***Scenario Layout Foreword***

Generally, this document is laid out in a way that will explain the nitty-gritty behind each portion of the scenario, both in terms of what a professor / honors advisory board might want to know (represented with italicized text), and in terms of what’ll be directly presented to the game player (represented in normal type). The italicized text will try to explain the *what* and *why* behind a specific part of the scenario, as well as potentially explaining any underlying mechanics of the game. The normal type will explain *how* this information will be conveyed in the diegesis.

I’ll try to include as much external information as possible for each of these points (maybe a news article or statistic that explains why something is especially relevant to the scenario, or a real-life situation that I took inspiration from when writing an interaction), but if you find anything that needs any sort of clarification, feel free to let me know! A lot of this clarification will be provided by some Google Docs comments.

With that… here goes! I have a high-level overview of the scenario laid out below, with links to each section’s explanation. Just click on one of the bubbles in order to head to that section’s explanation! (Sorry for the small text on each of them - adding hyperlinks to images is a little weird, and I needed to sacrifice some size and readability in order to get all of the bubbles on the same line.)

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You also can bring up an outline of the document for easier navigation between sections. You can open this outline by clicking:

**View → Show Document Outline**

**Background**

*The player is going to take control of a character, who henceforth will be referred to as “the avatar.” The avatar works at a medical devices company (similar to, say, a company like* [*Medtronic*](https://www.medtronic.com/us-en/index.html)*), and they’re a part of a team that’s working towards building an Artificial Pancreas Device System (further referred to as APDS.) This APDS is a closed-loop system that combines a couple of components (a continuous glucose monitor, a.k.a. CGM, an insulin pump, and some sort of computer to coordinate calculations for both other devices) and acts as a self-sufficient replacement pancreas for a diabetic.*

*The background portion of the scenario will present some important information to the player; some of the pertinent topics to be discussed are as follows:*

* *A rudimentary explanation of what diabetes is*
* *The mission of the company that the avatar works at (further referred to as “The Company”), and how an APDS will treat diabetes*
* *The avatar’s role in the company*

The scenario begins with the avatar sitting at a desk in an office environment. The avatar is looking at their computer screen, which is displaying some sort of testing suite’s progress. (It’ll look something [like this!](https://www.froglogic.com/wp-content/uploads/2016/03/CocoCodeCoverage-750x551.png)) There’s a lot of fully green meters (indicating that the avatar has finished testing for many use cases), but there are some that are half red, and some even further away from completion; there’s an “overall completion” total at the top right corner, and it’s listed at around 70%. Exact descriptions of what the avatar is testing aren’t necessarily important at this stage - it’ll be later cemented through conversations with peers that the avatar is responsible for testing a lot of the code related to a communication component of the APDS.

There needs to be some sort of wireless transmission of information amongst the CGM, the insulin pump, and the external controller; this is what the player’s avatar will be testing. This communications pathway will be multipurpose; it’ll be the channel by which data (glucose levels, insulin amounts, etc.) is sent between the devices, but will also be the channel by which the software of each of the devices can be updated. (The FDA is eventually trying to require that medical devices can be reliably updated; the avatar’s company will be getting ahead of this eventual requirement by including the capability for their initial launch.)

Suddenly, the avatar’s phone rings; it’s an alarm, with the description “team meeting”. The avatar heads over to the meeting, and sits down in a larger auditorium-esque room. (We don’t need to actually show the avatar walking over to the meeting; instead, we can simply fade-out of the office environment and fade-in to the auditorium. This’ll ensure that time isn’t wasted on non-essential scenes.) The meeting begins - a project manager is explaining how they’re nearing the release of their APDS, and that their company’s progress has been discussed on a recent episode of 60 Minutes.

The feature plays on a screen in the auditorium - it’s mostly a conversation between one of The Company’s managers and a reporter. This conversation is in the middle of the entire 60 Minutes featurette, which is covering medical devices as a whole. Throughout the conversation, the manager from The Company describes the fundamentals behind diabetes, and then how each of the components of an artificial pancreas work to aid a patient’s failing pancreas. The reporter is pretty impressed with all of this, and the interview as a whole has a very hopeful tone - it’s clear that this technology is going to make a huge impact on the lives of diabetics around the world!

The segment comes to a close, but before the project manager is able to turn off the recording, it starts to move into the next segment of the featurette. “It’s pretty amazing what some of these medical devices can do, but they’re not totally without fault. At a recent cybersecurity industry conference, two researchers showed just how easily hackable some of these devices are…” - right around this point, the project manager turns off the report, and jumps back into their meeting.

Everyone claps, happy at how their work has been portrayed in the media! The project manager says, “It’s clear that you’re all excited about this, and it’s awesome that the public has seen how all of our hard work is going to positively impact the world. Let’s get through these next few weeks - we’re in the final stretch now!” After that, he disbands the meeting with instructions for individual teams to meet up - he’ll be meeting with every team to discuss their remaining progress.

With that, the avatar heads into a smaller meeting room, and is surrounded by a couple of other team members. (Like I mentioned earlier, this transition doesn’t actually need to be shown - we could simply have a “scene cut” between rooms.) A small display at the front of the room displays “Component Communications Team” - the project manager walks into the room and begins the check-in. The conversation begins with the manager mentioning testing, saying, “Alright - like I said, we’re in the final stretch! What’s the progress on testing the communications between the APDS components - you all ought to be almost finished at this point, no?”

*By this point, the background ought to be fairly clear to the player - they’ll understand the purpose of The Company, and the role of the avatar within The Company. These points will be expanded upon through future conversation, but it’s safe to assume that the “Background” phase is over at this point!*

**Quandary**

*Now that the player has been presented with some background information about the scenario, they’re ready to be primed with the ethical dilemma. This dilemma will be referred to (as the title of this section would suggest) as “the quandary”.*

*The main quandary presented to the player will be about the robustness of the test suite that the avatar is in charge of running through. While the avatar’s own code might be passing all of the test, they’ve recently become concerned about the possibility of the APDS being hacked; there hasn’t been any sort of penetration testing done on the device, as cybersecurity hasn’t been a concern of the team up until this point.*

*Of course, actually recognizing the quandary in the first place is a part of this ethics game. So, the avatar’s concerns need to be pointed towards, but not explicitly stated - the hope is that a player will implicitly understand that these concerns are ones that they ought to have if they were placed in this situation.*

*Another facet of the quandary concerns the completion of the avatar’s test suite. If they spend too much time focused on researching cybersecurity implementations, their own code won’t be as robustly tested as it ought to be. As a result, the player needs to find a reasonable balance between completing the avatar’s own testing and investigating implementing more security.*

The meeting with the project manager continues, and each coworker on the communications team speaks on the progress of their testing. At some point, the project manager turns towards the avatar to ask how they’re doing. “How’s the testing of your modules coming along? Remember, we’ve got to push all of this code by the end of the week so that the final deployment team can wrap things up!”

**Interaction Point:** The avatar will be able to say where along the line they are in regards to testing. A percentage slider (something that looks [a little like this](https://i.imgur.com/mcxtkxG.png)) will appear on the screen, allowing the player to enter in how far along the line they are in their code.

Depending on the amount of testing that the player admits to doing, different things could happen:

0% - 40% → The project manager (as well as your co-workers around you) would react fairly poorly to this, expressing some concern. The project manager says, “Well. It looks like you still have quite some work to do - you might want to plan on a couple of late nights this week. You *need* to get this code done in time - everyone’s relying on you!”

40% - 80%→ The project manager would react somewhat neutrally, encouraging you on on your progress, but pushing you to continue working hard: “You’re a little off-track, but I’m sure you’ll be able to do it - you always do some incredible work, so I definitely have faith in your abilities!”

80% - 100%→ *(Note - this would effectively be lying to the project manager, as the avatar’s code is* not *this tested. Other co-workers, who are more familiar with your progress, will remember that you lied, and your reputation in their eyes might decrease a little bit and influence further conversations with you.)* The project manager would react very positively, saying, “Wow - you’re killing it! Keep pushing through - if you finish before the end of the week, you could absolutely help with someone else’s testing!

Once that interaction is finished, the project manager begins to wrap up the meeting. “Does anyone have any last lingering questions?” A co-worker raises their hand, and starts to speak:

“Well, right near the end of the news clip you were showing us, they started talking about the hackability of the device. That concept has come up in passing through some conversations with other coworkers, but we’ve never focused too much on it - are we going to try and look into testing the APDS against hackers?”

The project manager sort of laughs, and then (in an understanding, but still deflective manner) says, “I think you’ve been watching too many crime shows. We’re not too concerned with the idea that someone is going to hack into one of these APDS’s. Besides: we’re not a cybersecurity firm - The Company is not hugely equipped to do some of that sort of testing!” The co-worker who asked the question seems generally satisfied with the answer, and agrees that the completion of the device as a whole is a more pressing concern. The meeting draws to a close, and the avatar returns to their desk.

*The co-worker asking about the hackability of the device is the key point here - it’s an opportunity to present the player with one of the main facets of the quandary. It might be a bit too heavy-handed, but as of right now, it’s the most elegant way I can think of to present this sort of information to the player!*

**Reflection #1**

*In order to gather data on how the player is reacting to the scenario, we’re going to provide two points throughout the game. Throughout these points, the player will have the opportunity to respond to a prompt; the prompt is written in such a way to push them towards thinking about the situation as if they were a part of it. These reflection responses will be collected automatically and reported to the professor, who could then grade them for completion (and use them as overall talking points for discussion).*

*This reflection will be fairly hard to present diegetically, as it necessitates that the player directly address the scenario from their perspective. As a result, it’ll be one of the few times throughout the scenario that there’s some sort of non-diegetic material.*

Once the avatar has returned to their desk, they take a small journal out of a nearby drawer. They open the journal, and they see, written on the top of the page:

What decisions are you facing at this point in time? What have you seen so far that you might want to consider as you’re completing your project?

**Interaction Point:** The avatar begins to write in their journal!

*This prompt is fairly wide-open. For the same reasons as was presented in the quandary section, we don’t want to directly address the existence of the workplace’s ethical quandary - instead, we’ll give the player some space to write about their experience so far, with the hope that they’ll mention being concerned about the tight testing deadline or the lack of focus on the APDS’s security.*

**Info Gathering**

*Once the player is finished with the first reflection, they’ll move into the main chunk of the game: the information gathering phase! During this section, the player will be able to direct the avatar into different situations; most of them will consist of conversations with different co-workers or professionals! (Others might be involving certain actions they can take around the workplace, like looking for more documents about the project, or devoting time towards testing code.)*

*Since it is a workday, though, there will be a finite limit on the amount of interactions that the player can engage with. Each “day” of work will have a set amount of “time units” (let’s say, for example, 10), and each interaction will take up a certain number of these units. (Talking to a co-worker about what they’re working on, for instance, might take up 2 time units.) Once the player has used up all of their available time units, the day will end, and the avatar will go home. (They’ll also have the option, at any point of the day, to decide to finish work early, and just cut the day off short; this wouldn’t be an ideal choice, of course, but it’ll be interesting to see if and when students decide to shorten their experience with the game.)*

*While we do want the player to be actively exploring as many conversation threads as they can, this time limit will provide a necessary layer of realism, complexity, and replayability to the game. Because the player only has a limited amount of time, they’ll be pressed into thinking a little harder about the types of interactions they’re having. This isn’t unlike a real life scenario - since they’re grappling with an upcoming deadline, time is of the essence, and there are only so many different decisions that they’ll be able to make. Placing a limit on the amount of interactions will also allow different students to have fairly different experiences with the game - hopefully, this’ll lead to more conversations amongst the students about some of the possible paths that could have been explored. Ideally, this’ll make the players want to play the game again, too, to see through some of the other paths.*

*I’ve listed a number of possible interactions below, but this is by no means an exhaustive list; since this section is going to compose a fairly large chunk of the game, we’d want the total number of available interactions to be quite large. I’ll also be foregoing some details associated with each interaction - in a perfect state, all of these interactions would be a part of a thickly interconnected interactions web, where certain interactions would have bearing over how other interactions play out. I’ll mention some of the detail in order to give a taste of how certain things might change, but this is generally where a lot of detail will need to be fleshed out!*

**Interaction Point: Test Code** - The avatar will spend some time continuing to test their code, hoping to get closer to reaching their deadline.

*Each time the player chooses to test code, the total testedness of the APDS has a chance of changing. There’s a potential for the test completion to simply go up, and this’ll be fairly beneficial - the chances of a poor end-game consequence happening will decrease, and the project manager might react a little more positively during their interactions with the avatar. However, like any real-life testing scenario, there’s a potential that the testedness of the code goes down as the avatar discovers some additional bug.*

*This “Test Code” interaction will always be available for the player to carry out, as it is the avatar’s job. However, in order to do this, they’d have to ignore a lot of the potential conversation interactions; they might end up getting praise from the project manager / a promotion / a raise for completing their testing, but the underlying lack of security will still exist, and could potentially rear its head in the consequence stage.*

**Interaction Point: Look For APDS Resources** - The avatar walks around the office a little bit, and discovers a brochure / folder of info / news report that divulges more information about diabetes.

*Since the player might not know too much about diabetes, I think it’s important to provide them with some avenue for learning more about the disease. I’d want this to be a repeatable interaction, so there’d need to be a couple of different points of information the player could find. (One of them, for example, might be an* [*explanation on nocturnal hypoglycemia*](https://www.diabetes.co.uk/nocturnal-hypoglycemia.html)*, and how the APDS is an incredible solution for something like that.) This might not have any direct influence over any of the consequences, but a player might be more concerned about the potential for a hacker to do some wrongdoing if they learn about some of the various dangers of diabetes.*

*Another resource that the player might find is a diagram of the overall architecture of the APDS (maybe drawn on a large whiteboard somewhere in the office); this’ll both teach the player how the device works, and also serve to highlight all of the ways the device’s components communicate with each other. The vulnerability to hacking* won’t *be mentioned on this whiteboard, as the device’s cybersecurity hasn’t been a chief concern of the development team at this point; still, though, a keen player might infer that these communications might leave the product open to infiltration.*

**Interaction Point: Talk to the Project Manager -** The avatar decides that they need some clarification on the project, and so they visit the office of the project manager. The project manager greets the avatar kindly: “Hey there! How’s it going?”

*At this point, the player will be able to choose various different conversation threads to explore with the project manager. Additionally, there will be an option to open up a thread of “serious conversation” with the project manager; this will give the player the ability to take one of the major actions outlined in the Action phase, such as* [*quitting*](#ow7j419dojsh)*,* [*asking for a testing extension*](#io83xdb69l47)*, or* [*making a case for hiring cybersecurity workers*](#2bzpfph8dvuz)*. As follows are some of the threads of conversation that can be opened up with the project manager:*

Reasoning Behind the Deadline → The avatar asks why the deadline is when it is, and the project manager responds: “Well, from a purely financial perspective… we’ve almost exhausted our funding! As you know, the JDRF has sponsored the R&D of our APDS, and we’ve been making good use of this money thus far to finish up the device. We’re almost through, though, so we need to get this testing finished as quickly as possible so we can move on to the FDA approval. If you want to figure out more about the JDRF’s involvement, I can give you the phone number of the rep - she’s super friendly!” *(This will open up the* [*“Talk to the JDRF Sponsor”*](#jqp5i2utuaf7) *interaction point.)*

“Apart from the whole funding angle, we’re trying to get this device out as soon as we can for the well-being of diabetic patients! Right now, Medtronic is the only company with an FDA-approved artificial pancreas; our device is poised to be a more inexpensive alternative to theirs, and could help a *ton* of patients manage their disease with ease. We’d be doing the world a huge service by getting this device out sooner rather than later.”

FDA Regulations → The avatar asks about the upcoming FDA approval, and mentions security as a concern of theirs. The project manager responds, “Once our team finishes up the testing, we’re going to send it off to the FDA for their pre-market approval process. A good portion of this process is just checking to see if our device is compliant with all of their standards - since we’ve been poring over these regulations throughout the development of this, I’m sure we’ll pass this with flying colors. After that, there’s some outpatient studies we’ll have to run - JDRF hooked us up with a couple of interested patients, and we’ll run trials of the device with them!”

“In regards to your questions about security… the FDA simply doesn’t require that we have all these cybersecurity measures implemented. They’re focused on making the device safe to use, not on locking it down as securely as Fort Knox. If you want to talk with legal about these requirements more, just visit their office - it’s down on the third floor!” *(This will open up the “*[*Talk to the Company Lawyer*](#1bix1qhngr6)*” interaction point.)*

The Avatar’s Role → The avatar asks about their role in the project. The project manager responds, “The communications team you’re a part of is a pretty integral piece of the puzzle! The transfer of data between the glucose monitor, the insulin pump, and the smartphones we’ll be using as our control devices is essential for the smooth operation of the device. Your whole team has been doing a terrific job at developing this link - all of your testing up to this point has shown us that your code is really sound! We’ve just got to finish up all of the testing to ensure that everything is running as it should.”

**Interaction Point: Talk to the JDRF Representative -** The avatar uses the phone number they received from the project manager to call the JDRF rep. A friendly voice answers and begins to answer the avatar’s questions.

“So, as you probably know already, JDRF is hugely committed to helping diabetics around the world deal with their affliction. When we were founded in the 70’s, we were focused on researching a cure for diabetes; since then, though, we’ve recognized the power of technology, and how it can be harnessed to make diabetes much more manageable - while we’re still some time away for a total cure, we can try and minimize the disease’s impact as much as possible. That’s why we’ve directed a *lot* of our research efforts towards the Artificial Pancreas Project; creating a closed-loop device will take most of the work out of the hands of the patient, and automate it like a working pancreas already would do.”

“To date, we’ve invested about $110 million in research projects related to APDS’s - we’re the world’s leading funder of diabetes research! A small slice of that $110 million was granted to your company’s project. We believe that anybody, regardless of their financial situation, ought to have access to this life-changing tech - your company’s designs use technologies that are a *lot* more affordable than most of the other devices in production, and we think that this will do an immeasurable amount of good for the world. The foundation has been lobbying for *years* to get insurance companies to cover these automated devices - as of right now, though, Anthem is the only large company willing to cover an APDS. With your device being so inexpensive, though, we might be able to change a couple of minds!”

*The point of this conversation is to show the player how The Company’s APDS could change the landscape of diabetes management by making it much more accessible. This, coupled with the project manager’s warning about running out of money, is designed to expose the player to the advantages of getting the device out sooner rather than later.*

**Interaction Point: Talk to the Company Lawyer -** The avatar heads down to the third floor to talk to a member of The Company’s legal department. They ask the lawyer about the FDA’s regulations on the security of medical devices.

“You’re good to be concerned about this sort of thing - it’s really important that we pass through the FDA’s approval without a hitch, as running through the process a second time will be a huge blow. Fortunately, though, we’re in the clear when it comes to security. In 2014, the FDA released a document outlining a lot of cybersecurity recommendations for medical devices - that same document was updated in 2018 with a couple more points about data privacy. Thing is, these recommendations are just that: recommendations. They’re not going to hold back approval of an APDS for these security concerns, because they don’t have the resources to test devices for security holes - because of that, we’ll be absolutely fine for approval without the need of hiring a cyber team. The FDA is much more concerned with the safety of the insulin we’re using, or how our pump deploys it.”

“There have been rumblings about the FDA solidifying some of these recommendations into an official set of standards, but I think that move is *years* away. It took them four years to even update their draft on the recommendations - it’ll be 2030 by the time they have any sort of actual standards. I definitely think that these are important considerations, but they’re definitely not at the forefront of our mission; we want our device approved and in the market as soon as possible, so diabetics can start living more normal lives.”

*This conversation is meant to expose the player to the lack of a legal requirement for implementing cybersecurity measures into the device. This legal angle is an interesting one to consider - while The Company won’t be liable for any security breaches in their device, should they still be concerned with the possibility of it?*

**Interaction Point: Talk to the Concerned Co-Worker** - The avatar decides to strike up a conversation with the co-worker that spoke out about cybersecurity at the meeting. The avatar asks them to talk a little bit more about their concerns, and they’re met with this:

“Oh, yeah. I’m not sure if you watched the rest of it after the meeting, but the end of that 60 Minutes episode had a small bit on the potential for security compromises for medical devices like ours. I don’t think there’s ever been any cases of a hack happening, but… the potential is there, right? After I got back to my desk, I read this article about Dick Cheney - apparently, he had his pacemaker’s wireless functionality removed, because he had concerns about it being hacked. It’s not *totally* out of the question that this could happen, right?”

*The player is going to have an option to respond; if they choose the more empathetic route, and show the co-worker that they’re also still concerned about the device’s security, the co-worker will say the following:*

“Now that you mention it, a good friend of mine works in the cybersecurity industry. I can give you her number if you’re interested in talking about this stuff a little more?”

*This is one example of a way that running through a certain interaction can open up further different interactions! If the player reaches this point of the interaction, a new interaction will open up: “Talk to the Cybersecurity Worker”. If the player instead responds in a way similar to the project manager’s first response, the co-worker will say something along the lines of:*

“Yeah, I suppose you’re probably right - the chances of someone wanting to hack someone’s insulin pump are *pretty* low. I guess I’d rather get this tech out sooner - we can’t justify keeping it away from the public just because there’s a super tiny potential that it’s hacked.”

*On a general narrative level, this interaction will introduce some more merit into the concerns behind cybersecurity. Hopefully, this will give the player some pause, and force them into thinking about the reality of a potential hack.*

**Interaction Point: Talk to the Cybersecurity Worker** - Since the avatar was given the number of a cybersecurity worker, they decide to talk to her about the potential for an APDS to be hacked. On the phone, the cybersecurity worker says the following:

“Huh! So, I don’t work in the medical devices industry, but I’ve heard some whispers of security concerns from other security people. Last year at Black Hat, there was a group of two people who presented on the security of these things. They ended up hacking into a pacemaker and installing some malware, just to show that it was possible and that people could potentially do some nasty stuff. It’s pretty scary when you think about it - once devices like these become a lot more prominent, who knows what might happen? Anyways… I can email you a link to the presentation, if you want - that way, you can see for yourself what’s up!”

*This interaction is meant to further convince the player that the potential for the APDS to be hacked is a very real one. After this interaction happens, the player will have the option to choose the interaction “Research the Black Hat Conference”*

**Interaction Point: Research the Black Hat Conference** - While at their desk, the avatar decides to watch the Black Hat conference on cybersecurity concerns for medical devices. They research the concept more after watching the conference, and discover the company [WhiteScope](https://whitescope.io/#features_area) - they send an email to the contacts provided on the website, and ask about the pricing options of hiring a cyber team to consult for The Company’s APDS.

*If the player follows this trail of interactions all the way to emailing WhiteScope, they’ll eventually receive a response (maybe the workday following the day the avatar emails them), explaining the pricing and necessity of some security consulting. They can later use this information when they’re talking to the project manager - this might have some powerful influence over the project manager, and will help the avatar convince them to hire a cybersecurity team.*

**Action**

*While the player will be guiding the minor actions of the avatar throughout the information-gathering section, this section is instead reserved for some major actions that are available to the avatar. These actions will have a significant impact on the outcome of the simulation as a whole, and could actually even prompt the game to end immediately. Like a lot of the info-gathering interactions, these actions could change depending on what information the player has gathered up until that point.*

**Action Point: Talk to Project Manager -** The avatar will visit their manager to have a serious conversation with them about the course of the project. During this interaction, there are a couple of different things that the avatar can do; these options are as follows:

**Ask for an Extension -** The avatar asks for an extension on their testing, claiming that they don’t have enough time for the project to be fully tested. The project manager will ask the avatar what their level of testedness is, and the player will be given an option to respond with a given percentage of testedness, [similar to the interaction at the beginning of the game](#6q09co85k8xn). The project manager will respond differently to the avatar depending on how their answer differs from the initial one the player chose:

Less Testedness → If the player responds to this question with a percentage that’s lower than the one that was initially given, then the project manager will be frustrated. “At the beginning of the week, you said you were further along in your testing - why did you lie like that? I understand that there’s a lot of pressure to finish this project up, but you’re hurting the whole team when you’re not communicating this information. Now, in order to make our deadline, the whole team will most likely have to pull some serious overtime.”

Same Testedness → If the player responds with the same amount of testedness, then the project manager will react with some confusion. “You said the same level earlier this week - what have you been doing this whole time?” Here, the player will have the option to transition into the “[Ask for a Cybersecurity Consultant](#2bzpfph8dvuz)” conversation line in order to explain themselves; it’ll be slightly harder to convince the project manager for this, though, as they’ll be slightly frustrated with the avatar for their lack of performance over the last week.

More Testedness → If the player responds to this question with a percentage that’s higher than the one that was initially given, the project manager will be happy, but curious. “You’re moving right along as planned - why would you need an extension?” Again, the player would have the option to transition into the “[Ask for a Cybersecurity Consultant](#2bzpfph8dvuz)” conversation line; this time, though, it’ll be slightly easier to convince the project manager to do this, as they’ll be pleased that the avatar has been able to juggle their responsibilities with the security investigation.

*Ultimately, regardless of the level of code completion, the project manager won’t give the avatar an extension - the game will be designed and balanced around having a certain amount of time available to gather information, and awarding the avatar with more time would alter this balance. Instead, this interaction will simply influence the ultimate outcome of the simulation.*

**Ask for a Cybersecurity Consultant -** The avatar will make a case to the project manager for hiring a cybersecurity consultant to work on securing the APDS from potential hacking threats. The project manager will react differently to this request depending on how much information the avatar has collected at this point in the game. Some of these different reactions are as follows:

No Information→ If the player has done no info-gathering related to cybersecurity concerns, then the project manager will not be too convinced by this request. “I definitely understand your concern, but like I told your coworker earlier this week, we just don’t think it’s worthwhile for us to devote resources to this sort of testing. There’s never been any cases of infiltration like this - why should we hold up the release of the APDS just for fear of something happening? There are millions of people we’re going to help by releasing this, so we need to just make that final push and actually release it!”

Some Information → If the player has done *some* info-gathering, but hasn’t quite gathered *all* of the available information on the cybersecurity concerns, then the project manager will be somewhat convinced. *(An example of partial information might be some of the stories about medical device breaches, but without any of the information about some of the medical devices security consultants that can be hired.)* “Hmm… I definitely agree - it *is* really concerning that people have been able to hack into other medical devices like this. I do appreciate you bringing these stories to my attention. Ultimately, I think we still need to release the APDS according to schedule, but I’m absolutely going to look into how we might be able to bolster the device’s security. We ought to be able to include any security updates in a post-launch patch!

All Information → If the player has engaged in almost all of the cybersecurity-related info gathering interactions, then they’ll successfully convince the project manager to hire a cybersecurity expert. “I had no idea that the potential for wrongdoing was so high… we’re going to have to push our launch back a couple of weeks in order to ensure that our device is as secure as possible. I’m going to talk to one of these security consultants to get some sort of idea of how long this might take, and then I’ll call a team meeting to announce this. Thank you for all of this information - you’ve just gone above and beyond to protect our customers, and The Company hugely appreciates your efforts.”

**Quit -** The avatar tells the project manager that they’re going to leave their position. If they’ve mentioned the cybersecurity consultant before choosing this option, the project manager will say, “Listen - I know that you feel very strongly about the security of this device, but leaving your position isn’t a solution to this issue.” A similar response will be elicited if the avatar has talked about a deadline extension, but not the cybersecurity concerns. If the player *hasn’t* talked about either of these things, and instead jumps straight into the “quit” option, the project manager will be quite confused. “I didn’t know you were having difficulties… I’m sorry to hear that you’ll be leaving us!”

*Generally, quitting is not a great decision for the player to make; as is explained in the Consequences phase, it* may *have a small impact on the final outcome of the scenario, but only if certain conditions are met.*

**Reflection #2**

*The function of the second reflection point is fairly similar to the* [*first one*](#i0feql2svk5z)*; we’re trying to collect some sort of data from the player about how they’re processing the scenario. In collecting this data, we’re hopefully prompting the player to think a little more critically about the situation at hand. Once the player takes an action leading them to a game-ending consequence, they’ll be presented with this reflection; again, similarly to the first one, we’ll present this diegetically through a notebook that the avatar decides to write in.*

The avatar opens their notebook, and sees the following prompt at the top of a page:

What information have you learned about your situation? How did this information lead you to make the decision you just made? What do you think will be the consequence of your decision?

**Interaction Point:** The avatar begins to write in their journal!

**Consequences**

*Depending on the player’s actions, various consequences can result at the end of the scenario. Some of these consequences will be instantly triggered by a player’s action, whereas others will happen after the player’s available time runs out. These consequences are formatted in the following way:*

**Name of Consequence**

*Conditions for consequences*

Brief description of what the player will see

*These consequences also might have random results associated with them; this would reflect the unpredictability of the real world, and allow for players who made the same decisions to still have different outcomes.*

**Quitting, No Convincing**

*Conditions: Avatar quits his job, and doesn’t try to convince the boss about the need for security.*

The avatar quits their job to the relative confusion of their coworkers and boss. The APDS is delayed for a few days, as the rest of the coworkers need to finish up the work that the avatar left to them. The product is eventually released, and things seem to go well… but there’s always a chance that something bad could happen.

*There’s a potential for this “something bad” to come to fruition within this ending; there are a number of different things that could happen, including insurance premiums rising for diabetics who don’t eat “properly”, or a prominent diabetic being placed into a hypoglycemic coma by a hacker.*

**Quitting, Some Convincing**

*Conditions: Avatar tries to convince the boss about security and presents them with some evidence (as outlined* [*in this Action*](#5duj2rel4cpl)*); then, they quit their job.*

The avatar quits their job, and the departure is announced to the rest of the coworkers. The project manager is relatively conflicted about the security concerns after the avatar’s departure, as they’re aware that they might be partially to blame; after some coworkers come to the project manager to reiterate the concerns that the avatar was propagating, the project manager decides to go ahead with the cybersecurity implementation. The APDS is delayed for a few weeks to accommodate this, and then is released with some new security features!

**Quitting, Full Convincing**

*Conditions: Avatar fully convinces the boss to implement security features, and then quits.*

The avatar quits their job to the immense confusion of the boss. The APDS is delayed for a couple weeks to accommodate the new security features, and then is released without a hitch!

**Deadline Hit, Testing Barely Progressed**

*Conditions: The deadline passses, and the testing is still within 5% of the original starting point.*

*This outcome has a number of sub-consequences associated with it, depending on whether the avatar has tried to convince the boss about implementing some cybersecurity results.*

No Convincing

The release of the APDS is delayed slightly, as there’s still a lot of testing to be finished that the avatar neglected. The project manager calls the avatar into their office to discuss their performance.

*There are two outcomes that might happen, both of which have different probabilities associated with them. The more likely outcome involves the boss warning the avatar of their poor performance, and saying they need to shape up in the future; along with this, the avatar’s coworkers harbor some ill will towards the avatar for delaying the project. The less likely outcome involves the boss firing the avatar for not performing well.*

Some Convincing

The release of the APDS is delayed for more testing. The avatar is called into the project manager’s office, and the same outcomes as the consequence above are possible. Once the testing of the APDS is done, it’s pushed out. The project manager, frustrated that it took longer than initially anticipated, drags their feet on investigating implementing security patches.

*There’s a small possibility that something bad (as was mentioned in* [*this consequence*](#fsx09lykdakv)*) happens after the APDS is released without security implementations.*

Full Convincing

There’s a delay, just like the other sub-consequences within this consequence. When the project manager calls the avatar into their office, they say that they’re disappointed that they weren’t able to progress on their work. With this, though, they do understand, that the avatar were doing important work on researching security solutions. The project manager regretfully informs the avatar that the security patch will need to come out after the release of the APDS, but outlines a timeline for the security patch’s R&D.

**Deadline Hit, Testing Somewhat Progressed**

*Conditions: The deadline passes, and testing is around 80% - 90% completed.*

After some consideration, the project manager decides that this is a good enough threshold for the testing to be at, and the APDS’s release schedule is not impacted by your testing. Depending on whether the avatar did any convincing about the security implementation, the outcome may change:

No Convincing

The APDS is pushed out according to schedule, with no plans for future security patches. *There’s a decent chance of something bad happening (as is outlined in* [*this consequence*](#fsx09lykdakv)*), though.*

Some Convincing

The APDS is released on time, and the project manager immediately starts looking towards hiring a cybersecurity consultant to patch in security measures. *There’s a chance that something bad related to this lack of security happens, but it’s fairly small, as the patch out to be pushed out within a small window of time.*

Full Convincing

The APDS is delayed, as the project manager spends a little time looking into finding a cybersecurity consultant to implement some security features.

*Once the APDS* is *released, regardless of whether or not it’s had its cybersecurity measures implemented, there’s a small chance that something bad might happen post release. This chance for a poor outcome is not related to security breaches; instead, it’ll be related to small bugs within the avatar’s communication code. There’s a small chance that someone’s device totally fails in an interference-heavy area (like a concert), as the avatar didn’t spend time fully testing the redundancy of the data communication. There’s an even smaller chance that someone goes into a hypoglycemic coma as a result of their control device communicating bad instructions to the insulin pump, resulting in an insufficient management of their glucose levels.*

**Deadline Hit, Testing Mostly Finished**

*Conditions: The deadline passes, and testing is above 90% completed*

The project manager is pleased with the completion of testing, and the release schedule of the APDS continues like originally planned!

*This consequence will also have varying changes depending on if the avatar was able to convince the project manager to implement the cybersecurity; these are all the same as the* [*“Deadline Hit, Testing Somewhat Progressed”*](#c8rhcdxlqc8t) *consequence, though, so I won’t write them again here. The difference between this consequence and the other one is that there will be no chance of communication bugs; the potential for security-related issues still remains the same (depending on when / if the security implementations are made), but at this point, the APDS is robustly tested.*

**Reflection #3**

*After the scenario has come to a close, we’ll provide the player one last time to reflect on their experience as a whole. As the scenario will have finished at this point, there’s no huge impetus to present this reflection diegetically - instead, they can simply be met with the following prompt:*

Are you satisfied with the outcome of this simulation? After knowing the impact of your decisions, what - if anything - would you do differently if you had the opportunity to go back in time?

**Interaction Point:** The player writes their response to the prompt!

**[To-Do List]**

*This scenario layout is a living document - I’m going to be adding to it throughout the summer to make it more robust and realistic, and to keep up a high level of familiarity with the project. As such, I’ve created this section to list out some of my objectives for the outline.*

* Flesh out some actual dialogue for sections that only have descriptions; this includes:
  + The 60 Minutes presentation
* Add some more information gathering points, including:
  + Talking to another team within your company about their medical device (say, a pacemaker) and whether *they’ve* implemented security features
* Watch some cybersecurity talks about hacking artificial pancreases, and make related interactions more realistic. (Find out some technical background behind a hack, and make sure that there’s a larger layer of realism surrounding conversations)
* Develop the “talk to the press” storyline, including:
  + An info-gathering scenario where someone recommends that you ought to go to the press (maybe a family member?)
  + An action point, where you can go to the press with information about the situation that’s developing; there’ll be certain thresholds of information that must be gathered in order for them to take your story seriously
  + Edits to lots of the consequences, where it’s mentioned how talking to the press will impact the outcome of the simulation
* Look into the possibility of a hack coming from a security patch; depending on what you find, consider adding another info-gathering interaction that’ll illuminate this possibility, and then change the [“Some Information”](#5duj2rel4cpl) action option in such a way that illuminates the potential danger of just “updating security later”
* Outline some of the underlying parameters that you’ll have to keep track of throughout the simulation, and then update corresponding interactions to indicate how they’ll change these parameters
* Start thinking about how much time ought to be allotted to the player for making these actions, and assign “time values” to each of the conversations accordingly