’s JavaScript console (a preferred method of debugging) had cluttered the edited files. Cleaning the code gave the
opportunity to adhere by best practices and implement Intro scripts as unobtrusive JavaScript on its own separate file.

4.2.2 Second Sprint

With the basic framework of Impress and Intro now functional, the first parts of the tutorial and narrative could be implemented. The tour introduces the simulation as a turn-based game and then walks the user through the elements in the Introduction page explaining their functions. The toggle switch’s logic was changed to turn this new Intro tour on and off.

The narrative was expanded to cover thirteen turns where each turn represented a month. This simulated passage of time in the system and allowed for an easier way to incrementally implement and introduce contexts as elements could be added at a desired month. The new narrative places users in the role of one of Global Sparks’ new Information Security Officer (ISO), opting to make the original role of Chief ISO the end goal of the game. Depending on the user’s performance over the thirteen turns, two different endings are available, though the logic to make this happen would not be in place for a while. The final narrative was added as Impress-rich files that loaded dynamically on the Introduction page.

Moving on to develop the Policy page code uncovered persistency problems with the toggle switch’s state. The introduction of cookie behavior alleviated this problem while introducing several others. The getter, setter, and checker functions in Figure 6 show how the cookie logic was implemented. The checker function would run on window load and set
the toggle switch accordingly.

```javascript
function checkCookie(name) {
    var cookie = getCookie(name);
    console.log(cookie);
    if (cookie === "on") {
        tick.checked = true;
    } else {
        tick.checked = false;
    }
}

function getCookie(name) {
    var cookieN = name + "=";
    var ca = document.cookie.split(';');
    for (var i=0; i<ca.length; i++) {
        var c = ca[i];
        while (c.charAt(0) == ' ') c = c.substring(1);
        if (c.indexOf(name) != -1) return c.substring((name.length + 1), c.length);
    }
    return "";
}

function setCookie(name, value) {
    document.cookie = name + "=" + value + ";";
    console.log(document.cookie);
}
```

Figure 6: JavaScript cookie helper functions.

In addition to an Intro tour, the Policy page needed an additional helper tool for users. Although changing a set policy displays a graph of cost to risk ratio and the appearance of an overlay informs the user of risk and cost values as a 5-point scale (very low, low, average, high, very high), the interplay between a set policy’s cost, risk and employee satisfaction is never explained in the simulation. The addition of Anno.js was perfect for this purpose as Anno’s interface is similar to Intro’s but its functionality is better suited for quick tooltips instead of lengthy tours.

The inclusion of a third library called for a new debugging session. All
three libraries use z-index values for CSS styles in order to bring their overlays to the forefront of the browser window. This causes Intro and Anno to whitewash certain elements, most notably the menu buttons and the characters. Neither library’s documentation mentions this bug and online methods did not alleviate the problem. Through trial and error testing, it was found that placing the whitewashed elements on a container such as a div would override the z-index properties and apply the right styling.

Adding an Intro tour resulted in odd behavior where the tour would either not function or highlight a random element and display a tooltip from a different tour. The solution came from dealing with Intro’s scope. Before moving to the Policy page, Intro was only included to the HTML view that held the narrative. As this view was dynamically loaded onto the simulation with a jQuery call, any element within the browser window but not in the HTML file, such as the menu buttons, could be included onto the tour. Elements from this tour would clash with those of the newly implemented one. Calling Intro’s library from a parent view HTML file, in this case index\_private.html solved this conflict and allowed the inclusion of tours in other views. Highlighted elements can be interacted with during an Intro tour. In elements such as the toggle switch, this would essentially break all other Intro tours. Adding a disable script for the element to the tour in question made sure this would not happen.
4.2.3 Third Sprint

It should be noted that while the Impress library was a good choice for delivering the narrative, its functionality was at times too limiting. In addition to not being able to destroy the presentation and only allowing keyboard navigation, a lack of animations gave each slide a stilted quality. A jQuery extension to Impress, jmpress.js\[32\] solved these problems and added extra functionality. While the architecture for a move to jmpress is included in the final product, there was not enough time to implement it.

The ability to skip a tutorial presented a usability challenge as a skipped tutorial had to start where the user left off and not from the beginning in case the user decided to have the tour. Adding a function that returns the last shown step to Intro’s API together with an onexit callback that saved this variable allows all Intro tours to have this function. This addition also meant that tours could no longer be exited from by clicking outside the created overlays as this did not provide the onexit callback.

With the tutorials functioning and persistency solved with cookie behavior, a function to start tours if the cookie had set the switch to ON was added. Since the cookie sets the toggle switch’s position on window load, the autoStart function in Figure 7 checks whether the switch’s checkbox is ticked and if so runs a switch case to select and run the appropriate tutorial tour. If the checkbox is not ticked, all instances of Intro are terminated and the cookie is set to false to maintain integrity. A setTimeout call runs the autoStart function two seconds after window load.
The cookie was expanded to handle Incidents. Setting a month’s policies results in one of twelve Incidents each with their own different implications for the user and the simulation. The narrative was also sorely lacking in this aspect as information on the Incident page was, again, not explained. Each Impress presentation was always meant to include at least one slide that would help the user in setting better policies. Adding story elements to the policies was relatively simple as each incident had a corresponding JSON file and Python getter methods that would populate the page when needed; expanding these files and adding methods provided the necessary information. The cookie stored the narrative here and loaded the “Incident slide” on the Impress presentation dynamically next month.
Including incidents to the narrative revealed a game breaking bug that still plagues the final product. Expanding the simulation to become turn-based clashes with the machine learning algorithm. No matter what policies a user sets, the Incidents page will display information related to a default case. All feedback that results from a particular incident (the dynamic Impress slide, character dialogue, timeline styles) reflects the wrong information. A complete redesign of the time sequencing assets was needed to fix this bug, this was beyond this project’s responsibilities. All further development was done with a workaround that simulated the correct Incidents.

Time constraints meant that while the narrative had already planned for the introduction of new locations, devices, and authentication mechanisms, these would not be implemented but alluded to. Impress presentations were changed accordingly and Intro tours were added to the start of every turn exploring the implications of the contexts.

4.2.4 Fourth Sprint

The characters are the only context implemented as imagined during requirements analysis. The user starts off with one employee and is introduced to an additional five over the course of the thirteen turns, keeping in line with the narrative. JavaScript logic uses the global variable that keeps track of the turn counter to hide or show the characters as appropriate. The jQuery, JavaScript, HTML and CSS that controlled the dialogue for the characters was expanded to include five different
chats. One for introduction to display on the first turn the character appears on the interface, three for policy interaction depending on the Incident incurred with a month’s policy, and one for the final turn. Here, a bug was revealed as two turn counters existed, resulting in different turns depending on how a user navigated between pages (a Python based counter if view buttons were used, or a MySQL counter for the menu buttons). Resetting the relevant SQL table and deleting the Python counter solved this problem.

The characters were given their own personality through their dialogue, but their visuals did not reflect this; Impress told a story but without visual aids. As a whole, the simulation was still a wall of text. To correct this, sketches were made and fleshed out with a graphics editor. If appropriate, web graphics and tools (like the sign generator[33]) were chosen over own designs. All visuals taken from the internet are cited in Appendix B.

Timeline visuals offer additional feedback by keeping track of policy results across the thirteen turns. The cookie was expanded once more to accommodate each month’s state across the game. Implementation of the visuals was more involved than apparent as each “orb” needed to be placed on a div container and the thirteen orbs needed a container of their own to avoid conflicts with Intro. Separate switch statements were used to select the containers for previous months and that of the current month while two functions control the coloring logic for each orb.

Next, a scoring system was implemented. A numerical weight value be-
between positive and negative two was added to the incidents’ JSON files. These are stored onto the cookie when displayed in the Incident page. A negative weight indicates an overall risky policy, a positive weight a costly policy, a zero a balanced policy. This weight is tallied across turns; if the final count falls between positive and negative ten, players are shown a “good” ending, or a “bad” ending otherwise. This weight value also plays a vital part on selecting the appropriate character chats to be displayed with a switch statement to select a div suffix and a double for loop that hides all chats then displays the correct set of chats.

The final addition to the tool was a workaround for testing with the Incident bug. Developing incident dependent behavior was done on a controlled environment. As most of this behavior (timeline coloring, character chats, dynamic Impress loading, and score keeping) now hinges on the weight implemented on the JSON files an incident could be simulated one at a time. On a real run-through, the Incident bug defaults this value independent on the set policies. To simulate incident behavior, an algorithm assigns a random value instead of drawing information from files. This workaround is solely cosmetic as the user’s policy settings are still not reflected accurately.

A last debugging session readied the final product for testing. Impress’ autoplay was changed to give users more time with each slide’s content. Intro’s bullets, which displayed tour length, were hidden as they would behave erratically when tutorials were skipped and restarted. Characters, due to the MySQL counter behavior, would appear on the Incident page a turn before they were meant to, special case handling was needed
for each character to solve this. Styles were changed throughout to give a more seamless presentation overall.

Testing

A copy of documents used for this section, including timestamped partial transcripts of interviews, can be found on Appendix C.

5.1 Methods

The tool was tested with a convenience sample of information security experts. Prior to starting the test, users were notified of the “Incident” bug explained in the previous section. Subjects were asked to comment and focus on the tool’s visual communication and presentation.

Demographics gathered dealt with previous knowledge of any version of the SPRKS system, years of expertise in information security, experience with other tutorial or introduction materials (more specifically, in-game tutorials), and the amount of time spent playing a video game and whether the subject considers him/herself a “gamer”.

The subjects were then asked to play through the simulation. To gain further insight into the tool’s usability, testers were encouraged to think aloud as they moved through the different stages of the game. To keep the sessions’ focus on the visuals of the tool, and due to a last minute bug with the starting Intro, players were asked to turn on the tutorials after giving initial insights on the user interface.
The work of Brockmyer, et. al[34] served as a guide in the development of a questionnaire to be filled out at the end of the expert’s session with the tool. Ten questions were used to gauge the system’s efficiency in teaching the simulation’s workings, believability of the narrative, and the overall difficulty of understanding how the system should work.

In addition to the quantitative questionnaire, participants were asked open-ended questions that focused more on the usability of the tool in the workplace, whether the testers learned something from their sessions, and a discussion on how the tool could be further improved. Subjects were asked to elaborate on their answers if these held particularly insightful remarks.

Audio from all sessions was digitally recorded.

Before discussing results, it must be pointed out that Participant 1’s session was different to the other three. For this first session, the participant was instructed to first explore dynamic SPRKS before being exposed to the tool in the hopes of offering a better contrast of the system with and without the implemented tutorials. A questionnaire was filled for both systems after either session.

This approach was abandoned as exposure to the unstable environment of dynamic SPRKS drew focus away from the final product and exasperated the subject. To avoid further confusion, the survey’s questions were reworded to eliminate ambiguities and dynamic SPRKS was no longer
used. Nevertheless, all of Participant 1’s answers will also be taken into account as the survey’s questions were clarified during the session and the subject offered clear insights on the tool without taking dynamic SPRKS into account.

5.2 Results and Analysis

Participants 1, 2 and 4 were familiar with previous versions of the SPRKS system, either by being exposed to a deployed version of it or by being familiar with the product owner’s work. Experience as an information security expert varied from fifteen months to four years. While three of the participants (P1, P2, P4) had experienced in-game tutorials, only one (P4) considered himself to be a gamer.

Response to the visual communication aspects of the tool was generally positive. The visual interface and overall presentation were ”engaging (P2. [64:47])” and ”clean P3[28:56])”. Keeping the design scheme of the simulation unchanged helped Participant 4 [00:32] to recognize it on first sight though he did not remember the simulation itself. The narrative kept users entertained and introduced contexts as desired (P1. [35:34], P2. [35:18]). Fleshing out the characters also produced desired results (P2. [58:18]). Participant 2’s run-through demonstrated this the best as she interacted with new characters as soon as they appeared. The different personalities given to the characters’s speeches engaged the participants as desired (P1. [31:27], P2[32:56]).

However, various areas could have been improved. The most important factor in determining the usefulness of the simulation as a teaching tool
is how it interacts with a player’s choices. There is to be no disconnect between what the simulation thinks of a certain month’s policy and what the user gathers from the feedback of said policy. If, for example, the simulation deems a month’s policy too costly, the user should have no doubts that the policy was costly and should receive hints to correct next turn’s policy accordingly.

In that aspect, testing was unsuccessful. As one of the participants remarked, “there was no sense of causality. (P1. Survey)” This inconsistency can be attributed to the Incident bug as, from the user’s point of view, it ignores all policy settings and displays the same Incident even if the desired policy was completely different than that of the previous turn. Specifically, the bug suggests the user to change the “Password Attempts” policy on all turns, even if this has already been done. Understandably, this disjoint frustrated many of the participants even after they were informed of the existence of this problem. It should be noted that Participant 2, fully aware of the bug, continued to change the policies by using other visual cues such as the timeline colors and the characters’ dialogue to guide her choices.

The tutorials fulfilled their purpose (P2. [04:30 - 05:26], P4. [08:38]) but had their own set of problems. Participants knew how to control the introduction overlays with little help and the content was clear enough to warrant not asking for clarifications. Yet the greatest weakness of how the tutorials were presented is how difficult to find they are. All participants had to be asked to turn on the tutorials; it’s doubtful the tutorials would ever had been displayed without this prompt. There was
also a sense of the tutorials being, for lack of a better word, annoying. Participants 1, 3 and 4 were quick to turn them off as soon as the initial tour was done.

Conclusions

6.1 Summary

As a whole, this project could be considered to be incomplete. The main aim of understanding the system’s inner workings was only partially met as the logic behind certain cogs, notably the time sequencing mechanism responsible for the incident bug, remains unclear. Nevertheless, the proficiency acquired in the languages involved was suitable to finish the goals set within the given time. Considering it was only the first time delving so far into JavaScript, Python and advanced CSS, the primary aim can be considered a success. Likewise, this first use of the \LaTeX tool proved to be a challenging but rewarding effort.

The main goal of having the final product properly introduce users to the system was partially met. When in use, the tutorials and tooltips implemented helped participants in the use of simulation. The malfunction of the tutorial switch highlight function was a great loss, as the tutorial’s weakness lied on how easy it was to miss on the user interface. As one of the participants was quick to point out: “it should be ON by default (P4. [05:28]).”

Arguably, the narrative is the more successful of the project’s additions. The ability to control the Impress slideshow with the arrow keys worked
well when the auto play function moved the slides too fast. Content-wise, having the story introduce aspects of the tool after a certain time (i.e. at a certain in-game month) served to ease experts on to the more advanced features, holding their interest. As one of the participants stated: “in helping me to experience a broken simulation, (the narrative) was effective (P1. [38:07]).”

6.2 Evaluation

Project management should have been handled better. Granted, it took far too long to have a starting stable platform to work with. Once this was achieved, after the move to static SPRKS, developing times did not fare better. Here, a stricter or better planned management scheme would have come into play by keeping the project on track. For example, if one aspect of development was taking far too many resources to accomplish it would bring all other processes to a standstill when an alternate working route should have taken over instead.

Given this and other unfortunate external factors (library conflicts, unstable environments, game-breaking bugs), it is somewhat surprising how well aims and goals were met. While working with dynamic SPRKS, any type of trouble would represent several days of searching and trial and error to fix. These situations could be solved within an hour or two in the final weeks of work. The resulting code was not “pretty” but it did what it was meant to.

The expert run-through sessions served in showing how far the simulation had come, and how far it has yet to go. With the bugs that
currently plague it, the final product would not do what it is meant to. However, these bugs were not in the scope of this project; if they were to be eradicated, this tool could prove its worth as a part of a company’s basic onboarding of junior information security officers. It must also be noted that a broader and bigger audience would have been the desired way to test out the tool.

6.3 Future Work

Before any additional work can be conducted, the code must be de-bugged. The Incident bug notwithstanding, running the simulation will inevitably yield JavaScript errors and CSS inconsistencies. Among these is a lack of styling consistency when using either Intro or Anno as these libraries will, at times, shift an element from its position on the browser when in use. With JavaScript it is more of a need for code cleaning; most errors printed to the console are due to out of scope function calls.

To improve on what the existing tool currently does, we must run down the list of issues taken from the expert testing sessions. A recurring matter was the simulation’s inability to conserve their policy choices from turn to turn, essentially forcing them to set a new policy with each turn. Defaulting these values to a player’s previous turn choices is implemented in the code but will only work when the Incident bug is solved as these values are taken from the MySQL database with incorrect values written to it. Alternatively, as suggested by a participant (P3. [14:09]), the inclusion of a button on the Policy page that has this function could serve this purpose. Along the same trail of thought, an addition that keeps better track of a user’s policy history is sorely needed (P1. [54:06]).
Visually, there is plenty of room to grow and change as well. Transitions between Impress presentations slides should not be as fast as they currently are; keyboard navigation should also either override or cancel the autoplay behavior as both methods can cause a slide to be missed due to timing conflicts. Although it was also out of scope, all participants suggested the graphs on the Policy page be labeled more clearly. Adding feedback mechanisms to this page that point out the interplay between policies (i.e. why a policy’s risk is affected by a choice in a different policy) would also serve to inform the player in his/her decisions.

A redesign of the Incident page may help better communicate what the user must do as well. As it stands, the Incident page describes a relevant incident and its consequences, but it does so in an unappealing manner. Ideally, a user should stop to take in what their policies have brought about. Since this page must also persuade a user to take recommended actions, redesign of the interface should take advantage of Fogg’s captology principles for social actors (p. 89)[14].

Long term additional features would revolve around further expansion and gamification of the tool. The introduction and implementation of new contexts and policies to serve them, tailoring the narrative to fit a company’s situation, even implementing a competitive or cooperative factor would all serve to further prepare junior information security officers for what may be coming up ahead. Adding a realistic touch to the way the policy setup works will also serve to better the simulation. One of the experts (P2. [69:16]) offered a scenario where two characters
would have conflicting interests: one of them wanting the policy’s cost to be low, the other one its risk. Going forward, the narrative itself would be better served by this concept of “introducing noise” from time to time.

6.4 Final Thoughts

There were two major personal takeaways from the methods followed during this project.

First, persuasive techniques, like Fogg’s captology, must be taken advantage of. When gamifying a teaching simulation, user engagement is not to be ignored. The teaching concepts and game mechanisms must also entice players to keep playing. This holds especially true for onboarding tools as they are to be used to speed up an introduction process. Keeping a balance between giving a user room for error and walking them down the right path will make the final product both engaging to employees and viable to employers.

Second, a properly set sprinting method of project management serves these types of projects well. When a developer must work with existing and convoluted code, breaking down the project into manageable sections and implementing them one sprint at a time proved to be an effective way to deal with incidents such as structural bugs and asset conflicts. Particularly, ending each sprint with a major debugging session kept the rate of error encounter manageable.

There is, and always will be, room for improvement. All aims and goals
met pale in comparison to how much further the tool can be brought
along. Before any coding or background reading started, the require-
ments for the final product seemed simple to achieve, or at the very
least not as difficult as they turned out to be. The Dunning-Kruger
effect[35], where one becomes aware of a need for training, became more
and more apparent as time went on as it was clear how inadequate start-
ing skills were.

Yet, this is a positive finding for the Dunning-Kruger effect also derives
positive insights. Perfection is inexistent, but the search for perfection
is a worthy one. All hurdles found, and at times thrown, during this
project served to improve the skills necessary to keep going forward.
Starting with almost no skills relevant to the project and being able to
hand in the final product is, at the very least, a satisfactory learning
experience.
Bibliography


Appendices

7.1 Appendix A: System Manual

All project assets can be found in the narrative branch of SPRKS home repository: https://github.com/mapto/sprks/tree/narrative.

In order to run the simulation, the following Python libraries are needed:
- web.py : http://webpy.org/
- Mysql-python : https://pypi.python.org/pypi/MySQL-python/
  - numpy : http://www.numpy.org/
  - scipy : http://www.scipy.org/
  - matplotlib : http://matplotlib.org/
  - setuptools : https://pypi.python.org/pypi/setuptools
  - libatlas : https://pypi.python.org/pypi/atlas/0.27.0
- pydot : https://code.google.com/p/pydot/
  - pyparsing : http://pyparsing.wikispaces.com/
  - graphviz : https://pypi.python.org/pypi/graphviz
- pytest : http://pytest.org/latest/
- mock : https://pypi.python.org/pypi/mock

A number of these libraries can also be found at http://www.lfd.uci.edu/~gohlke/pythonlibs/.

Additionally, a MySQL database must be setup. The schema is provided along with the files in the included code under static/sql/schema.sql. It can also be found in the branch repository under https://github.com/mapto/sprks/blob/narrative/static/sql/schema.sql. Administrator privileges for the database should be given to user root, and this user’s password should be set to “1234”. These values can be changed to fit existing administrative privileges by editing the environment.py file starting from line 42.

While the simulation will run in any modern browser, it is designed with Chrome in mind.
7.2 Appendix B: Design Assets

Initial sketches of toggle switch are shown in Figure 8.

The Impress presentation images stick close to the literal meaning of each slide. For example, the very first impress slide talks of Global Sparks expanding onto the American west coast, the visual for this slide is shown in Figure 9.

Where possible, own designs were used, sources for other images will be contained in this section.

Figure 8: Getting the design right for the toggle switch by sketching

Figure 9: Global Sparks acquires US west coast utility providers
Figure 10: Used for jan.html. Source: http://www.wiki-credit.fr/wp-content/uploads/2012/02/credit-impot-2012.jpg

Figure 11: All Keep Calm posters were generated on http://www.keepcalm-o-matic.co.uk/

Figure 12: Used for june.html. Source: http://www.dmmshop.eu/uploads/news/medium/1c78625cbb9b92ff73ff8ff359b3e3b79a.jpg
Figure 13: Used for july.html. Source: http://claytrinity.org/wp-content/uploads/2014/07/Road.jpg

Figure 14: Used for july.html. Source: http://www.scbhrserv.com/uploads/1/8/8/7/18878844/1926681orig.jpg


Figure 16: Used for oct.html. Source: http://legacy.mcpmag.com/images/0904mcp passfaces.jpg
Figure 17: Used for nov.html. Source: http://www.youmanmedia.com/images/fingerprint red.png

Figure 18: Used for dec.html. Created at: http://wigflip.com/easystreet/

Figure 19: Used for fin.html. Source: http://www.eratestrategies.com/wp-content/uploads/2011/01/contract.jpg

Figure 20: Used for fin.html. Source: http://www.tst.uk.com/wp-content/uploads/2013/02/Slider3.jpg
Figure 21: Used for hired.html. Source: http://www.labelsolutions.co.uk/wp-content/uploads/beer-cheers.jpg


Figure 23: Used for fired.html. Source: http://greatdaymoving.com/wp-content/uploads/2012/01/Office-Move-Pic.jpg
Figure 24: All Incident warning signs were created with the warning sign generator at http://www.addletters.com/warning-sign-generator.htm#.U-vuSibbd8E
7.3 Appendix C: Testing Materials

7.3.1 Study Information and Questionnaires

Study Information

To Whom It May Concern,

The study you will be asked to participate in is part of an MSc Computer Science summer project. You will be asked to use a software simulation game with the purpose of getting an opportunity to better develop and apply knowledge of information security policies, particularly those related to passwords. This study will focus on the visual communication and presentation of the simulation and what it intends to teach. As such, some please try to disregard any inconsistencies in the simulation as they are beyond the scope of this research.

In order to help us better understand and measure how the simulation game supports learning of information security, we will ask each of you to do a couple of things. First, we will ask you to briefly answer a few demographics questions before the study. You will be then asked to play through two different versions of the game in question. After each session, you will be asked a few questions in oral form, your answers will be recorded. Your session should not last more than 45 minutes.

Any data that we collect as part of this study will only be used for the purposes of this study. Information about you will not be shared with anyone beyond the course and study administrators. We will use the collected information for the purposes of research publications, but it would be published only in anonymised form and without any way to relate it back to you.

Please do not hesitate to ask any questions or share any comments that you might have. We will greatly appreciate both of these.

We hope that you will enjoy this study as much as we will!

Looking forward to work and have fun with you,

David Corrales and Martin Ruskov
On a scale of 1 to 5, how difficult would it be for novices to

1. How well do you think the system represents difficulties related to password length?

   Very  1  2  3  4  5  Not at All
   Comments:

   2. How well do you think the system represents difficulties related to required Password Symbol sets?

   Very  1  2  3  4  5  Not at All
   Comments:

   3. How well do you think the system represents difficulties related to Dictionary Checks?

   Very  1  2  3  4  5  Not at All
   Comments:

   4. How well do you think the system represents difficulties related to History Checks?

   Very  1  2  3  4  5  Not at All
   Comments:

   5. How well do you think the system represents difficulties related to Password Renewal periods?

   Very  1  2  3  4  5  Not at All
   Comments:
6. How well do you think the system represents difficulties related to Password Recovery methods?

Very 1 2 3 4 5 Not at All

Comments:

7. Understand how the game progresses (i.e. how each "turn" flows)?

Very 1 2 3 4 5 Not at All

Comments:

On a scale of 1 to 5
1. How effective was the presentation in helping the experience of using the simulation?

Not at All 1 2 3 4 5 Very

Comments:

2. How believable was the narrative used in the simulation?

Very 1 2 3 4 5 Not at All

Comments:

3. How difficult was to to understand the intended system?

Very 1 2 3 4 5 Not at All

Comments:
## Survey Answers and Comments

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### Comments

**P4, Q2.** It doesn't matter much. Password1 is still a meaty password

**P4, Q3.** Do you mean a few hundred common passwords or any dictionary Word? Does it include obvious permutations?

**P4, Q4.** Storing clear text for distance checks = you should be fired!

**P4, Q5.** I didn't use renewals

**P1, Q7.** Didn't know why things were happening. No sense of causality – were things happening because of my choices, OR because the logic was broken OR because of a forced narrative OR because my policy was being reset without my knowledge every month (as explained to Me during the session)
7.3.2 Timestamped Partial Transcripts

Participant 1
August 18th, 2014 - Present: Interviewer (I), Participant (P) and Project Supervisor (S)

Note that the first part of this run-through (from 1:30 to 15:44 is not relevant to this study)

[00:00] I : Are you familiar with the SPRKS system?

[00:15] P (to S): Hang on, is it the one I saw a few month's ago? So I am familiar with a version of it.

[00:30] I : How experienced would you say you are with information security?

[00:57] I : Have you previously experienced a game introduction?

[01:05] P: Yes

[01:07] I : Do you play video games and if so how often?

[01:18] P: Once a year, I don't know

[15:46] I : If you would (register with the system)

[17:26] I : If you would, please just turn the tutorials on.

[17:41] P : (referring to Intro tour) Thirteen? Why thirteen?

[18:50] I : You've actually switched off the tutorials, so turn them on for me again.

[19:15] P : (referring to Intro tour) Change a month's policies?

[19:17] I : Yes this month's policies. Once you move on to Consequences, you won't be able to go back to Policies to change them again for this turn.

[19:48] P : Why do policies change every month?

[19:51] I : It's just part of the game. You can change policies every month, you don't have to.

[20:02] P : It'd be more realistic if it was...maybe six. Or twelve.

[21:08] I : Alright, so you can mess around with the policies and set them whenever you're ready.

[21:40] P : (referring to a graph) What's plen?

[21:42] I : Password length

[22:00] P : (referring to a set of graphs) What am I seeing here? What's the unit of result?

[22:31] S : It's a percentage, but I don't know why it says result. It's two metrics, should only be one line. Each line shows a metric.

[23:32] P : So it's in fact two different y-axes?

[23:33] I : Yes

[23:47] P : Who's Iza?

[23:50] I : That's the one employee you have

[23:58] P : I'm an ISO

[24:35] I : Now here's actually one of the bugs we could not sort out. Basically, any policy you set will always yield this incident. This (page) you can sort of ignore if you want it.

[25:00] P : (referring to Intro tour) "First month's always the hardest." Is it?

[25:28] P : (referring to the tours) Can I just turn these off?

[25:48] P : (referring to Incidents page) So another one's instead of this one

[25:50] I : Yeah, this (Incident) will always show. You can set the most secure policy and it will still show.

[26:10] P : The risk and cost didn't refresh. So I don't know...

[26:43] P : (referring to Impress slide) What does this mean?

[27:01] I : Ideally, if I had more time I would have implemented a different set of policies for working from home. So this is just hypothetical. If that had been implemented how would that have changed your policies. And this policies could be the same as they are at work, but that might not be the best case, or the most desirable case.

[27:51] P : (referring to a graph) So nothing's changed.

[28:26] P : So I changed Password history check. And that chart doesn't change, and the renewal password chart changes a little bit. Do I get an explanation as to why?

[28:50] I : You could (pointing to the policies tooltips)
This just talks about password renewal. I'm not gonna learn anything if.... Yes it teaches me something that they're interconnected but if it doesn't say why I've not learned anything.

A new guy turned up. Why's he here?

You'll get an explanation next turn.

I don't know what the effect is. This is the same information. I don't know what's happening. So I'm just gonna keep playing.

(to himself) All these people. Can I change these people's views? Susie said policies are strict

Yes. Actually if these (Incidents) worked they would say something different depending on what policies you've chosen.

But I'm not going to see anything different here.

You actually will but not depending on the Incident. Right now it's based on a random algorithm. That's why it's also painting up differently here (pointing to the timeline orbs) otherwise here would be....

(pointing to different colored orbs) What do these mean?

It's in the tutorials. There's risky, costly and balanced. And gray is a month you haven't gotten to yet.

(referring to a graph, while changing it's policy) It's not changing

It may be changing something else

How am I gonna know that? Scroll all the way up and remember what they look like and school down again?

(referring to policy setting defaults) So it wipes off the changes that I make every time?

You actually will but not depending on the Incident. Right now it's based on a random algorithm. That's why it's also painting up differently here (pointing to the timeline orbs) otherwise here would be....

(referring to a graph, while changing it's policy) It's not changing

So I haven't changed these (policies) for a lot of months, and these (orbs) changed anyway.

So whatever I do, something random is going to happen?

Yes

I'm being asked to stay. I didn't know what was going on but OK.

OK. Thank you. I'd like you to answer (the questionnaire)

I liked the simulation? It seemed to be broken.

The back-end was broken. Well like on the presentation: the graphics the story. How was that?

The story was the same. In terms of presentation helping me to experience a broken simulation, it was effective but I didn't really know what was going on.

Could you just write that for me (in the questionnaire)

Alright, just three more questions. So, what would you think would be the advantages and disadvantages of having a system like this in your workplace?

What did it do?

Something that helps employees learn the importance of security policies

Employees? All employees? Not just CISOs? A tool like this well it's about policy management, so for employees not as effective. Because they're not security managers. It's not about personal security management.

Would you say you learned something from this simulation? If so, what?

Again, I've seen previous version of this. So anything I might have
learned I'd already learned. It may have had something new if I hadn't seen the previous version.

[42:31] S : Can I ask you to.... What would those things have been?
[42:50] P : Well again this appears to be based on papers that I have already read. And work I'm already familiar with.
[43:05] S : What is it based on? What kind of information and knowledge do you find in there? For example, which papers
[43:16] P : There's the Trust Economics Risk model paper and also the Password policy paper.
[43:33] S : Sorry, can you tell us these papers in ways we can actually know what you mean?
[43:41] P : So there was the Password policy modeling paper
[43:43] S : Simon Arnell's...
[43:44] P : Yes. That modelled people moving between home, on the road and office locations. And how the password policy affected the security. The likelihood of breach, the cost of support in terms of helpdesk and things like that how much of a delay it was to an individual's work and how easy the password policy was for them to manage in terms of remembering or forgetting passwords
[44:27] S : Did you find these things here in the simulation?
[44:29] P : A few of them. There's locations. A policy plays out differently in different working environments with different threat models. But it wasn't clear to me from the tool what the consequences of a specific policy were, because the tool didn't seem to be working. It (the simulation) served to provide me with things I knew.
[45:35] I : And last question, how can the simulation be improved? Besides it actually working
[45:59] S : You mean a security manager would be able to give us some insights on how it should work?
[46:12] P : It needs to be grounded. Are there any elements of the narrative which could be likened to other organizations. Because if no one buys the narrative they're not gonna buy what happens on the tool. Seems like the narrative is kinda forced. It's like playing a computer game where you try to jump over like a bridge it's telling you to go forward, you think you can go left or right because there's a clear sky, but there's like a fake wall. You have to go forward. So when you say someone's decided to work from home in February and you have to play for thirteen months. Things like that it wasn't clear to me why that happened. Like it says "first months always the hardest" and that's just the way it is.
[47:32] S : So basically to you, the narrative didn't feel realistic. It didn't allow the free will that you were expecting from the game.
[47:42] P : Yeah, I wasn't sure what I could control at all on the tool. Half because of the narrative is very linear and half because the logic of the tool reacting to my choices seemed to be broken. I wasn't sure what was broken and what wasn't.
[48:07] S : Did the narrative sound plausible? It's a linear narrative.
[48:12] P : These are things, from the few I looked at, they seem to align with some interviews I've seen with employees in companies.
[49:42] P : The issues raised by the employees, I've seen similar things in interview that I've read.
[50:18] S : So, if we go back through the narrative, do you think you'd be able to tell what things to you subjectively make sense, what things are questionable.
[50:45] P : It's an education tool is it? So am I to take it if I'm being educated that the first month of being a CISO is always the hardest. If it's said "you've already done a month, the first month was difficult". If the narrative deliberately made me have a difficult first month and
that was part of the story, the premise, then I would have understood it more. But it seemed like whatever I did, the first month was going to be the hardest as if to say the system knew the following twelve months would be easier.

[51:30] S: Which makes sense if there's nothing new in there
[51:47] P: I was just confused as to what I was supposed to be learning
[52:03] S: So you were unsure what part of the scenario was specific and what part was generally applicable to troubles like that.
[52:21] P: Like I said, I wasn't sure what was part of the premise of you walked into this setup, this is what's happening. What stage of my tenure as a CISO was I walking into?
[52:52] P: And I didn't feel I had a good overview of what was going on. Just seemed to click around a lot and remember the things from one screen to another. Try to keep things in my head. So I couldn't review what was happening last month.
[53:17] P: My only was to recall what happened previously on was to look at the blobs at the top
[53:21] S: To what extent would you consider that realistic?
[53:26] P: One criticism level that a lot of dashboards is they reduce security management to a traffic light. That's essentially as if you've taken your system logs, represented them subjectively as a traffic light color and destroy them every month. So when you look back "oh, what happened last month?" you just got a color. No way to analyze, improve. There's no history of my choices.
[54:06] P: For instance if someone went through the tool and changed things every month could they look back and say "oh, I changed that and it was good, but then I changed this other thing and that was bad. So what I did on that one month was good but what did I do during that month? I can't tell now. All I've got is a traffic light color"
[54:38] P: It disposes of the insights of the user, because the user is not allowed to look at the previous decisions were. Just kinda throws them away.
[55:00] P: For instance, you have the risk/cost stuff the probability for the month. Why not represent those over time.
[55:18] P: If you have the blobs and then you had some other time series going along like adjacent to that. This policy had this particular risk. Then you'd been able to understand shock events.
[56:08] I: Well that's all I have for you today. Thank you for your help
[56:10] P: It's alright.
[56:43] S: This really helped with some (procedural) things we'll need to work out.
[56:46] P: I guess it's just an issue with participant selection. I've been involved with the development of this since you started.
Participant 2
August 21st, 2014 - Present: Interviewer (I), Participant (P), Supervisor(S)

[00:00] I: Are you familiar with the SPRKS system?
[00:02] P: Yes
[00:05] I: How many years of experience do you have with information security
[00:06] P: Four. Four years now.
[00:13] I: Have you previously experienced a game intro like a game tutorial.
[00:18] P: Yeah, some form of, yeah.
[00:23] I: Would you consider yourself a gamer?
[00:26] P: No, no. Not a gamer
[00:30] I: How often would you say you play video games?
[01:06] I: I'm going to ask you to register for this. There's no restrictions on
username or passwords, and an email can be something at something
[02:05] I: Okay, now as you go through the system, I want you to think aloud. Tell
me what you like about it, what you don't like about it, what you think
of it.
[02:18] P: (pointing at character) Am I this person over here?
[02:19] I: We're getting to that
[02:45] P: (as Impress finishes) Okay, can I see it again?
[02:48] I: It'll loop through. If you click on it you can control it with (the
keyboard)

[03:07] P: (reading narrative to herself)
[03:26] I: If you have any questions just...
[03:27] P: I will, I will. (after reading Impress slide, pointing at character)
Ok, so I can ask her things like.
[04:12] I: Do me a favor, click tutorials on.
[04:30] P: (to herself) Thirteen months, okay. (pointing to timeline) So it's kinda
symbolized this way. Check story at start of...Okay.
[05:15] P: (Intro tour on blobs) Okay, okay, so red means risky, but it doesn't mean
it lead to negative consequences.
[05:20] I: Not necessarily.
[05:26] P: (continuing on tour) Costly, okay. Or balanced. Click on the...oh what we
just did.
[06:02] P: (about the tour) The grayed out button looked as though I couldn't
click it. Because before there was black that was suggested, "Next" was
black and then at the end all of them were gray.
[06:25] P: (navigates to Policy, running into a new bug) Do I click on one? Is one
happening right now?
[06:33] I: Interesting. (navigates to Introduction). I'll have to log that
[06:47] P: So is the first month happening right now?
[06:49] I: Yes
[06:50] P: And am I supposed to know that? I mean do you want to visually show it
somehow?
[07:15] P: (to herself while choosing policy settings) 8 characters. Sounds like
UCL a bit. That's the dictionary check. (clicks nonresponsive options)
[07:22] I: It just takes a while longer.
[07:25] P: This thing should have showed as I was doing it.
[07:39] P: (referring to a graph) Risk supposed to be spelled with a K, right? Okay,
so isn't that's length. What's the result? What's the unit?
[08:12] I: It's a percentage, if I remember correctly
[08:19] P: (as graphs change with her choices) Oh so doesn't seem to be much
difference between the lengths. A big one between...I guess no length
then.
[08:43] P: No difference, do I interpret this correctly?
[08:44] I: Yes
[08:46] P: (to herself) Password to history check. Okay. So if I change it to
annually.
Ok, so maybe you want to change the chart labels to match these (policy names)

It's represented as we do with variables but not necessarily clear to someone who's a lay-person you know what I mean?

(to herself) Password attempts. Ok

(pointing to a policy) What does this...oh wait there's this {tooltip}. I don't have to ask you.

You've actually stumbled onto another bug. When a tooltip is shown you can just click outside of it to make it disappear.

Yeah, I felt

But if you click it once it's displayed, it'll appear on top of it and now it will not go away. So one layer's gone, but the second one will just stay there

(referencing to the risk cost element) So my risk is very low, my risk is very high. Did this happen after I changed settings?

Yes. If you change any policy, (the element) will reflect that

So let's change something to see what happens. Let's say I make the password 12 characters. Cost is low but risk is very high. Ok, so the cost changed from very low to low.

Here's actually one of the major bugs that I could do without. Basically, no matter what sets of policies you set on the Policy page, you will always receive this incident. You know how it says that you don't set password lengths, so there's actually a choice to it. But if you set it to 3 or 10, it'll still show this (Incident page)

I understand. And something disappeared as well. Is the month over? or?

Yes. If you hit End Turn, you'll go forth to the next month. But because of this bug, risk and cost also disappear. Also, because of that now up here (on the timeline) like on the tutorial said, it was supposed to reflect that. Because the incident is not working as it should, it's actually just a randomizing algorithm that will set the policies to be displayed up here.

Everything else. For example, characters are supposed to give you hints after a month. So that will still work.

(read from window) significant data loss this month. So this is the outcome of my actions. Of my policy changes.

Yes, or one of them.

(On second turn's Intro) "Always the hardest", OK.

(referring to policy choices) So these things reset. Because I remember last time I set this to 12.

They are not supposed to. They're supposed to carry over from your last months. But again...

So this suggested I.... Risk average, cost average. OK

(pointing to blobs) Now this is still just based off the randomizing algorithm not on what you did last month.

Sure. (talks to Iza). A bit over budget...well. I should probably change this. Cost low, brilliant! I will stay within the budget

(on Incident page) I did!

No this thing always shows.

Ok

Costly. Also with every Incident you were supposed to get a different (Impress) slide for every incident, but it's not working. At the end I will show them all to you.

(Imprint aludes to introduction of working from home context). Ah! Ok. Can I set the screen lock on her computer if she's working from home? Is (the context) in there?

I actually ran out of time to implement it.

Sure, sure. (to herself, on Policy page) make passwords longer.
The cost is very low, so that's good. Attempts. I know I'm going to get the bruteforce messaging, but.

It's just fun to play around with it.

Mm-hmm, mm-hmm.

(reading from Incidents) Risk probability 0. That's quite excellent.

(points to a timeline blob) And this means? Red means?

You might think of it showing some label on mouseover or something different?

Depending on whether your policy was risky or costly or balanced they will say something different.

(points to a newly colored blob) So it appears straight after I've set the policies. OK

No new person? Are they saying anything this time?

(points to a timeline blob) And this means? Red means risky

You might think of it showing some label on mouseover or something different.

Depending on whether your policy was risky or costly or balanced they will say something different.

Visually it looks very nice, just things are not updated as you were saying. (to herself) how to make the risk go down?. Cost average.

(settling a policy) Just cost increase?

Risk very low for the first time. And cost average

(exits Impress slides too quickly) No pointers?

(settling policies) OK, let's make it more harsh on people. Risk low, cost low. What do I need to do more?

(settling policies) I think I had it on automatically. Yes that should take care of the problem they said they had to do to much to get the passwords sorted out. Or did they mean the actual password creation.

(setting a policy's hitbox) Is it hard to click for some reason?

(settling policies) OK, let's make it more harsh on people. Risk low, cost low. What do I need to do more?

(setting policies) I think I had it on automatically. Yes that should take care of the problem they said they had to do to much to get the passwords sorted out. Or did they mean the actual password creation.

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(setting policies) I think I had it on automatically. Yes that should take care of the problem they said they had to do to much to get the passwords sorted out. Or did they mean the actual password creation.
same thing. I know what it is. The older people in the company are boring.

P: (to herself) Risk very high, cost very low. Let's make them change.
Stick to 3 attempts. Risk very low, awesome

P: I'll just make the people happy.

P: Let's see what happens now. What's the color of the circle? What would be desirable?

I: Blue. The main point of it (the simulation) is just to find a balance

P: And blue is balanced?

I: Yeah. But I mean balanced throughout your stay. It's not all that bad if you're just constantly being risky or constantly being costly. As long as the end result is a balance

P: (as the majority of the blobs were green) Ok, so I have to get more red

I: (The blobs) are being randomized though, so let's see what happens

P: Oh, see? You got a blue

P: Wow! That's the blue!

P: (referring to a navigation button on Impress container) I should really move that button

P: (on reading Impress slide announcing a grant) Ah! Wow...

P: Ok, no new people

P: But (the existing people) might have something new to say

P: (on talking to Kevin) He's probably psyched, the personality of this guy

P: (talking to other characters) Wow. So. Yeah. Because I'm balanced now.

I: Wow, it's a shame the password policies don't carry over because I would just keep them the same.

P: (to herself) How do I do this right?

P: (recalling the balanced policy) So risk was average and cost cost was very low this is what I remember. Or was it the other way around?

P: (to herself) How to be sensible?

P: Have to reduce the risk.

P: Risk average, cost low. Let's just see what it gives me

I: Eventually the narrative will tell you that it's after your term as ISO. It's more on the future work.

P: So it's giving me perception that it is a new month, rather than to make me act on that.

I: Yes

P: So, is the algorithm rating my actions better if I care more about risk or about cost? I'm wondering how did you write it?

I: The policy algorithm themselves aren't mine they are from a previous project. So, the way my algorithm handles it is it weights a little less on risk than cost. So it would prefer (the policy) be a little costly but less risky.

P: Oh, OK. I understand.

P: (to herself) Why is the risk still so high?

P: (on getting a low risk, low cost estimation) Wow! How did I do that? I thought nothing will change. I think I deserve blue this time

P: So each time you the start of a new month it goes back to the setting that first. And risk

I: Yes, it defaults to a base policy. All choices are taken from that.

I: It's not supposed to, but that's what it does

P: Otherwise I would have kept it once I was balanced.

I: It's always constant, I mean always the same. What I picked the
previous month doesn't matter, it is always the same, as it was a fresh month as if starting from scratch.

[39:31] I : Yes
[39:33] P : I guess it would be difficult to say how to change over the course of twelve months.
[39:43] P : (to herself, while setting policies) Never tried this.
[40:11] P : I think that's a good: risk very low, cost average. OK
[41:03] P : (on reading narrative) Ah, just about finished here. It's not nice. What are these people saying?

[41:20] P : Yes risky? Why's it risky?

[42:33] P : (to herself) Let's take the things I think are roughly right.
[42:47] I : Oh, just about finished here. It's not nice. What are these people saying?

[43:47] P : (on reading narrative for final turn possible outcomes) Ok, so it depends on my performance. So what'd I do last time?

[44:27] P : (on finishing turn, to herself) What's gonna happen now?
[44:33] P : (pointing at characters) Do they have anything to add?
[45:26] P : Ok, so this is the point where I understood what I'm supposed to do.

[45:58] I : Yes.

[46:01] P : Try going back.
[46:11] P : So would it have rated me as a CISO?
[46:17] I : Yes. And now it's not going to work because it's all reset. Great. Well, that was kind of a bummer. I believe you would have been hired, actually

[46:33] P : Because I was just balanced. For three months out of fourteen.
[46:40] I : (navigates to Impress presentation of final turn) Here, we'll just go into the last thing here.
[46:52] I : (navigates to incident presentation) Ah, it should have gone on to the final

[47:13] P : (reading final presentation) Oh. (chuckles at the end)
[47:19] I : OK now (navigates to incident presentation) these are the possible pointers you would get once the back-end works. So this one you can just do with the arrow keys, it doesn't move on its own.

[47:41] P : (on reading too_strict's slide) Ok, so this is what I normally got. And this would be replaced by the ones I've just seen.
[49:50] I : Yes.

[50:08] P : Yeah. Interesting. Interesting. But the assumption is. You are saying things are changing, but the company is static, you know what I mean? If you could show the current scenario for this month, what's going on, and then adjust your algorithms accordingly. So if you say there is an increased risk or maybe people are being negative and you can't really trust them. Maybe you should change algorithms based on that. Is that
the first step you took?

[50:42] I : That's all on future work

[50:49] P : But yeah, it's very nice visually. I like it.

[50:55] I : We've actually gone way over time.

[50:59] P : No, no, it's fine. It's interesting.

[51:04] I : Ok then. I'd like you to fill out this form for me. It's just a quick survey. If you have any comments as you go along, we'd love to hear them.

[51:20] P : So it's about password length? I think it's something anybody could relate to password length. Although not everybody would have corporate experience, but I guess sites would require them, even University systems so. Something people should definitely (be familiar with)

[51:45] P : "How difficult"? I would say a four. So not really difficult.

[51:50] I : My wording's a little strange there

[51:52] P : Don't worry I think I got it.

[51:55] P : "How well do you think the system represents difficulties related to required password symbol sets?" I think the wording is not very clear. I think if you say alphanumeric, special characters etcetera that would be easier. Otherwise we can relate to that as well, so I give it a four.

[52:17] P : "System represents difficulties with dictionary checks." Again I think this is something people are familiar with.

[52:27] P : History checks. It's increasingly "I wanted to have a similar password to a password like two years ago or something. Because it's a strong one and I've memorized it. But then I couldn't for an email account." I think this is one that people are increasingly aware of but would give it three, because less for the rest.

[52:58] P : (Password Renewals) This is something typical for companies. This is not something any user would be asked to know. Specially for an account like Tesco shopping. And you're asking how well does this (simulation) represent password renewals. So you had annually.

[53:18] I : Annually, quarterly and monthly. And never.

[53:23] P : Yeah, I guess it's represented well. I'm the classic user that never goes to the extreme. Always between two and four (regarding survey)

[53:36] P : Password recovery methods. So it was automated or not. Don't you want to have two tickboxes for automated and helpdesk? Because currently you have a tickbox and you don't really tell what the other option is right? So I know what it is, but a novice wouldn't probably. I'll give you a three.

[54:21] P : How the gameplay progresses? You helped me understand that in the beginning. For example I could go into the Introduction etcetera. If I had understood that on my own. Maybe you know trial and error. Maybe use some shading. I guess you're using that, it turns from gray to red if you've been there.

[54:53] P : You saw me struggling with the slides. Maybe it's a design thing. If you see it from other people, you may draw a conversion from that, but if it's only me, don't worry.

[55:05] I : It's really a design choice on my part. But the next button should not be there.

[55:10] P : You could have an arrow. And the slides were quite fast to be honest. So for a novice I would give it a two.

[55:28] P : So the way it was presented. I think, oh it was very nice. I'll give it a 5. Visually it was very nice.

[55:39] P : The simulation (narrative). I guess it depends on your background. Depending on who the target group is of your tool

[55:50] I : The target are supposed to be junior information security officers.

[55:58] P : So I think elements like the watercooler talk and stuff so they would have the corporate... They can relate to that, so I think that's good.

[56:08] P : Sense of the intended system. I think I understood it all well. Because
I: Alright. Thank you. Three (questions) more.

I: So what do you think would be the advantages and disadvantages of having a system like this in your workplace.

P: I guess the disadvantages would be that it's artificial. Maybe it if could tailored to the company or something like that and make you aware of certain issues specific to the company.

P: Once the algorithms are a little less predictable, it would be that actually exciting. Whereas here you're just playing to be balanced and once you've done it, you just try to keep it the same. Life and the situation outside changes and even as you show it in the slides, things change. So adjust it to that maybe.

P: And then advantages. I guess it makes you aware of the cost, because probably as a junior information security person you don't really realize that much. You think more on the security side and I suspect not many people talk to the users actually and see what the actual cost is. They always want to be better safe than sorry. If something goes wrong, they would know it's their responsibility. And if it's a drain on productivity. There's often an attitude of you know "just do it," "you'll get used to it." As they say "suck it up". So I guess it makes people aware of that.

P: I was thinking of the different people I had on the right-hand side what their role was. I guess you were trying to kind of reflect different personalities with the way they spoke. I guess it makes you aware that you have to get people's opinions.

P: It was quite artificial that more of them came with time they and they were old people (contractors). I guess this wouldn't be natural. The number increased. What was natural is that they reflected the stage the company was at. Few were permanent workers and more contractors this was reflected on the people that were hired and who gave me assistance.

I: Would you say you learned something from the simulation and if so what?

P: Sorry, I'm trying to differentiate what was previous knowledge and what's knowledge right now.

P: I guess it would have been more interesting to see incidents tailored to my actions. You showed them to me later, there were incidents but there were no consequences. But the pictures that you showed me with guidance on how to pick the next policy were quite in line with what the people were saying roughly. So that's good. The question's what have I learned?

P: It was a very exciting experience but what have I learned? It's a very specific question

P: The graphs surprised me. I mean the graphs were very much straight lines. So there was hardly any difference between six and ten characters

S: Maybe something that would be a bit realistic I would think. Because between six and there's not much-

P: It does like a nearly straight line

S: Well the thing is there, the simulation is kind of trying to reverse engineer from the incidents so. I wouldn't really look into it too closely at this stage unfortunately. But yeah I think between the six and ten characters there's not that much difference after all.

P: So, I think I didn't learn this here because of having this (professional) background. There's a security usability trade-off. That's something somebody could learn and somebody might not realise there's a cost to humans. I guess there's an expectation in companies that people would just make up for any changes. As Angela (Sasse) says...
in her lectures, boots stay for half an hour longer and have to cope with that rather than this take time off the work.

[62:50] P: Otherwise, it was a very interesting, exciting experience definitely. The interface is very nice.

[62:58] I: That was actually going to be the next question. How can the simulation be improved?

[63:05] P: I guess unexpected events and maybe some hints as you're changing things. Maybe some prompts saying "are you sure?" Or if someone picks something extreme just point it out "this is changing to the extreme".

[63:23] P: If it is supposed to be a game. You could say like, oh this is a rival company and this is the guys' policies. You know, he's having cost very low, risk very low. Have a competitive element and you could have multiplayer games at the same time. Or maybe somebody makes a move and then other people wait to make a move so it doesn't have to be at the same time, everybody sitting at a table getting like overtime. Our office colleague plays Diplomacy. So it's like everybody makes a move and then they react to that. You could make it similar, it doesn't have to be simultaneous but they make move and the game can take days.

[64:24] P: Of course you could animate the people, what they say.

[64:47] P: I think it's quite engaging. It's quite nice. It's the usual usability rules you see the system status, what month you're in and you can see where you are. So the flow is good.

[65:02] P: Add some unexpected occurrences as I said and maybe some reviews. Not on every month, but maybe every quarter. So say this is your performance or maybe. Or an unexpected event could be "somebody's after your job." So evaluating your performance right now. Get things right because your job is in danger. Ways to make it more fun, unpredictable and exciting.

[65:42] P: You could have something like: you're given somebody to help you and this other person has conflicting opinions. But then for example you could trade. Say: "oh, I will give you longer passwords if you change the frequency of-"


[66:26] I: That's very good. Thank you.

[66:31] P: You could have someone that mentions videos instead of having the Global Sparks showing the quotes, you could have video maybe with audio to make it exciting. Introducing the company, showing your office. This suggestions are based on S's previous game Target. You had an office, could visit different sites, talk to workers something like that. I'm just suggesting things that would create a massive amount of work. But I think it would make it exciting. It'd make people immerse in that.

[67:05] I: Yeah, I think you've given me quite a lot to write for future work. But it's very exciting though.

[67:12] P: Another thing is important: time pressure. You have to make decision right now. So if you set the policy within the next two minutes you get a bonus or something like that. Or an evaluation of companies is coming up if you set your policy within the next minute you'll have made it to the next evaluation something like that. Entry for a prize for best company or best security, most friendly to employees stuff like that. So typical game features.

[67:50] I: Ok, well that's actually all I have for you. I want to thank you again. It's quite insightful.

[68:05] P: I really liked the interface I remember I think it was last year that the students stayed and worked over the summer. So yeah, I'm glad it looks very nice. Well done.

[68:14] I: Thank you.

[68:19] P: And even if you have your algorithms just introduce some noise from
time to time. Life is unpredictable introduce some random thing. Change things a bit. Because now you are just trying to make things the same as you did when you got the balance. But life is about surprises.

[68:45] I: Specially when it comes to this.
[68:47] P: Companies all. It's a big place and people are very different. And things are probably unpredictable

[68:55] I: Yeah. That was actually one of the things I wanted to implement. When I started with the dynamic version, because this is the static version, it was basically you would set something, but you would get vetoed by the higher-ups.

[69:16] P: That's what I just thought. You could have certain roles like CO and he has a conflicting interest. Maybe for the risk to be low, and you have someone from HR that wants the cost for the people to be low.

[69:38] I: It got to the point where I could no longer do it. Just because I wasn't up to the task and it was just a massive JavaScript algorithm with all the interplay with the other languages.

[69:49] P: I can imagine.
Participant 3
August 22, 2014 - Present: Interviewer (I), Participant (P)

[00:00] I : You will be taking part of a study for my final dissertation. I am gonna ask you just a few demographics questions, then we'll go through the simulator once and then I'll just ask you a couple of exit questions.

[00:21] P : OK

[00:22] I : While you're in the simulation, I'd like you to think aloud. If anything seems out of place, if you have any questions, stop me and ask.

[00:33] I : There is something that you should be aware of and that's the back-end of the simulation is essentially broken. So for this session, I'd like you to focus more on the visual communication aspect of it. Graphics, the story, the narrative.

[00:51] P : Fine

[00:52] I : Specially the Incidents. I will point it out to you. It's a game-breaking bug. So let's first start by filling this (consent form) for me.

[01:36] I : So some demographics first. Are you familiar with the SPRKS system? In any one of its versions?

[01:45] P : No

[01:47] P : And how many years of experience have you had with information security?

[01:53] I : Do you mean, in terms of studying?

[01:56] I : Studying, teaching, researching.

[02:01] P : Not very long at all. Just actually since I started here. So about fifteen months.

[02:10] I : Have you previously experience a game introduction? In-game tutorials, how-to-plays?

[02:20] P : I've seen other people play games, but I personally never have

[02:22] I : That was gonna be my next question: how often would you say you play games? Video games?

[02:27] P : Never

[02:29] I : You've been exposed to game intros. You've never actually run through them?

[02:36] P : No, no, no. I'd say no actually.

[02:46] I : Let's move on to the simulation then. I'll be taking notes. Now first I'd like you to register. There are no strict rules when it comes to usernames or passwords and emails just have to be something at something. Doesn't have to be your precise email.

[04:03] I : (as participant struggled to register) This password is different than this password.

[04:22] I : If anything comes to you mind just let me know.

[04:39] P : (on Impress slides) I wanna go back. It just came quite quickly. It's too fast. I'm giving up a bit, because I don't feel I got any drive to. Well I'll just go back here (navigates away). Is that ok? Is that alright? Or am I wrecking your experiment?

[05:05] I : Hang on. Not quite. Now we're going to the wrong part here.

[05:15] P : Sorry

[05:16] I : It's alright. There we go. If you want to control (Impress). You just have to click here and then use the arrow keys.

[06:03] P : Iza's a bit weird.

[06:10] P : Is (the presentation) going back?

[06:12] I : It'll just loop on its own. What I'd like you to do is turn on tutorials for me. And just run through that.

[06:59] I : Interesting. Can you go back to Introduction for me?

[07:04] P : Why?

[07:05] I : That was a bug that happened there.
P: Oh, sorry. I thought I was supposed to interact with it (the tour).

I: It is but not at that point. Basically, you did something I hadn't accounted for. So that's pretty cool.

P: I'll always do stuff people don't account for. People do that.

P: So am I OK to (move along)? So I clicked on the policies there actually.

P: (while on tour) I don't really see what I'm supposed to do. I've no idea. (on the blobs) The policy is too risky, well I hadn't an opportunity to set it. So I can't comment, it's just what's presented to me. Too costly. Balanced. "If you're stuck"? Yeah, because I don't really understand what I'm supposed to go and change. I want to click on Policies and do what I think. Am I allowed to do that?

I: Once the tutorial's over for this one.

P: (while on tour) I don't really see what I'm supposed to do. I've no idea. (on the blobs) The policy is too risky, well I hadn't an opportunity to set it. So I can't comment, it's just what's presented to me. Too costly. Balanced. "If you're stuck"? Yeah, because I don't really understand what I'm supposed to go and change. I want to click on Policies and do what I think. Am I allowed to do that?

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so why do I need to reset it every time, that's just annoying.

[14:09] P: Can you not have a button where you just go "as before"?
[14:13] I: It is technically something that it should have done. It should keep your choices from past turns. But because of the incidents not working, it's not saving that accordingly.
[14:25] P: Ah I see. I'm just thinking about future users. If I was using it I'd want to just say "as before". Which I suspect that is what people would do.
[14:36] I: An actual as before button, though, would be great.
[14:44] P: Yeah. Because lazy people like me like things like that.
[14:59] P: (referring to policies) I feel like changing it. You could change it for a bit of excitement. (to herself) Password length to twelve, let's have three symbols in it. And let's just kick you out at three. No password history check, actually. And quarterly. Let's see how it changes things. Very high risk. Ok, we need to change that. Need to change...strict checking, yeah.

[15:57] P: One more to go? Do you have to do them all?
[15:58] I: Yes
[16:02] P: What's the point of doing them all if I'm virtually doing the same thing each time? Because you need to go through the people. I don't mind, it's just-
[16:15] I: You have a fairly big point there.
[16:19] I: (on Policies) I'll just do the same, but if you need me to fill them out, I'm happy to do it. It's just going to be the same.
[16:29] I: What we could do is. Skip the policies. By that I mean, you don't have to set them. But have a read through the introductions.
[16:50] I: (The simulation) does have a linear narrative but the meat of it is policies. Which is, as you say, very repetitive.
[17:10] I: Most of (the introductions) are just three slides. You don't have to scroll them over and over.
[17:18] P: We're doing this again, yeah? One more time?
[17:29] I: (to herself, setting policies) Ten. Reset, two. Reset, three.
[17:40] P: (referring to suggested "as before" button) Definitely the button. Someone has their preferences and then obviously if there's a problem, then they can always go in and edit.

[17:54] P: So what should I do now?
[18:01] I: Because the policies don't quite work, up here (the timeline). This is controlled by a randomizing algorithm. And based on its color, the (characters) would say different things. So by now, you've gone through all three. But you haven't read what they said. For example if you could just (click on them).
[18:26] P: (to herself) Ok. This is what people...
[18:39] I: These are just more to give you hints about how to go about this turn.
[18:58] P: OK. So, how do I know when this turn starts?
[19:11] P: Sorry, what am I doing? I don't understand what I'm supposed to be doing. I'm really confused as to what I'm supposed to be doing (for the study)
[19:20] I: I just wanted you to get a full run-through it. Because it is thirteen turns. I just wanted you to go all the way.
P: Want me to set the password policies?
I: You don't have to, (the back-end) is practically broken.
P: I've got ideas about what I'd like to do differently actually. Should I share those with you?
I: At the end, yes.
P: I just assumed it was defaulting to my default. It's not.
P: Do I have to go back through all of them?
I: It's the last turn.
I: Do you want me to fill these out or not bother?
I: No.
P: Just next, then.
I: And it happened again, sorry. It's supposed to have a final turn where depending on how you did over the past thirteen turns you'd be either asked to stay a little longer doing your job in the simulation, or you're basically fired.
P: Ok. I think I'll be fired.
I: I think you did fairly well, at least according to the randomizing that happened. But (the bug) has happened twice now. Everytime I try to do it, it works just fine. I'll have to figure it out.
I: Ok, so basically, if you're hired, you'd get something like this. (navigates to Impress show)
P: I probably would have seen that. Should we just assume I saw that one?
I: And if you're fired, you'd get something like this (shows different Impress).
P: Someone's got a sense of humor. Whoever's designed this.
I: Yeah, that was all me.
I: We'll get (the computer) out of the way because it's a little annoying.
I: If you could fill this out for me. It's just a questionnaire based on the simulation. My wording's a little weird for the first couple of questions. So if you have any questions please let me know.
I: Ok, now just some open-ended questions. So what would you think the advantages and disadvantages would be of having a system like this in your workplace?
P: I suppose advantages might be that you could specifically adapt the password policy. You can anticipate the consequences. It'll help you justify your decision making.
I: Could you tell me some disadvantages then?
P: Well, it's all theoretical, isn't it. I mean the thing about risk is. Risks always exists but how they manifest themselves, they might not at all there might be a security risk that doesn't manifest itself. So to some degree it's quite conceptual. That's the nature of risk.
I: Would you say you learned something from the simulation and if so, what?
P: I did, actually. Because I'm thinking I'm a really practical person, so I'm always thinking about tools in the workplace. So I like the idea. I'm a bit impatient, as you've probably noticed. I mean with interfaces, so if things aren't immediately obvious I get quite frustrated. So I was thinking the things that frustrated me was not being able to set the default as to what I wanted. Also, I thought there were little gaps in the narrative. I wasn't sure what I was supposed to do, I needed a bit more labeling. I understand you're prototyping so this is a different process. I was thinking of using it in the workplace.
I: What do you mean by labeling, though?
P: Well just giving a bit more of a narrative as to what the different sections do and why you would go there. Things like policies and consequences are really evident, but for example the little people, the different archetypes. It's a really nice idea, I like the idea of humanizing. On one hand it's quite interesting, on the other hand I'm
thinking I'd get very focused on what I want to do, and I don't care about them. Because I get into that mode where I'm doing the sort of thing and- Gotta get going. I'm not really bothered with what Bill from IT thinks, I don't care. Unless the connection between their narrative and what I'm doing is evident. That's probably just me. Because I'm a bit like that.

**I**: How do you think the simulation could be improved?

**P**: As I said, one of the main things is the default thing. Not having to go back through, I think that would be good.

**P**: I actually did like your archetypes. It fit their personas. It feels like I'm being negative about them, I'm not. I think they're a nice touch and if you have time and want to mess around. Especially if you're an employee and you're thinking about different views you would be interested. But I just wanted a little bit more meat to that, rather that just a few quotes. So what's that telling me? Why are you telling me? Why are you telling me this? A little more of the "so what" factor and I don't know what that would look like I'd have to think about it.

**I**: Ok. Would you have anything else to add to your comments?

**P**: I think, visually it looked really nice. I think that it was quite humorous, which I really like that. It makes it nice. Graphically, it was really clean and I did think the design was nice. It's a really basic thing, but you know that I missed the other stuff on the policy? The reason was, it wasn't because I didn't see the scrollbar. It was that I thought it was too much of a gap. I thought that was where the page broke. So I didn't bother to scroll down. I don't know if there's people as impatient as me, do you know what I mean? So I did see it, but then I saw the white space and then I thought "well, it's probably nothing down there." On reflection, it's not very helpful to you.

**I**: It actually is. That goes to my design where all policies should have been up top, and if you clicked something, then they should have moved back down.

**P**: But I do think overall, it looked really nice. I mean presumably people will get some kind of understanding as to why they'd be using it anyway. Whereas I'm in a different scenario, I'm just commenting on the prototypes.

**I**: Alright. Unless you've something else, then. Thank you for your time.

**P**: No, good luck with it. Thanks
Participant 4
August 22nd - Present: Interviewer (I), Participant (P)

[00:03] I : So you've told me you're familiar with S's work. So you're
familiar with the SPRKS simulator, I take it?
[00:09] P : I don't know which one this is, but I do know what he was working on
previously. So yeah it was actually SPRKS; it was a thing with
different kind of user organizational roles that people had and you
were working the password policy and deploying it and seeing how they
react to it.
[00:29] I : That's pretty much what we have here.
[00:32] P : (on seeing the user interface) This is very much like the one I saw
last time
[00:35] I : Can you tell me how many years of experience you've had with
information security?
[00:41] P : Say, four? Three, four. Three or four
[00:50] I : Have you previously experienced a game introduction. Tutorials, run-
throughs.
[00:56] P : You mean any game or this one?
[00:58] I : Any game
[00:59] P : Yeah
[01:01] I : Would you consider yourself to be a gamer? How often do you play video
games?
[01:07] P : Quite often, it depends actually. I am a gamer. I play lots because I'm
doing a PhD. So I would say yeah definitely.
[01:20] I : I'm going to ask you to register first. There are no strict checks of
anything except for the email which just needs something at something
[01:38] P : (about Impress) This thing's moving on its own.
[01:51] I : You can click on it and use the arrow keys to control it.
[02:04] P : (about Impress next button) There should be a previous button though.
[02:10] I : (about Impress' keyboard handling) Give it a click
[02:11] P : Oh, right. I see.
[02:13] P : (about Impress) No. Stay on the first page. Obey me. There should be a
pause button there as well.
[02:39] P : (to himself) I see, so I'm a UK company.
[03:02] P : It's also a thing that I think, when I move the arrows it doesn't
reset. I'm not sure because just before when I moved back it just went
immediately right. I may be wrong.
[03:51] P : (to himself) Ok, fine. What's Iza?
[04:15] P : (about character dialogue) See I'm kinda (bad) at scrolling with my
computers and this text is a big chunk and I can't really...locate
where I scroll. I would put in a few paragraphs in there. Or smooth in
the scrolling so I can see the lines going up and see where I am.
[04:40] P : Ok, I can't select text
[05:12] P : (referring to presentation) OK. This thing keeps scrolling forever.
[05:14] I : It will, yes.
[05:20] P : Is the tutorial turned on now?
[05:21] I : Head back to introduction for a second. I wanted to ask you that. And
just hit the tutorials.
[05:28] P : So it should be on by default then. Oh ho, I see.
[05:38] P : So I get the whole tutorial now? Or in several pieces later on?
[05:44] I : Several pieces
[06:01] I : (explaining a styling bug) Yeah. CSS does weird things.
[06:16] P : Check your story. What does check you story mean? It means I can read
these notes?
[06:20] I : Yes.
[06:23] I : (about the tutorials tour) You can actually control it with the arrow
Yeah, I was gonna check this. It's very important, telling me this that I can check the story. This is never going to change, the Introduction, right?

It is. After every turn your story changes.

Ok. (referring to button label) Is it still called Introduction?

No.

Probably you'd want to change the name here then. Because it really seems like this is not something I should pay attention to. It gives me the idea that it's always the same thing.

So it's the same thing this is during like the start of each turn I can change policies right? During each turn?

Yes

(looking at tour's buttons) I can barely read.

I wasn't able to figure out how to get that working.

(to himself) Adjust the policies.

The whole like color scheme is kind of strange. I understand that now I'm learning how to play so I shouldn't be able to end turn but maybe I am if click here (Policy) or not?

As the tutorial goes on, you have to either go through the whole tutorial or skip it before anything else can be done.

One thing. Well actually-yeah I can skip individual so yeah. Probably the end turn button should look different, you know what I mean? So I should know that this one (button) is not the one I should click on just to check various clicks it does. It's something that you have to do when you're playing something or you're seeing a new interface, you click everywhere and check what's going on. But this one has consequences that I can't cancel right? So it should look different basically. I guess this is just saying that I'm currently in the Introduction so these colors says what you didn't know. Probably end turn should have like some I don't know maybe like a you know fast forward button on a video camera or something that says. These options won't be available anymore or something will happen I don't know.

(reading the to himself) And you can skip these tutorials at any time using the Skip button. I won't skip it. OK. Right from where you left off, cool. That's a good thing.

Should probably say skip and this (resume) at the start. And I'm not sure you need to say welcome as well since I've already started you know? I don't know.

Now we know the purpose of the game.

Good luck is also kind of.... I don't know. If there's a reason why you put it then you should keep it, but if there's no reason I don't like clicking too much. But that's me.

So, if I click on consequences, it means I can't go back to policy? Consequences is just for the previous turn right? So clicking consequences gives me consequences of the previous turn.

Of this turn actually. So if you go on to Consequences, you won't be able to come back to policies to change that policy. Basically, once you go on to Consequences, that month's policy is set.

Then what's the purpose of End Turn?

Consequences actually shows you Incidents that happen due to your policy. End turn just moves along to the next turn.

So say. Right now let's say I've set a policy. Then when I enter
consequences in month four will show me consequences of the policy I set in month three, right?

[10:46] I : No, no it is for that same turn.

[10:50] P : The same turn. That doesn't make any sense. Because first of all that means that there really are two steps to-. First of all, the first thing is you didn't tell me this before so maybe I have clicked. It should really be clear that these are not different views of the same interface, but different steps in a process. And basically I can't go back. End turn is good for this in terms of wording, consequences really isn't.

[11:30] P : Also, it doesn't really make sense to me that there are turns if consequences are results of my actions on the same turn. I would almost expect that when I click end turn, I would get the consequences. For instance you switch me directly to consequences and I can see then that I can't go back to Policy and play again and end my turn again and see the new consequences. I would see consequences just as a link to go back to different consequences that happened in different months.

[12:00] P : So basically, the way I would see it is: (points to timeline) this is the timeline so I can see my history here. And this is the last month I'm at, and I have two views. I have the policy view with the decisions I made and the consequences views with this is what happened. You know when I'm in the current month, I can change the policy and on the current month when I go for instance to consequences it'd say you need to end the turn before the consequences are made. Or something. And then maybe I can click on the next month and say Continue. Then that month would start and the consequences of the month where I am will be created. So then this timeline is what I would use to move forward. I'm sure that I never block myself accidentally. Because I know where I am. And clicking on seven (blob) will have some icon, some visual signal. And these (the rest of the timeline) are just views that don't do anything bad as a consequence of clicking. So I can't get myself stuck. Because I already have two ways of getting myself stuck, so it's not cool for me.

[13:15] P : (to himself) I'm very cool when it comes to messing with things.

[13:18] I : (after P interacts with an element outside the tour) It would actually work, but I want you to go through the tutorial first.

[13:23] P : Ok. (referring to graph) Why is it a "c"?


[13:36] P : So this chart is something that's assumed I guess? And then the reality will be displayed when I get consequences.

[13:42] I : Yes

[13:44] P : It should say this, I guess, in the tutorial. Because here it makes me believe that this (graph) is the truth. And then if I do the same things over turns but actually-. For instance say I have this policy, I play the consequence is different will the chart show me what the consequence was? Or will it show me the same information?

[14:01] I : It will show the same information

[14:14] P : (when tutorial finishes) Yeah, I can play. Number of symbol sets, any. Password dictionary check. Well it depends on what type of dictionary it is. Surely you want to ban the easy passwords, not all the passwords. I have dictionary based passwords.

[14:57] P : (to himself) What's going on with this interface? Password history check.

[15:00] P : Is it me or is it kind of inresponsive? The scrolling and the clicking...

[15:09] I : Here (policy page) the clicking takes a while. Its mostly because it calculates everything and then it displays something.
P: You're just responsible for the tutorial part right? Not for the whole thing.
I: Yes.
P: They should give some feedback that it's calculating something. A spinner or something, maybe here (on pointers).

(to himself, setting policies)
P: Oh, this is not acceptable, this is bad. Better. Good.

P: This is not something you're concerned about, but I don't agree with what they say here. This is very, very insecure. It's really terrible, this (policy). Well I don't know if you care or not, but it forces you to store the password and clear certain distances. And the main reason why passwords get stolen is because they're not stored properly not because people get them stolen off phishing or something.

P: (on policies) System asks user to renew...never. That's really good.

(to himself) Ah, yes, all the user updated data models. Definitely looks better than last time. Cool. Next.

I: Here, I'll bring your attention to a game breaking bug. It'll take a while to fix. No matter what policies you set, you will always get this incident. You know how it says that you don't set a limit. You could set limit to three or ten, it'll still come up

P: As bruteforce
I: Yes. To get around that, just for the demonstration. Every up here (the timeline) is randomized. It has a randomizing algorithm.

P: So I'm not in the real game anyway?
I: No. Ideally, you would have been. But this bug came up like a week ago or so and it will take a while to fix.

P: Fair enough. (reading Incident results) Same thing you can force the matter and I should finish this up. Zero point eight out of one I guess. Percent probably. Bruteforce - online or offline should probably be set as well.

I: I'm sorry, what was that?

P: It should say whether it's an online attack if it's online bruteforce. Because bruteforcing is also used to say when your passwords get stolen offline and then they bruteforce in. I guess it's kind of obvious. Anyway they don't speak at all about password storing which saddens me.

End turn.

P: Yeah, so there's really nothing more to the turn than the consequences being displayed right?
I: Yes.

P: (referring to tutorials) "Nice work getting through your first month." Thank you. I haven't been sacked yet, I don't know why. Some controls, ok, yeah, sure. It's also late to tell me. Buttons also work in between pages. I'm confused now. Oh and make sure to talk to your employees.

P: This bit here (the presentation). It's been scrolling whilst the tutorial was being displayed ok? I guess it should stop. I should then be invited to click next and then it moves. The main issue I have with it is I don't know which is the first page. So there are some things going on but. Ok, now I know. But there should also be some indicator which displays so I know where to start.

P: (referring to presentation) Pointers for this month. Sure.

P: (presentation finishes) What? Is that it?

I: Yeah, most of them are usually three. Some months are longer, like six slides.

P: I was just like, the good luck page. Like, you know it's scrolled just when I pressed. Also, if I press too close to the automatic scrolling then it should either cancel the automatic scrolling or cancel my pressing. That's totally not very important. OK Cool.

P: (referring to policy setting defaults) What? That's not what I said. Go away.
I: This is actually due to the incident bug. It should reset back to whatever you set from the previous turn.

P: Ok. I'm gonna make an even worse policy. I'll make the most dangerous policy in the world. No limits. I'll just annoy people. I like to annoy people.

P: (referring to Susie) I don't wanna talk to her

P: Incidents. So there can be several incidents or always just one?

I: There are a total of 13 different incidents that technically should be able (to be displayed)

P: What I mean is will I always see just the most permanent incident? Or can I see several of them in this page.

I: The way the simulation works it will bring out the more prevalent one. The riskier one or the costlier one.

P: So only one at a time. I cannot see more.

I: Yes.

P: It doesn't really tell me that there may be more things happening than what I've just seen. I don't know if it's part of the game. If I should figure it out on my own or not. It's kind of obvious when you think of it but you know it's a game so you always expect the game not the reality.

P: So now I have to guess many of the game mechanics. And I'd like to know the game mechanics. I can play better.

P: (referring to tutorial alluding to adding context) OK, I don't get the point of this message

I: That's because it should be playing after the story runs through once

I: That was supposed to be the point, but once I figured out the policy bug, I could not set the different contexts. Eventually, you were supposed to be introduced to passfaces and biometric authorization, but.

P: Then do I have more choices or items coming up here (on policy page)?

I: You would have, but no not on this one.

P: Yeah, because I don't know I could have. Well you know I like game design so. OK, I'll just continue playing. I'll be quiet. Like there could be more things it could have like some useful view authentication practice and how I want to manage them in everything. So that when I go onto the policy I already have the things I want. And I don't have this long view. Because I remember when playing the previous game, you had to go through this long policy view and you had to go through it for every type of device and every type of profile you had in your company and it grew into something kind of annoying. And I can imagine that whenever you add more options like having biometrics and everything you need all the options and all the policies are put together in one place and it just goes really big and it's a lot of clicking. But that's probably not in the scope of what you're doing.

P: I don't see much more happening now, and I have to do more clicking.

I: Yeah, it's going to turn in the same thing for the entire (simulation), so I'm just going to stop here if you don't mind.
I: Alright. Eventually, because there are thirteen turns so on what would come to be the fourteenth turn depending on how you did during your stay, you would either be asked to stay in your position or get a better position as chief ISO, or you'd be basically fired. So I'd like you to see both of those cases. So I'm just going to run the story.

P: (on "if fired" presentation) Ok, so. Based on your performance, your position has been given to someone else. Ok sure. It's what's expected.

I: That's one.

P: (on "if hired" presentation) Oh, so they fired other people.

I: And just, for completeness' sake. After every turn you are given some pointers on how to do better. Because of the incident bug you're only given one, and these are the other ones that should the incident work would be displayed. I'm not sure if you'd want to have a look at it. This (presentation) can only be moved by the keys.

P: Well, I guess a lot of what happens at the end of the game depends on the mechanics of the game. So there's only one way of winning the game right now, which is having a policy that goes to the end. So I would assume that varying some path of randomness and how everything's gonna be cured and how it can be attacked. I don't know. There could be more in terms of telling me how well I did than just three conditions. Because I first assumed that if I get this one, I may assume I've done really well but I've not done well enough to be, you know, promoted. So I should be given some kind of score. Some feedback on the costs of my policies overall. Best security risk and then I guess I know you could have the same policy across different playthroughs and have different scores based on the events.

P: If you meant to make this educational I guess you should tell people how well they fared even before this event happens. For instance, maybe I was very unlucky with the random events that occurred in one game, but my policy is actually quite OK. But this wasn't apparent in the scoring system. Well, there's no scoring system.

I: OK, I'd like you to fill this (questionnaire) out for me if you don't mind.

P: (reading the survey) Novices. Password length.

I: It's basically one question for all the different policies

P: So when you say it would be for novices. So that means security novices?

I: Junior information security officers

P: So people who've just graduated basically.

I: Yes

P: You know one thing is all the feedback you'll get from this system is like for instance it tells me employees like this and employees don't like this so that's cool. But it never really points me to any research or authoritative information on the topics or any information on what is being done in the industry and whether that's considered good or bad by usability researchers. So there isn't really a learn more thingy. When I click on this interrogation (tooltip) it gives me some information which is really, I think, is very relevant to playing the game. But there isn't a way to go further and actually learn why one thing would matter or not if I didn't know. So, I mean I guess the goal is to learn from experience, experiencing things by playing the game but I guess that's not how you would practice the job. You would practice like this when you're a senior, because you've understood what happens. But when you're a junior you would really rely on some information, some knowledge from others because you have no clue and you don't want to (screw) up the job basically.

I: If I don't know some thing in security and I'm giving to you my productivity or something I would really try to ask some questions. See some people who have experience. For instance, I know nothing about
Venn testing so I would not just try random things I would first try to learn on my own and go back to it. There isn't this opportunity in the game. So, maybe it could have like a textbook entry or something and I can go through amounts of information. Maybe you want to make it very tedious to read so it's maybe a kind of last resort option or something. It's your job to decide what role it plays.

P: (reading survey) Password symbol sets.

P: (to himself) Password renewal periods? Not sure.

P: (referring to his answer on password renewal question) This is not sure.

P: (to himself) Presentation in helping the experience of using the simulation...what? What is the presentation? You mean the tutorials?

I: The visuals, the graphics, the tutorials. Yes.

P: Everything? Everything in the game or just the tutorials?

I: Well, more on the tutorials. But just about everything in the working game.

P: (to himself) How believable was the narrative.

P: How difficult was it to understand...what? The system.

P: Don't really know what I'm doing, the mechanics are not very clear. I mean I know how these things work because of other reasons not because-

I: OK. Couple more. What do you think would be the advantages and disadvantages of having a system like this in your workplace?

P: Well, the advantage would be I guess. If you've just heard the security aspect of things, if you just understand the threads that kind of cue up the policy items then you don't understand the impacts on productivity or your employee's work or the cost. Then I think it could be useful to train on this without having to go through many, many things. It's your job to decide what time for me to play through the game, I would need to probably tens and tens of different playthroughs with all the different options which require a lot of clicking in order to understand what really caused it and what matters and what bad things I should not do. So I really care about knowing that for instance I shouldn't enforce four symbol sets because it really prevents my employees from working, especially if I have to renew passwords. So I should be able to understand this, but at no point does the game tell me: "no, no don't do this." Now I can't really know, because you told me there's a bug, but I'm not sure it's all "oh, you really (messed up)" or-. It's a bad decision to put these things together from a usability point of view.

P: You know it's pretty easy for me to play the game only looking at the risk or cost metrics, the cost metrics is not very clear for someone that doesn't know anything about productivity costs. I don't understand if it's just implementation costs, in which case I might just want to care about if I'm in a company that's very poor and gives me a poor ledger. Maybe I'll pay attention to it. But maybe I'm in a company where I have money to do operations, and then I'll just completely ignore the cost metrics and only care about security. So it really doesn't tell me that it's not just an implementation cost but security, usability impact as well for the employees.

P: And as I told you before, there's no way for me to understand from the game actually why things matter. So I would have to play lots to understand things. I have to trust the simulator to be a reflection of reality because I can have information first hand. I can have an authority telling me that yeah this game is actually correct. While information security people are usually, you know very kind of arrogant. We know everything. We don't take advice from people who have to prove to be better than us. So it's kind of a mindset in the profession as well.
I: So would you say you learned something from the simulation and if so what?

P: No.

I: And last one. How can the simulation be improved?

P: Well, I've told you.

I: Yeah, you have. But in addition to all that you've mentioned.

P: I would like some more differentiation between productivity costs, implementation costs. I would like to sort of have more options. Biometrics for instance, more authentication factors. More options in the password dictionary check. I really think there's more to it than just yes or no. Same thing for password renewal. My employee was telling me about how it takes time to get any permission changed. Maybe there should also be some way for me to choose the number of staff I have on helpdesk or security operations. That increases the implementation costs, but it also decreases risk because it actually enables employees to comply for instance. This is something that's not visible. Here I would choose between implementation costs and productivity costs and productivity costs, when it gets too high, it creates security risks. That's how it works in companies but that's not visible at all. If I were actually someone who's never done usability or people in security lectures or anything, I would have no clue at all about this, and this is what I need to learn. Not what I think I'd want to learn, but that's what I would need to be told.

I: That's a great point actually. Ok. Unless you have something else to add. Thank you for your time.

P: No. Good luck with it.
7.4 Appendix D: Code Listing

The following does not include all code listings. Included are the differentials between the “demonstrator-1july” branch and the “narrative” branch. Essentially, only code that was added or changed since reducing the working set will be included. Files that were added to the repository, are listed in their entirety, edited files only display changes made during development. As all Impress-rich HTML files follow the same format, only one has been included. Likewise, only one JSON file is included as all edits on these files followed the same procedure shown.

To make code reading a little easier, this section is organized by language. Starting with Python, and moving to CSS, HTML, JSON, ending with JavaScript and jQuery. Files associated with each code section is explicitly stated before the listing.
The following three functions from users.py are the getters and setters for the simulation’s turn counter.

def get_turn(self, username):
    result = db.select('users', where="username=$username",
                        vars=locals())
    if len(result) == 1:
        entry = result[0]
        turn = entry.game_turn
        return turn
    else:
        raise Exception("Unable to read user's turn")  

def end_turn(self, username):
    new_turn = self.get_turn(username) + 1;
    db.update(tables='users', where="username=$username",
              vars=locals(), game_turn=new_turn);
    print "end turn" + str(new_turn)
    return new_turn

 def end_game(self, username):
    new_turn = 0;
    db.update(tables='users', where="username=$username",
              vars=locals(), game_turn=new_turn);
    print "end game" + str(new_turn)
    return new_turn

These statements from timeline.py kept the counter in check by incrementing it until the fourteenth turn was reached.

    new_date = users.users_model().end_turn(session.mysession.session.user)
    if new_date > 13:
        session.mysession.session.turn = users.users_model().
        end_game(session.mysession.session.user)
    else:
        session.mysession.session.turn = new_date

Changing the score class in score.py gave the button the ability to act as an “End Turn” button.

class score:
    def POST(self):
        session.mysession.session.turn =
        users_model().end_game(session.mysession.session.user)
        raise web.seeother('/intro')

These functions made use of the built in functionality with AJAX to extract additional information from the JSON files needed for the Impress presentation.

def get_upper(self):
    return self.data['impress-upper']

def get_lower(self):
    return self.data['impress-lower']
CSS below is part of the Impress implementation on the right

```css
.upper {
  display: block;
  font-size: 35px;
  /*line-height: 72px;*/
  margin-top: 10px;
}

.calendar {
  height: 425px;
}

.middle {
  margin-top: 30px;
}

.middle img {
  display: block;
  margin: auto;
}

#sign {
  padding-top: 150px;
  padding-bottom: 150px;
  height: 100px;
}

.lower {
  display: block;
  position: relative;
  top: 15%;
  transform: translateY(-75%);
}

#bullets {
  transform: translateY(-235%);
}

ul {
  list-style: disc;
  padding: 10px;
}
```

This is the introductory Impress presentation without the hardcoded narrative, all other Impress-rich files follow this same structure.

```html
<div id="impress">
  <div class="step slide" data-x="-1200" data-y="-1500">
    <p class="upper"></p>
    <div class="middle"><img src="../img/impress-feb-1.png" class="calendar"></div>
    <p class="lower"></p>
  </div>
  <div class="step slide" data-x="-1200" data-y="-1500" data-z="-2000" data-rotate-x="90">
    <p id="upincident" class="upper"></p>
    <div class="middle"><img id="midincident"></div>
    <p id="loincident" class="lower"></p>
  </div>
  <div class="step slide" data-x="0" data-y="-1500" data-rotate-y="-180">
    <p class="upper"></p>
    <div class="middle"><img src="../img/impress-intro-6.jpg"></div>
  </div>
</div>
```
Changes to the index_private.html file were extensive as it held many of the visual elements implemented.

The timeline. To keep the listing readable, src and class attributes have been omitted from <img> tags. They are "static/img/month.png" and "timemonth" respectively. The characters. Chats have been omitted as they are hard coded here and manipulated with JavaScript and jQuery.

The toggle switch
<code class="highlighter-rouge" data-highlight-class="switch-switch"

<input value="Tutorial" name="switch" type="checkbox" id="myswitch">

Tutorials</code>

Changes to the index_private.html file were extensive as it held many of the visual elements implemented.

The toggle switch
<code class="highlighter-rouge" data-highlight-class="switch-switch"

<input value="Tutorial" name="switch" type="checkbox" id="myswitch">

Tutorials</code>
All JSON files were given "impress-upper" and "impress-lower" attributes to dynamically populate the Incident slide during Impress presentations. The incident's "id" attribute serves to load the corresponding image to Impress. The "chat-modifier" attribute gives each incident weight to be used across the simulation for scoring, narrative purposes, and styles.

"id": 1,
"name": "default",
"type": "general",
"policy": {
  "plen": 8,
  "psets": 1,
  "phist": 1,
  "prenew": 1,
  "pattempts": 0,
  "precovery": 1
},
"description": "Your policy looks reasonable.",
"event": "No major incidents happen as a result.",
"consequences": "Other ISOs have been calling you asking for advice with their policies.",
"risk": 0.3,
"cost": 0.3,
"risk-modifier": -0.01,
"cost-modifier": 0.1,
"impress-upper": "You struck a good balance between risk, cost, and employee satisfaction last month.",
"impress-lower": "Keep it up!",
"chat-modifier": 0
The characters' dialogue logic is controlled with these jQuery calls. When a character is clicked, all other opened dialogue boxes are closed and the correct one is shown. This also allows for a character's dialog to close by clicking on the character a second time.

```javascript
$(document).ready(function() {
    $('.andydiv').on('click', function(e) {
        if ($('.andyquote').css('display') == 'block') {
            $('.andyquote').css('display', 'none');
            if ($('.izadiv').css('display') == 'block') {
                $('.izadiv').css('display', 'none');
                if ($('.kevdiv').css('display') == 'block') {
                    $('.kevdiv').css('display', 'none');
                    if ($('.susdiv').css('display') == 'block') {
                        $('.susdiv').css('display', 'none');
                        if ($('.drkdiv').css('display') == 'block') {
                            $('.drkdiv').css('display', 'none');
                            if ($('.heldiv').css('display') == 'block') {
                                $('.helquote').css('display', 'block');
                                $(e).prop('tagName', 'div');
                                e.stopPropagation();
                            } else {
                                $('.helquote').css('display', 'none');
                                e.stopPropagation();
                            }
                        } else {
                            $('.helquote').css('display', 'none');
                            e.stopPropagation();
                        }
                    } else {
                        $('.helquote').css('display', 'none');
                        e.stopPropagation();
                    }
                } else {
                    $('.helquote').css('display', 'none');
                    e.stopPropagation();
                }
            } else {
                $('.helquote').css('display', 'none');
                e.stopPropagation();
            }
        } else {
            $('.andyquote').css('display', 'block');
        } else {
            e.stopPropagation();
        }
    });
});
```

Tooltip.js holds all the logic for the simulation's use of Anno.js for its tooltip behaviors. The content attribute holds the text displayed as a tooltip and as such has been omitted.

```javascript
var passAnno = new Anno({
    target: plen,
    content: '...',
    position: "top",
    buttons: []
});

var symAnno = new Anno({
    target: psym,
    content: '...',
    position: "top",
    buttons: []
});

var dictAnno = new Anno({
    target: pdic,
    content: '...',
    position: "top",
    buttons: []
});

var histAnno = new Anno({
    target:phis,
    content: '...',
    position: "top",
    buttons: []
});

var renewAnno = new Anno({
    target: pren,
    content: '...',
    position: "top",
    buttons: []
});

var pattAnno = new Anno({
    target: patt,
    content: '...',
    position: "top",
    buttons: []
});

var recAnno = new Anno({
    target: prec,
    content: '...',
    position: "top",
    buttons: []
});

var endAnno = new Anno({
    target: pend,
    content: '...',
    position: "top",
    buttons: []
});

plen.addEventListener("click", function() {
    passAnno.show();
});
psym.addEventListener("click", function() {
    symAnno.show();
});
```
Tutorials.js has various functions to it. The cookie is implemented here, as are all the Intro tours used for the tutorials (hard coded values are omitted if too long). Styles derived from Incidents are also handled here.

```javascript
var tick = document.getElementById("myswitch");
// store toggle switch to tick variable
var iupper = document.getElementById("impress-upper");
// store upper impress div in iupper variable
var imiddle = document.getElementById("type");
// store risk type in imiddle variable
var ilower = document.getElementById("impress-lower");
// store lower impress div in ilower variable
var curStep = 1;
// by default all introductions start at the beginning
var costly = "#369ead";
var risky = "#c24642";
var balance = "#2e4174";
var gray = "gray";
var cookieName = "tutorials";
var cookieChats = "chats";
var cookieImpressU = "iupper";
var cookieImpressM = "imiddle";
var cookieImpressL = "ilower";

function colorMonth(turn, prevMonth) {
  console.log('month color ' + turn + ' ' + prevMonth);
  if (turn == 2) { turn = "feb"; }
  selColor = getCookie(cookieChats);
  if (selColor > 0) {
    setCookie(prevMonth[0], costly);
    prevMonth[1].style.background = costly;
  } else if (selColor < 0) {
    setCookie(prevMonth[0], risky);
    prevMonth[1].style.background = risky;
  } else {
    setCookie(prevMonth[0], balance);
    prevMonth[1].style.background = balance;
  }
}
```
function handleImpress(impress, value) {
  impress.init();
  document.addEventListener('impress:stepenter', function(e){
    var duration = e.target.getAttribute('data-transition-duration') ? e.target.getAttribute('data-transition-duration') : value;
    // use the set duration or fallback to 2000ms
    timing = setInterval(impress.next, duration);
  });
}

/*
pointTutorial highlights the tutorials switch at a certain interval and hides it shortly after.
*/
function pointTutorial(flag) {
  var intro = introJs();
  intro.setOptions({
    showBullets: false,
    exitOnEsc: true,
    exitOnOverlayClick: true,
    scrollToElement: false,
    showStepNumbers: false,
    steps: [
      {element: '#tutdiv', intro: 'Click me if you’d like some help', position: 'right'}
    ]
  });

  if (flag === 1) {
    intro.start();
    tick.disabled = true;
  }
  if (flag === 2) {
    tick.disabled = false;
    intro.exit();
  }
}

if (document.title == "Introduction" && turn == 0) {
  // tutorial pointer will only show on first turn's introduction
  setTimeout(function() { pointTutorial(1), 2000); })
  setTimeout(function() { pointTutorial(2), 4500); })
  /*
   cookie helper functions (checker, getter, setter and deleter)
   */
  function checkCookie(name) {
    var cookie = getCookie(name);
    console.log(cookie);
    if (cookie === "on") {
      tick.checked = true;
    } else {
      tick.checked = false;
    }
  }
  function getCookie(name) {
    var cookieN = name + "=";
    var ca = document.cookie.split(';');
    for (var i=0; i<ca.length; i++) {
      var c = ca[i];
      while (c.charAt(0) == ' ') c = c.substring(1);
      if (c.indexOf(name) !== -1)
        return c.substring(name.length + 1), c.length;
      // the +1 removes "=" from return val
    }
    return "";
  }
  function setCookie(name, value) {
    document.cookie = name + "=" + value + ";";
    console.log(document.cookie);
  }
  function deleteCookie(name) {
    document.cookie = name + ";expires=Sat, 01 Jan 2000 00:00:01 GMT;";
    console.log(document.cookie)
  }
if (document.title === "Incident") {
    setCookie(cookieImpressU, iupper.innerHTML);
    setCookie(cookieImpressM, imiddle.innerHTML);
    setCookie(cookieImpressL, ilower.innerHTML);
}
if (document.title === "Impress") {
    document.getElementById("upincident").innerHTML = getCookie(cookieImpressU);
    document.getElementById("midincident").src = ".\..\img\impress-incident-" + getCookie(cookieImpressM) + ".gif";
    document.getElementById("loincident").innerHTML = getCookie(cookieImpressL);
}

/*
check cookie for tutorial switch position
*/
checkTutorial();

function checkTutorial() {
    cookie = getCookie(cookieName);
    if (cookie === "on") {
        console.log('if cookie');
        tick.checked = true;
        cookie = setCookie(cookieName, "on");
        console.log(cookie);
    } else {
        console.log('else cookie');
        tick.checked = false;
        cookie = setCookie(cookieName, "off");
        console.log(cookie);
    }
}

window.onload = setTimeout(function() {
    autoStart();
}, 2000);

/*
Intro / Jan tutorials
*/
function autoStart() {
    console.log('tick: before autostart');
    if (tick.checked) {
        switch (title) {
            case "Introduction":
                startTutorial();
                break;
            case "Password policy":
                passTutorial();
                break;
            case "Incident":
                inciTutorial();
                break;
        }
    } else {
        introJs().exit();
        setCookie(cookieName, "off");
    }
}

window.onload = setTimeout(function() {
    autoStart();
}, 2000);

/*
Intro / Jan tutorials
*/
function startTutorial() {
    setCookie(cookieName, "on");
    tut = introJs();
    switch (turn) {
        case "0":
            first.style.background = risky;
            second.style.background = costly;
            third.style.background = balance;
            tut.setOptions{
                exitOnOverlayClick: false,
                scrollToElement: false,
                showStepNumbers: false,
                showBullets: true,
                steps: [{
                    intro: "...
                },
                {
                    intro: "...
                },
                {
                    intro: "...
                },
                {
                    element: 
                },

```javascript
intro: "...",
position: "right"
},
{ element: "#story",
  intro: "...",
  position: "right"
},
{ element: "#policy",
  intro: "Change policies as needed",
  position: "right"
},
{ element: "#conseq",
  intro: "...",
  position: "right"
},
{ element: "#score",
  intro: "...",
  position: "right"
},
{ element: "#timesec",
  intro: "...",
  position: "bottom"
},
{ element: "#first",
  intro: "If your policy was too risky",
  position: "bottom"
},
{ element: "#second",
  intro: "Too costly",
  position: "bottom"
},
{ element: "#third",
  intro: "Or balanced"
},
{ element: "#izadiv",
  intro: "...",
  position: "left"
},
{ element: "#frame",
  intro: "...",
  position: "top"
},
{ intro: "...",
  position: "right"
},
{ element: "#tutdiv",
  intro: "...",
  position: "right"
},
{ intro: "Good Luck!"
}
});
tut.onexit(function(){
  second.style.background = third.style.background =
  first.style.background = gray;
  console.log(tut._currentStep + ' on exit before ' +
  curStep);
  curStep = tut.currentStep();
  console.log(tut._currentStep + ' on exit after ' +
  curStep);
  tick.checked = false;
  setCookie(cookieName, "off");
});
tut.oncomplete(function(){
  second.style.background = third.style.background =
  first.style.background = gray;
  console.log('intro finished');
});
break;
case "1":
tut.setOptions(
  exitOnOverlayClick: false,
  scrollToElement: false,
  showStepNumbers: false,
```
showBullets: false,
steps: [
  {
    intro: "...",
    element: "#nextButton",
    intro: "...",
    position: "top"
  },
  {
    intro: "Use whichever way suits you best"
  },
  {
    intro: "...",
    element: "#izadiv",
    intro: "...",
    position: "left"
  }
],
}
});
tut.onexit(function(){
  curStep = tut.currentStep();
tick.checked = false;
  setCookie(cookieName, "off");
});
break;
}

case "2":
tut.setOptions({
  exitOnOverlayClick: false,
  scrollToElement: false,
  showStepNumbers: false,
  showBullets: false,
  steps: [
    {
      intro: "...",
      element: "#andydiv",
      intro: "...",
      position: "left"
    },
    {
      intro: "...",
      element: "#andydiv",
      intro: "...",
      position: "left"
    },
    {
      intro: "...",
      element: "#andydiv",
      intro: "...",
      position: "left"
    }
  ]
});
tut.onexit(function(){
  curStep = tut.currentStep();
tick.checked = false;
  setCookie(cookieName, "off");
});
break;
}

case "4":
tut.setOptions({
  exitOnOverlayClick: false,
  scrollToElement: false,
  showStepNumbers: false,
  showBullets: false,
  steps: [
    {
      intro: "...",
      element: "#andydiv",
      intro: "...",
      position: "left"
    },
    {
      intro: "...",
      element: "#andydiv",
      intro: "...",
      position: "left"
    },
    {
      intro: "...",
      element: "#andydiv",
      intro: "...",
      position: "left"
    }
  ]
});
tut.onexit(function(){
  curStep = tut.currentStep();
tick.checked = false;
  setCookie(cookieName, "off");
});
break;
}
```javascript
},
{ intro: "..."
},
{ intro: "...
}
]
});
tut.onexit(function(){
curStep = tut.currentStep();
tick.checked = false;
setCookie(cookieName, "off"));
});
break;
case "5":
tut.setOptions({
exitOnOverlayClick: false,
scrollToElement: false,
showStepNumbers: false,
showBullets: false,
steps: [
  {
    intro: "Quiet indeed",
  },
  {
    element: "#izadiv",
    intro: "...
  },
  {
    intro: "...
  }
]
});
tut.onexit(function(){
curStep = tut.currentStep();
tick.checked = false;
setCookie(cookieName, "off"));
});
break;
case "6":
tut.setOptions({
exitOnOverlayClick: false,
scrollToElement: false,
showStepNumbers: false,
showBullets: false,
steps: [
  {
    intro: "...
  },
  {
    intro: "...
  },
  {
    element: "#employees",
    intro: "...
  },
  {
    intro: "...
  }
]
});
tut.onexit(function(){
curStep = tut.currentStep();
tick.checked = false;
setCookie(cookieName, "off"));
});
break;
case "7":
tut.setOptions({
exitOnOverlayClick: false,
scrollToElement: false,
showStepNumbers: false,
showBullets: false,
steps: [
  {
    element: "#heldiv",
    intro: "...
  },
  {
    element: "#drkdiv",
    intro: "...
  }
]
});
```
[ { intro: "..." } ]
}
}
}
tut.onexit(function(){
curStep = tut.currentStep();
tick.checked = false;
setCookie(cookieName, "off");
});
break;
case "8":
tut.setOptions({
  exitOnOverlayClick: false,
  scrollToElement: false,
  showStepNumbers: false,
  showBullets: false,
  steps: [ 
    { intro: "..." },
    { intro: "..." },
    { intro: "..." }
  ]
});
}
tut.onexit(function(){
curStep = tut.currentStep();
tick.checked = false;
setCookie(cookieName, "off");
});
break;
case "9":
tut.setOptions({
  exitOnOverlayClick: false,
  scrollToElement: false,
  showStepNumbers: false,
  showBullets: false,
  steps: [ 
    { intro: "..." },
    { intro: "..." },
    { intro: "..." }
  ]
});
}
tut.onexit(function(){
curStep = tut.currentStep();
tick.checked = false;
setCookie(cookieName, "off");
});
break;
case "10":
tut.setOptions({
  exitOnOverlayClick: false,
  scrollToElement: false,
  showStepNumbers: false,
  showBullets: false,
  steps: [ 
    { intro: "..." },
    { intro: "..." },
    { intro: "..." }
  ]
});
}
tut.onexit(function(){
curStep = tut.currentStep();
tick.checked = false;
setCookie(cookieName, "off");
});
break;
case "11":
tut.setOptions({
  exitOnOverlayClick: false,
  scrollToElement: false,
  showStepNumbers: false,
  showBullets: false,
  steps: [ 
    { intro: "..." },
    { intro: "..." },
    { intro: "..." }
  ]
});
}
}
/*
 * Policies tutorial
 */
function passTutorial() {
    setCookie(cookieName, "on");
    if (turn == 0) {
        // show this tutorial only on the very first turn
        pass = introJs();
        pass.setOptions({
            exitOnOverlayClick: false,
            scrollToElement: true,
            showStepNumbers: true,
            showBullets: false,
            steps: [
                { intro: "...",
                },
                { intro: "...",
                },
                { intro: "...",
                },
                { intro: "...",
                }
            ]
        });
        pass.onexit(function(){
        curStep = tut.currentStep();
        tick.checked = false;
        setCookie(cookieName, "off");
        });
        pass.onStart();
        pass.goToStep(curStep).start();
    }
}
intro: "..."
}
}
pass.onexit(function(){
    console.log(pass._currentStep + ' on exit before ' + curStep);
    curStep = pass.currentStep();
    console.log(pass._currentStep + ' on exit after ' + curStep);
    tick.checked = false;
    setCookie(cookieName, "off");
});
pass.oncomplete(function(){
    console.log('pass finished');
});
console.log(curStep + 'inside tut');
pass.goToStep(curStep).start();
}
}*/

/* Incident tutorial */
function inciTutorial(){
    setCookie(cookieName, "on");
    if (turn == 0) {
        // show this tutorial only on the first turn
        inci = introJs();
        inci.setOptions({
            exitOnOverlayClick: false,
            showStepNumbers: false,
            scrollToElement: true,
            showBullets: false,
        })
        steps: [
            {
                intro: "...
            },
            {
                element: "#description",
                intro: "...",
                position: "right"
            },
            {
                element: "#event",
                intro: "An event that stemmed from the policy"
            }
        ];
        inci.goToStep(curStep).start();
    }
}

inci.onexit(function(){
    console.log(inci._currentStep + ' on exit before ' + curStep);
    curStep = inci.currentStep();
    console.log(inci._currentStep + ' on exit after ' + curStep);
    tick.checked = false;
    setCookie(cookieName, "off");
});
inci.oncomplete(function(){
    console.log('incident finished');
});
inci.goToStep(curStep).start();

});

tick.addEventListener("click", autoStart);
These scripts are part of the incident page's HTML file. They populate the cookie and keep track of the player's score.

```javascript
var tally = parseInt(getCookie("tally"));
var randScore = Math.floor(Math.random() * 3); // this will get a number between 0 and 2
randScore *= Math.floor(Math.random() * 2) == 1 ? 1 : -1; // this will turn that number negative 50% of the time
console.log('randScore ' + randScore);

window.onbeforeunload = function() {
  var adjust = parseInt(document.getElementById("chat-modifier").innerHTML);
  setCookie("tally", tally + parseInt(document.getElementById("chat-modifier").innerHTML)); // use when incident bug is fixed
  setCookie("tally", tally + randScore);
  setCookie("chats", randScore);
  setCookie("iupper", document.getElementById("impress-upper").innerHTML);
  setCookie("imiddle", document.getElementById("id").innerHTML);
}

The following scripts are part of index_private.html.

```javascript
var story = document.getElementById("story");
console.log(story.innerHTML);
var title = contentTitle();
// store the title dynamically to use in intro switch statement
function contentTurn() { return "$content.date"; }
var turn = contentTurn();

if (title == "Incident") {
  document.getElementById("turn").className = "activeturn";
}

if (document.title == "Final") {
  document.getElementById("poldiv").className = "endturn";
}

/* Cookie character chat behavior */
function showElement(name) {
  document.getElementById(name).style.display = "block";
}
function hideElement(name) {
  document.getElementById(name).style.display = "none";
}
var chars = ["iza","andy","kev","sus","hel","drk"];
var divs = ["intro","risky","cstly","blnce", "final"];

function hideChatDivs(name) {
  console.log(name);
  if (typeof name !== 'undefined') {
    for (i = 0; i < divs.length; i++) {
      hideElement(name + divs[i]);
    }
  } else {
    for (i = 0; i < chars.length; i++) {
      for (j = 0; j < divs.length; j++) {
        hideElement(chars[i] + divs[j]);
      }
    }
  }
}

function showChatDivs(index) {
  for (i = 0; i < chars.length; i++) {
    showElement(chars[i] + divs[index]);
  }
}

function currentChatDiv() {
  var cod = str.slice(document.getElementById("izadiv"));
}

var chatCookie = parseInt(getCookie("chats"));
if (turn != 0) {
  switch (true) {
    case (chatCookie < 0):
      hideChatDivs();
    showChatDivs(1); // show risky divs
    break;
  }
}
```
```javascript
if (turn == 13) {
    hideChatDivs();
    showChatDivs(4);
}

if (turn >= 6) {
    if (title == "Incident") {
        hideElement("andydiv");
        // don't display andrew incident page at "3rd" turn
        hideChatDivs("andy");
        // necessary since the chats are still being selected
        showElement("andyintro");
        // display andy's intro as a chat (overrides cookie settings)
    }
    console.log('andrew shows up');
    showElement("andydiv");
}

if (turn == 3) {
    console.log('turn gt 3');
    if (title == "Incident") {
        hideElement("andydiv");
        // don't display andrew incident page at "3rd" turn
        hideChatDivs("andy");
        // necessary since the chats are still being selected
        showElement("andyintro");
    }
    console.log('andy shows up');
    showElement("andydiv");
}

if (turn == 0) {
    hideChatDivs("sus");
    showElement("kevdiv");
    showElement("susdiv");
    showElement("kevinro");
    showElement("susintro");
}

if (turn >= 7) {
    console.log('susie and kevin show up');
    showElement("susdiv");
    showElement("kevdiv");
}

if (turn >= 6) {
    if (title == "Incident") {
        hideElement("drkdiv");
        hideElement("heldiv");
    }
    hideChatDivs("hel");
    hideChatDivs("drk");
    showElement("heldiv");
    showElement("drkdiv");
    showElement("helintro");
    showElement("drkintro");
    console.log('helen and drake show up');
    showElement("heldiv");
    showElement("drkdiv");
}
```

The code above demonstrates how to control the display of chat divs based on certain conditions. It includes a case statement that checks the value of `chatCookie` to determine which divs to show or hide. The conditions are as follows:

- For `chatCookie > 0`, it shows costly divs.
- For `chatCookie == 0`, it shows balance divs.

The code also includes checks for specific turns to display new characters, such as Andrew, Susie, Kevin, Helen, and Drake, according to their appearance after certain months.

The `console.log()` statements indicate when certain conditions are met or actions occur, providing insight into the control logic for displaying content.

The code also includes variable declarations for accessing elements by ID, which are used to manipulate the visibility of divs.
function monthSelector(m) {
    var prevMonth;
    var litMonth;
    switch(m) {
    case "1": litMonth = "jan"; prevMonth = first; break;
    case "2": litMonth = "feb"; prevMonth = second; break;
    case "3": litMonth = "mar"; prevMonth = third; break;
    case "4": litMonth = "apr"; prevMonth = fourth; break;
    case "5": litMonth = "may"; prevMonth = fifth; break;
    case "6": litMonth = "jun"; prevMonth = sixth; break;
    case "7": litMonth = "jul"; prevMonth = seventh; break;
    case "8": litMonth = "aug"; prevMonth = eighth; break;
    case "9": litMonth = "sep"; prevMonth = ninth; break;
    case "10": litMonth = "oct"; prevMonth = tenth; break;
    case "11": litMonth = "nov"; prevMonth = eleventh; break;
    case "12": litMonth = "dec"; prevMonth = twelfth; break;
    case "13": litMonth = "fin"; prevMonth = thirteenth; break;
    default: break;
    }
    console.log(litMonth + ' ' + prevMonth);
    return [litMonth, prevMonth];
}
}
colorMonth(turn, monthSelector(turn));
}

function colorAll () {
    for (i = parseInt(turn); i >= 1; i--) {
        //console.log(i + ' ' + monthSelector(i)[1].style.backgroundColor = getCookie(i.toString()));
        //console.log(getCookie(i.toString()));
        colorAll();
    }
    switch (i) {
    case 1: monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 6 : monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 7 : monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 8 : monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 9 : monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 10: monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 11: monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 12: monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    case 13: monthSelector(i.toString())[1].style.backgroundColor = getCookie("fin"); break;
    default: break;
    }
Impress iframe is loaded from intro.html. These functions, taken from intro.html, show how Impress is dynamically loaded and the caption on the Introduction button changes with each turn.

```javascript
var monthnum = $turn;
var month;
switch (monthnum) {
    case 0: month = "jan"; break;
    case 1: month = "feb";
        story.innerHTML = "Second Month";
        break;
    case 2: month = "mar";
        story.innerHTML = "Third Month";
        break;
    case 3: month = "apr";
        story.innerHTML = "Fourth Month";
        break;
    case 4: month = "may";
        story.innerHTML = "Fifth Month";
        break;
    case 5: month = "june";
        story.innerHTML = "Sixth Month";
        break;
    case 6: month = "july";
        story.innerHTML = "Seventh Month";
        break;
    case 7: month = "aug";
        story.innerHTML = "Eighth Month";
        break;
    case 8: month = "sep";
        story.innerHTML = "Ninth Month";
        break;
    case 9: month = "oct";
        story.innerHTML = "Tenth Month";
        break;
    case 10: month = "nov";
        story.innerHTML = "Eleventh Month";
        break;
    case 11: month = "dec";
        story.innerHTML = "Twelfth Month";
        break;
    case 12: month = "fin";
        story.innerHTML = "Thirteenth Month";
        break;
    case 13:
        story.innerHTML = "Final";
        var tal = parseInt(getCookie("tally"));
        if (tal < 10 && tal > -10) { month = "hired"; }
        else { month = "fired"; }
    }

    document.title = story.innerHTML;
    var frame = document.getElementById("frame");
    frame.src = "/static/impress/" + month + ".html";
```

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