PROFESSOR: Today, we are having a table read, which basically means that we're all going to go around and read the scripts where you have them standing as if now. The way it'll work is that say, Siri goes first. She would read the script aloud. We would all keep our laptops closed for the first reading. So just listen to her script as it flows. And then the second time she reads it, we will follow along on her script on annotation studio and make notes in real time.

And then afterwards we'll talk about any feedback that we have for her. And then we'll just go around the class. Do you want to say anything before we start?

AUDIENCE: I think not really, other than the fact that, I'm sure you guys know this, but feedback is best when it's very specific. So as we give feedback to each other, and you've been doing this for the most part, is to just really as much mentioning the things that really work as it does the things that don't work. Because I'm sure you all maybe felt this way when we were work-shopping the other day, but as a writer, it's very hard to put yourself out there and have people just give you critical feedback. So if we can also remember to just give some positive critical feedback as well, about things that we liked and things that worked, that helps the person in the hot seat feel a little bit better.

PROFESSOR: Yeah, for sure. And I also wanted to say, don't be afraid to repeat comments that other people have made, especially on annotation studio. If you notice that someone has made the same note that you were going to make, just that tag a reply to it saying like ditto or something. Because that'll draw people's attention to a space that's worth looking at a little bit more.

AUDIENCE: Andrea had something to say. I just want to make sure I don't lose it.

PROFESSOR: Oh, yeah. Sorry.

AUDIENCE: Just one of the techniques that I learned, actually from an entrepreneurship class, was the technique of doing the yes/and, as a way of giving positive feedback where you're sort of riffing a little bit or adding something to what somebody just said. And I think you guys did that, actually, in your comments. And that was received very positively, because it's like yes, you get it, and you're adding more to it.

PROFESSOR: And I will say that looking over the scripts that were sent in this weekend, I think everyone's in a really good spot as far as ideas go. Like the topics of your videos are actually very, very fascinating. So it's a really good space to be in. I think that the common sort of room for improvement that people have right now is connecting specific examples to the bigger picture. And I think that you get that in your head, but making it a little more explicit in your script is where your focus should be on next.

And I tried to give some of that feedback online. And maybe today I can explain some more of the comments if you didn't understand them as well. But connecting the facts that make up a tutorial video into a bigger picture, like this is why you should care, is a very tricky thing to do. But hopefully today, with the feedback of everyone in class, you can have a better sense of how to do it.

And I'll also say that at the end of the day this is your video, and the final decisions are up to you. So it is OK if people offer different pieces of advice, conflicting opinions. In a lot of my feedback I was saying this as a matter of personal taste. I don't really find this necessary in this part. And that's OK. Final decisions are up to you as long as you sort of justify why you've made the choices that you have.

And that I don't want you to feel like you need to come away from this table read with a checklist of things that you need to do. And then once you do them, like, the script is magically finished. Because that's not going to happen. And unfortunately, that's sort of how a lot of us approach these sort of things. At least that's how I first approached them. So it's OK to repeat people. Constructive feedback is good. The yes/and thing is a good strategy. And I don't know if there's anything else.

AUDIENCE: [INAUDIBLE] I'm the only one who doesn't know how to get onto the annotation software. Does everyone know how to do that? No? Yes? OK, then maybe I'm the only one who doesn't know how to do this.

AUDIENCE: Here's the homework on the first day.

AUDIENCE: Oh.

AUDIENCE: There's a link on the Tumblr.

AUDIENCE: OK. We should probably, in order to make this run smoothly, all be ready so that there isn't a big gap in between the first person. [INAUDIBLE]

PROFESSOR: Oh, this will also be an opportunity to practice hosting. So whenever you're reading the script, it's OK if things aren't memorized completely. But try to deliver it as you would on screen and we'll give you feedback on the hosting as well. So for this first reading, Julia, just go ahead and read it start to finish. If you have queues for like b-roll or something like that, just say this is the part where I'm going to have some b-roll.

AUDIENCE: OK, and should I also describe the animations?

PROFESSOR: Um, yeah. Just like briefly, briefly go over that. And so for this first read, everyone just close the computers. If you have to make notes, do it analog. Whenever you're ready.

AUDIENCE: What do a cellphone, a river, and a cancer cell have in common? The answer is fractals. Fractals in mathematics are never ending patterns. Scientists can program these infinite patterns by repeating a simple mathematical process over and over. So if you zoom in, you'll see the shape-- the same shape, again and again and again. And here I would show an animation of that on a computer.

Similarly, a tree grows by repetitive branching. Just like a fractal, a tree extends its branches one smaller than the other, but similar. A tree can't grow as far and precisely as a truly mathematical fractal, but we can still study nature in terms of fractals. In fact, so many things in nature have these pattern properties-- and show animation of all those things-- it sometimes feels like the world itself is one giant fractal.

Rivers of the planet flow like the blood vessels in our bodies. Lightning bolts become electrifying rivers of the sky. And just look at this honey-- show fractal honey-- here's something even wackier, a brain-fractal shaped forest. One way to explain this abundance of patterns is the fact that nature is just great at reusing efficient mechanisms. How and why that happens, we can't really tell.

But although the existence of fractals remains a mystery, mathematicians have found a way to study the wacky structures. Clouds are not spheres and bark is not smooth, but with fractal geometry we can mathematically explore them. In the 1970s, a mathematician, named Benoit Mandelbrot, was hired to investigate noise in telephone lines. Now Mandelbrot loved connecting images with numbers, so he immediately graphed the data he collected. And he came up with this-- show Mandelbrot fractal, and also the equation that comes along with it.

At first, the image didn't look too special. In fact, it kind of resembled a turtle with a giant head. It wasn't until night time that Mandelbrot looked closer. He zoomed in once and found a smaller turtle etched onto the original one, and an even smaller turtle on that one. Mandelbrot kept zooming and zooming and the turtles kept shrinking and shrinking, but they were still all the same shape.

Mandelbrot was convinced he'd seen a nightmare. But when the shape remained on the screen the next day, Mandelbrot knew he was onto something huge, a simple equation applied repeatedly, carried incredible properties. What if, thought he, you could create such expressions for other natural phenomena? And that's exactly what mathematicians do today. Fractal geometry allows them to model, say, mountain ranges, and then use the models to study earthquakes or creed realistic special effects for our favorite movies.

So you would show animating a mountain range from fractal triangles, and then a scene from Star Wars where that was used, or other movie. In healthier news, fractals may also help doctors diagnose cancer faster and more accurately. They can study the edges of various cells in our bodies using fractal geometry. Here the cell on the right is more jagged and repeating than the one on the left, which means it's the more aggressive, faster-growing cancer cell.

This way of discovering cancer can be that 10 times more effective than the current methods. So that's how cancer cells and rivers relate. But what about cell phones? They aren't really part of nature. Well, in the '90s a radio astronomer by the name of Nathan Cohen was having troubles with this landlord. The man wouldn't let him put a radio antenna on the roof. So Cohen decided to make a more compact fractal radio antenna instead.

The landlord didn't notice it. And it worked better than the ones before. Working further, Cohen designed a new version, this time using a shape called the menger sponge. The fractal's infinite sponginess allowed the antenna to receive multiple different signals. The menger sponge is not really the sponge you'd be scrubbing your back with, but you can still think of it like that. Imagine both water and soap getting through sponges holes, except the water is wifi and the soap is, say, Bluetooth. Without Cohen's sponge, your cellphone would have to look something like a giraffe to receive both those signals. Not quite as handy, is it?

Fractals are already very common, yet we're still searching for more applications, asking questions, building new patterns, and exploring nature's best, here at MIT and everywhere in the world. Look around you. What beautiful patterns do you see?

[APPLAUSE]

PROFESSOR: All right.

TEACHER ASSISTANT: Can I ask a question before we start?

PROFESSOR: Absolutely.

AUDIENCE: Is the reason why you have us not having our laptops up so that we don't want to start writing. Or from your perspective, as someone who doesn't process information auditorily, like with my ears, that was a really hard activity for me. Is it possible to still accomplish your goal while looking if we don't type?

PROFESSOR: So the reason why George and I don't have people look at the text the first time around is because when you're watching the video, ultimately you're not reading it with the script in front of you. And you'll notice that there may be moments where you tune out when you don't have a script in front of you following along, which is going to be the experience that a viewer is going to have.

And I know that that's very difficult to do, because we don't have the visuals, which is why we also do it again with the script. But the first time is more to just like experience it as close to an experience as the viewer would have of the video, because they're not going to be following along with notes. They're not going to know what's coming next. So whatever confusion you may feel in this first read-through is probably more similar to what an actual viewer of the video will feel.

AUDIENCE: That helps me understand that. I can deal with my discomfort now.

PROFESSOR: So how about for this next part, let's all go to annotation studio and look at the fractals document. Sorry, my internet's slow. Would you guys find it more helpful if, for the second time through, everyone got to read through the script at their own pace and then offered feedback? Would you rather do it that way? Yes? OK.

Then how about everyone take a look through Julia's script. Take a couple minutes to do that.

And if you have feedback while you're reading through, go ahead and make notes. And then we'll talk about it afterwards.

All right, has everyone gotten a chance to at least read through the whole script? OK. Let's go ahead and talk about it now, just in the interest of time. Julia, did you want to talk a little bit about some of the edits you were already thinking about making or some of the things that you're struggling with right now?

AUDIENCE: Yeah, so what the instructors have suggested is to take out some of the stories and examples and focus on one story, which is the one that has to do with the cellphone, because that is an example of taking a mathematical concept and applying it to real life. So that way I could delete or shorten the Mandelbrot story. But also some of the examples of fractals in nature, I would focus on them less and kind of put them at the end, maybe describe them less. But instead, explain more what a fractal is and some equations that come along with it, which to me is the hardest part, because the equations of fractals, even though they are--

So the equation for Mandelbrot, for example, is z equals z squared plus c. But the z's in there are complex numbers. And you just keep iterating the equation. So even though it could be simple to show what's happening in just a quick animation kind of plugging in numbers and see what happens, I cringe at the idea of simplifying it to that, because that is not necessarily the accurate representation.

So that's why originally I did not include the equation. I kind of wanted to, maybe, animate just the z equals z squared plus c at some point just to show what it looks like, but let the reader kind of explore that on their own if they wanted to. So I guess right now my biggest problem is can I and should I include more math in this or not?

PROFESSOR: I mean I don't think it's necessarily about the math. I think that the script has a good specific example. And it has a really great big picture. Like the pitch is awesome. I think that's a really great point to work from. It's just that the connecting piece seems a little bit-- like there's not as much connective tissue there. So when I'm reading through this, and I saw Nathan kind of had a similar comment, too, I don't quite get how all the specific examples actually relate to that big picture.

And for me, personally, it was understanding what exactly-- I don't fully understand what a fractal is yet, so I can't make that jump with you to all the applications of fractals. So I understand what you're saying how the math itself is maybe a little complicated to explain, but

I don't understand how a fractal is math, I guess. Does that make sense to other people? I don't know if anyone else felt that same confusion But it was like, I get the turtle thing, and I get it's a repeating thing, but I don't understand how math describes that.

AUDIENCE: OK, I guess that's an easy fix because you can just say there's an equation that goes along with all of these fractals that we can program.

AUDIENCE: I had a similar-- like to me, that's the big piece that's missing with this. That being said, let's pause and take a moment, and like you're big idea at the very beginning was to talk about how math isn't real, right? And this is so amazing that you've come so far. And these stories-- that I just commented-- that they make it real in this way that when we were first sketching on the board that first day, you were really struggling to figure out what were those anchors that were going to help you talk about that abstract idea.

And I feel like you really are doing a fantastic job at grounding this big idea in these stories. That being said, this is when being an expert or thinking deeply about a topic is so hard, being able to separate and to figure out what the rest of the world does or doesn't know about this thing, right? To you, what is probably very obvious, and I'm going to be very honest that I'm not quantitative person, right? So I'm probably at a sixth grade math level for this kind of a video. And I completely had a gap for me being like, I faintly recall having studied fractals in my early middle school years.

I remembered that it's a pattern and I remember kind of what it looks like. I have no idea how a mathematician goes from seeing a tree to being able to break that into an equation, and what that would even look like, or how it would-- that to me-- and how that becomes into a fractal. And to me, that's a big mystery to me, that I don't want you to explain everything because that would probably be really boring, honestly.

PROFESSOR: [INAUDIBLE]

AUDIENCE: Totally. But if there's some way, on a high level, explain what a mathematician is doing in there, why would I study that? Like, the big questions for me are like, why would I want to study that tree?

How would I go about doing it in such a way that would bring me to some sort of mathematical-- the why and the how is very interesting to me in terms of what the mathematician's actually doing and why they would do it and then how you would apply that to other things. So I don't need you to go into the whole equation, but I need to understand the process that a mathematician would go through. I don't know if you guys feel similarly.

AUDIENCE: I was thinking with that, what I was thinking the whole time, I know it's not fractal geometry or anything like that, but if you were to take-- you mentioned mountains, and just to describe how they're doing this-- because they know y equals mx plus b in sixth, seventh grade. I think that's when they start to learn it. So you could just put like a slope of this line. It's described by this equation. And it described this slope of a mountain. And that's kind of what it does, just to a lot higher degree.

I think that's something that they would understand what they already know with the math behind that. And it's just a little bit more complex. And one part where I thought that you could put that in is in scene three. So you just described fractals as never-ending patterns. So I think there's room there where you could kind of go into-- there's not even much rearranging you have to do. You could probably just insert something right there.

AUDIENCE: OK. Good to hear.

AUDIENCE: I thought there was really good examples that describe-- I thought it was pretty good.

PROFESSOR: Nathan brought up a point that I also had when I read this script for the first time about having so many examples. Do you want to explain that further?

AUDIENCE: Well, just at the beginning I thought that there are a lot of different examples in a row that were really cool examples. But all of them, I was like, each one I tried to stop and think, well how is that a thing? How does that work. But then there's another example. I just kind of got a bit overloaded.

AUDIENCE: OK. I think the animation might help with that because where I talk about rivers, blood vessels, and lightning bolts, and honey, if you look at them from above, like if you have pictures, they look very, very similar. So the idea is kind of to show the similarity. I guess somebody mentioned that the brain-shaped forest was kind of overkill with that. So I can definitely understand that.

PROFESSOR: I think that they're good examples. But what might be an issue here is that it's taking too long to get to the bulk of the video. And this is something that George and I were talking about, too, that you have really three themes in this video, cancer cells, nature, and cellphone lines. And I like how you open it with what do all these things have in common. But there's honestly so much to explore in each facet, that I'm wondering if you should just really focus on one, like you had said earlier.

Just because the thing that I kept thinking about-- which is along the lines of Nathan's thinking, and I mentioned it in the comments, too-- but it really reads like a BuzzFeed article almost at the beginning, with all these examples. And I keep thinking about how awesome of an article it would be with like GIFs showing all these different things. But there's not enough of a compelling reason to make a video out of it, right?

The whole story line of what's his name, Nathan Cohen, is actually, I thought that was really interesting. I don't know what example you guys thought was the most compelling to listen to or read. What did you guys feel about the cancer cells or--

AUDIENCE: From a biologist's standpoint, exactly what your concerns are with reducing the equations and math, that's what I felt you did unintentionally with cancer cells, in that you have to this really punchy statement, like this way of discovering cancer can be about 10 times more effective than the current methods. But coming from a biology background, you cut out so much in explaining how cancer is detected, what are the current methods and comparing it to the fact that the edges of the blubbing cells look like fractals in the first place. And so for me this was your weakest example.

And I enjoyed reading your script. And the other examples, I feel like just because you spent more time explaining them and fleshing them out, and you have, I think from your background, a better understanding of the Nathan Cohen story. They just sounded like stronger examples. So in my opinion, cut out the cancer even though it's cool and cancer is a very hot topic right now in all fields of study.

I think people will get more out of your video and more focused point if you choose fewer stories to tell.

AUDIENCE: And by doing so, you actually allow yourself to be able to allude to the cancer topic without diving into it. If you pick the Nathan story, for instance, and you go more deeply into explaining more of the meat that we're talking about, it doesn't mean that you don't get to mention how fractals could have an impact on cancer, right? It doesn't give you the same depth, but it's easier to apply the concept when you understand something deeply in that way. If that makes sense.

AUDIENCE: Yeah, it does make sense.

PROFESSOR: I think in general, and again this is sort of something that I saw with a lot of scripts, it's a lot of breadth and not enough depth. So lots of examples, but sort of shallowly sitting on top of them. I think this is an opportunity to really challenge your audience and teach them something really substantive that they're not going to get in school. And you can do that through the example.

And I think there's a lot that you can cut out. And again, we've noted them on the annotation so you can see exactly what we're talking about. But if you really rely on showing not telling, for example scene nine where you're describing rivers of the planet, the brain-shape forest, like you don't even have to say any of those things if you have the images pop up. Like there are lots of pattern fractal patterns in nature, like in rivers, anatomy, the sky, honey, right? Like you've reduced an entire scene down to basically five words there.

The other thing I wanted to mentioned, because this is sort of a tool that anyone can use, we talk a lot about the reveal, right? So Chris was talking about how you can use the camera to make a reveal. You have a really good set up for a reveal in the first scene. What do x, y, z have in common. That's pretty much exactly how the plants video was set up. What do all these chemical compounds have in common? They all come from plants.

And the reveal is that all these unfamiliar things come from a familiar thing. Here you've got sort of the reverse set up. You have all of these familiar things come from an unfamiliar thing. And I don't think a reveal works as well, necessarily, when you've got that set up, because people don't know what a fractal is. And so if you maybe switch scenes three and two, or maybe get rid of scene two, and just go straight to seem three, the answer are never ending patterns seen in nature and math called fractals.

That's like a subtle nuance, but a reveal set up to where you lead with a set of familiar, and then you reveal what the punchline of an unfamiliar. It doesn't work as well, necessarily, because the response is going to be "what" instead of oh, whoa, plants. You know?

AUDIENCE: Can I add one thing?

PROFESSOR: Yeah, of course. We talked about how the math stuff was really complicated. I feel like this-- maybe I'm way out in left field with this one-- but I feel like as soon as you feel like you're in that zone of being like, oh, I know a lot about this and it would be really hard for me to figure out how to share this with my audience, then to me, that's our negative truth is with these videos, is figuring out how to share those complicated ideas with the lay-audience.

As soon as you're in that uncomfortable zone and being like, I know a lot about this and it's complicated, that's where the truth is. That's it. That's our gift that we're offering the world, is how can you simplify a complicated idea for the public. So if you're in that discomfort place, I fell like we need to live in there. That's our zone. That's just the way I see it.

AUDIENCE: Would it help if like-- because I feel like I'm very curious of all the fractals [INAUDIBLE], would it help if [INAUDIBLE] explained it. When she said [INAUDIBLE], I just couldn't stop thinking about it. [INAUDIBLE].

AUDIENCE: Yeah, it's up to Julia to figure out what style helps her the best, whether talking it out or writing it out or what is your tool that's going to help you to get that complicated idea shared. And that's each of your challenges to figure out your own learning. To figure out how do you go into that challenging place and figure out how to simplify it. And if it's talking it out, then that's great. But maybe it's not for Julia, I don't know.

PROFESSOR: I also wanted to use your script as an example to talk about a broader thing that everyone can use, which is how you set up things with your intonation. So people generally associate emphasizing things with emphasizing your voice. At first-- this is scene 12-- at first the image didn't look too special. In fact, it kind of resembled a turtle with a giant head. But it wasn't until nighttime that he looked closer and he zoomed in. And there was a smaller one and a smaller one. And he thought they were all the same shape. And he had a nightmare. Like that's sort of the default way that we try to bring focus onto a natural subject when we're hosting.

But you can play a lot with emphasizing with the smaller voice, if that makes sense. So instead of saying he zoomed in on a smaller one, and a smaller one, and a smaller one. And then he had a nightmare. You can emphasize the weirdness by pulling back at an unexpected point. He zoomed in and he saw a smaller one, and a smaller one, and then a smaller one. Those are two different types of deliveries that you can use.

But you don't always have to rely on using your volume and sort of the brashness of your voice to emphasize certain topics, because it gets a little repetitive over the course of the entire episode. So you can do that for certain sentences, but for others, really play up the power of actually a quiet volume and an unexpected pull back that also draws attention too. Does that makes sense to people?

OK, does that give you enough to work with?

AUDIENCE: Yes.

PROFESSOR: I think it's a really good start. And again, let me know if you guys disagree, but I think that if you jump into the meat of your episode a little bit earlier, really dive into the Nathan Cohen story, you can use the anecdotes to actually explain some of the things instead of having to take whole scenes to go over concepts with an analogy that you don't need necessarily.

AUDIENCE: Yeah, I definitely hear that. That makes a lot of sense. [INAUDIBLE].

PROFESSOR: And just so you know, I timed it. And took you five minutes to read through the script. And I would give yourselves about a minute buffer room on top of however long it takes you to read the script and even describe the scenes. Because with b-roll and with cuts, you're going to have a little more time that your video is going to last, in addition to the time it takes for you to read the script. All right, does anyone want to go next? How about, the top one on the list. Why do some people handle the cold better than others?

So this is David. And did you change the script at all since last time I saw it?

DAVID: So my idea was-- I added some more research, to make it more [INAUDIBLE]. But I also think that maybe the wording in it is not ideal.

PROFESSOR: Wording is definitely the easiest thing to address in editing. So why don't you just go ahead and read the script aloud to us. And if everyone can pull their laptops down.

DAVID: So why do people handle cold-- why do some people handle cold better than others? Why do some people need to where lots of layers, where others feel fine in running shorts. What makes all the difference? Imagine a giant furnace. To generate more heat, we need to burn more coal. Now imagine your body as this giant furnace. Our metabolism is the fire. And sugars, which are broken down carbohydrates [INAUDIBLE], are the coals.

Inside your cells, the sugars are burned by mitochondria to produce heat and ATP, a molecule that starts and releases energy as required by the cell. To generate more heat for one, our bodies burn more sugars. This the first way we deal with cold. The second way we react to cold is that our blood is restricted by the other-- our blood is restricted through the other organs. The blood circulatory system exits highways to the different organs. Imagine

[INAUDIBLE] trucks carrying oxygen and heat to the organs.

As the speed of the trucks is higher, more heat falls out and is lost to the surroundings, hence our body slows down the flow of blood by tightening the blood vessels. It is the same way as squeezing a lane on the highway. The third way is during more extreme case of cold. Our body results to quick skeletal muscle contractions, called shivering, in an intent to create warmth by expending energy.

It turns out that our bodies aren't always equally created. A team of California geneticists, led by Doctor Douglas C. Wallace of the University of California, has found that many of the world's people are genetically adapted to the cold because their ancestors lived in northern climates during the ice age. This is a very big chuck [INAUDIBLE]. The genetic change affects basic body metabolism.

The genetic adaptation is still carried by many northern Europeans, East Asians, and American Indians, most of whose ancestors once lived Serbia. But is absent from people native to Africa. The genetic change affects the mitochondria, causing it to generate more heat and less chemical energy, which was very helpful to early ancestors trying to survive the cold. Other than our genetic make up affecting how much we can withstand the cold, our physical makeup also plays a part in our resist to cold.

We lose heat to the environment through convection of the air surrounding our bodies. When there's a greater difference in temperature, or more surface area exposed, there's a greater heat loss. We can slow down this process by reducing the surface area in contact with the cold surface or by increasing thermal resistance by insulation. In 1877, American biologist [INAUDIBLE] showed that the length of one's limbs affected the amount of heat lost to the environment.

Bodies with stockier frames and shorter arms mean less surface area exposed to the cold. This is so men with smaller bodies, which have more surface area to volume, lose heat more rapidly. Fat, which acts as an insulation, helps increase thermal resistance, making one lose heat at a slower rate. Thus more people with-- [INAUDIBLE] people with a healthy [INAUDIBLE] will be able to withstand the cold.

Other than our genetic and physical makeup, there's one more way to resist the cold, meditation. Introducing Wim Hof from the Netherlands. In 2009 he completed a full marathon in temperatures below minus 30 degrees Celsius, dressed in nothing but his shorts. Wim Hof is aptly named Iceman for his ability to withstand extreme cold conditions by turning up internal thermostat of his mind.

Wim Hof practices geothermal meditation that allows his body to produce more heat than the average person. Now this sounds wishy-washy and non-scientific, but a team of researchers, led by associate professor Maria [INAUDIBLE], from the department of psychology at NUS, faculty of arts and social science, showed for the first time that it is possible for the core body temperature to be controlled by the brain.

The scientists found that core body temperature increases can be achieved using certain meditation techniques. A second study was conducted with Western participants who use a breathing technique of the geothermal meditative practice. They were able to increase their core body temperature within limits.

Now that we understand our genetic and physical makeup, and how it affects resistance the cold, as well as how to combat the cold, maybe if the next Ice Age were to come, you will better be able to withstand and survive it.

PROFESSOR: Now, so we'll all go look at his script and-- actually, maybe this time we can talk more of the feedback and you can take notes, because you took a little longer than I thought it would. So I just want to leave enough time for everyone. But a quick note, when you guys read your scripts during the table read, read it like you would actually host it. You clocked in at exactly five minutes, but you read a lot faster than you talk normally.

And when people read, they often have the exact same intonation structure when they read a sentence. Which is to go, this is how I'm reading this sentence. I'm reading it, and my tone goes down at the end. I'm reading the next sentence, and it's going down at the end. And so every single sentence sounds the same. Does that makes sense? And when you do that-- and I know that you're just reading off of the script, but it's a habit that everyone falls into. When you do that, it makes it very, very evident that you're working off of a script.

When you talk in real life, you have different intonations in your voice. You go up. You take kind of pauses. Your voice goes down at the end of some sentences. Sometimes it goes up if you're asking a question. But when you're reading verbatim from text, your intonation tends to fall into the habit of having the same intonation structure. So just be mindful of that. And for people who are going next, really try to read your script as you would present in the video.

So that was just a quick note. Now how about everyone just read through the script. Don't worry about commenting. And then we'll all just sort of do live comment feedback on this one. OK, so I think this script has similar strengths as Julia's in that you have a lot of very specific examples. But I think it also struggles with having a hodgepodge of anecdotes, and not necessarily a real, unifying, noticeable theme.

My big question about this script is, is your theme more about why some people feel more comfortable in the cold or why some people would survive better in the cold? Because that's a point that Jamie brought up in the last class.

DAVID: The second.

PROFESSOR: The second. Because what I don't understand is how these specific examples actually imply better survival in the cold, because they're all about you burn more energy to produce more heat. But are some people's genetic makeup actually-- does it make them more prone to surviving in the cold? Or does it just make them more comfortable in the cold?

DAVID: Some people's genetic makeup allows them to create more heat, and therefore better survive the cold. Which is what makes them more comfortable. [INAUDIBLE].

PROFESSOR: But the way you open up the video, it kind of implies why do some people wear a lot of layers while other people can go running. Are you implying that the people who go running in shorts could survive being out in the cold longer?

DAVID: [INAUDIBLE]. They are able to do that because-- maybe because of the reasons below, maybe they're genetic makeup is predisposed to better withstand the cold. Or maybe they have a physical makeup that is just there that helps them to do.

PROFESSOR: But is that scientifically proven?

DAVID: Yeah. Based on the-- I cited the documents, the scientific study.

PROFESSOR: Because to me, I don't know how you guys feel, but to me, that's actually not established with the facts that you've given. Like if you took the person who was wearing shorts running and the person who was wearing a coat and you stuck them in Antarctica, would the person who was wearing shorts live longer?

I mean the person who was wearing shorts wouldn't complain as soon, right? The person who bundles up, they'd complain about being cold, but would they necessarily die first?

AUDIENCE: Yeah, [INAUDIBLE] while you were talking I put on my jacket.

AUDIENCE: Like I have seen stuff. I mean-- and I know whatever I've seen there's probably a million things out there to debate it, but if people are in hypothermic conditions-- and this kind of alludes to the metaphysical, I guess, like that aspect of you talking about with the marathon runner-- some people are able to make their core temperature warmer than it would be in just like ambient temperature, if they're actually in a colder environment. I have seen stuff like that.

What I thought would be cool with that piece, though, was if at the beginning you say why do some people handle the cold better than others, well, it's all these questions. But if you introduced with like, in 2009, whoever ran this marathon and he was wearing shorts. Like how was he able to do that. That way I think you're taking out that first chunk and you're replacing it with what you already have in there. So you're shortening it a little bit. And I think it's more of an interesting introduction.

Because that's the stuff that I thought was really interesting, is like how are people able to do this and scientists study them and whatever your facts are.

PROFESSOR: Yeah, I agree. I think it's a much more compelling opening than why do some people wear shorts outside. So basically moving scene 3C to the beginning. Go ahead, Julia.

AUDIENCE: The way that the scene 3C is currently placed it almost seems like the odd one out because it talks about meditation. So if you did start with it, that would be really cool. But also maybe replacing the word meditation with you're controlling something with your brain, just so it seems more like a scientifically-related concept. And the also, another thing is you name a lot of scientists and dates. So maybe you could talk about those experiments but not, name, people or locations. That might make it easier because then you don't have to think about California and Northern Europe in the same sentence that mean different things.

PROFESSOR: Nathan, were you going to say something?

AUDIENCE: I actually think it's more of the second scene. I feel like the second scene is kind of explaining on a cellular level and anatomic level how we stay warm. And it doesn't really connect to well to either the intro or the third scene. I think it's actually really interesting, but right now it's kind of like-- it doesn't really talk about why some people do any of these better than others. And then there's only like one part in the third scene where mitochondria is mentioned. I think that just needs a little bit better connected to everything else.

PROFESSOR: How vital is scene two?

DAVID: Basically, my thought process of how this is going to go is introduction, and then how our body handles, and what is the difference between people.

PROFESSOR: It's a very classic five paragraph essay form, right? Intro, background knowledge, question, example, right? Which is a very logical flow of ideas, which is why so many people write essays that way. But I think it's also why it's reading a little bit like a news story right now. It's reading a little bit like a part of a textbook, almost. And it really-- the stuff at the end is really the more interesting part, to me at least, the reason why maybe it should be a video over an article.

And I think PJ's idea of moving the example from the guy from Iceland as your opening will help with that. And I also agree with Nathan that you may not even need most of scene two, right, because the point of the video isn't to explain how we stay warm. The point of the video is to explain why some people are more predisposed to handling incredibly harsh environments than others.

Like I think the concept of hypothermia is fascinating, but that word isn't mentioned that all in this video. And let me know if you guys disagree, because this is a totally personal taste thing, but I feel like that would be a much more compelling example to use than to say you stay warm by shivering. And you stay warm by your blood vessels contracting. Like those are all very true facts that don't take away, necessarily, from understanding how people are more predisposed, it's just that you spend such a long amount of time on that. And it takes a while to get the bulk of your body.

It's like the same thing that was happening with Julia's. And it's very counter-intuitive because it's very different from typical science communication. That's not how you write a journal article. With a journal article, you span like five pages with an intro and set up. But with the video, I don't think you need the second thing. I think you need bits and pieces from it to explain the point, but what do you guys think?

AUDIENCE: I think may be to just like identify second scene. So it's on a cellular level. And then we shiver. So skeletal. Maybe just identifying it but not really expanding on it might be something to do.

PROFESSOR: Jamie, were you going to something?

AUDIENCE: Yeah, I'm just processing. This is one by going deep it allows you to go shallow as well, like with the Julia with diving deeply [INAUDIBLE] to something else. I'm with you now, about if we start with the idea of this runner who was able to beat the cold with his him, through telling that story, you can actually tell me about what's happening on a cellular level and how he was able to beat it, right?

So one thing that I think needs to be said somewhere in this is the idea that if you strip away some of the variables like what people ate or-- as someone who used to be a serious hiker, if someone has to go to the bathroom versus doesn't, that actually makes a really big difference on staying warm. Because if you think about it, if you have all this liquid and you need to go to the bathroom, your body's warming all of that up.

And if you just went to the bathroom you'd suddenly get a lot warmer. So taking those variables out, I'd say all things being the same, these two fundamental bodies, what's going on in a cellular level? That helps you understand the mind breaking, the cool extreme example we have of this guy beating the system somehow. But in order to understand how cool it is that he's broken and beat the system, we kind of need to understand what the norm is for the system.

So by using him as your freak example, it allows you to also tell the story of how things should work in a normal-- do you see what I'm saying? And then suddenly his story becomes your streamline, that forward motion throughout your video. And the backward telling of the story of the facts about how a person breaks down glucose or whatever, ends up being part of that forward motion because you're trying to explain this cool, weird freak thing of someone can actually use their mind to change, or at least to appear to change their temperature.

So I really like this re-framing. And I think it allows you to go deeper and to make it more interesting by doing less.

PROFESSOR: I think you also need to bring the point of the video earlier on, because right now it comes in scene four at the very end. Maybe if the Ice Age were to come, we would better be able to withstand and survive it. It's really random right now, because you haven't really set that up as an argument. So I would say put that at the beginning, too. Like there was this guy a long time ago. And he ran this marathon half naked. Why didn't he die?

Is there something about him that is genetically-- don't say genetically superior because that's very un-PC. But you know, are there genetic traits about him that would equip him to not only withstand cold temperatures, but maybe survive the next Ice Age. Is there something about him, about humans like him, that are different from other people. That's what I'm saying about it needs to get into the meat and the bulk of the video sooner, because right now it's a lot of intro, intro, intro.

And the example doesn't even come until scene 3C, which is over halfway through the video. Does that makes sense to people, what Jamie just said, about using a specific anecdote to describe a lot of the core concepts instead of just describing the core concept separately? Does that make sense?

AUDIENCE: You can have a lot of fun with that as it being your main story. Like imagine you running half naked across the football field with obvious snow out, right? That's a really fun intro. I mean, there are really fun things you can do that also make it concrete. Because you've done all the hard work already, which was coming up with the science behind it. You've already made it into a concrete story. Here are three specific things that might be happening. You just need a hook and a story line to help you tell that.

PROFESSOR: The application is what's going to differentiate it from a textbook as well. Because right now, scene two is a textbook moved to video. And that's fine, but it's not going to be interesting, I think, has all your anecdotes. I mean I have the concern that this-- what's his name-- coldman, Iceman. I had a concern that is wasn't scientific enough or robust. But since you added the stuff about the research from NUS, I do think that's interesting. Expand on that more. And cut out stuff from scene two to give you time to do that.

So I would say open with Iceman. Open with the big picture question, what are the fundamental qualities about him that differentiate him from other humans like me. Then you can talk about what exactly happens when people die of the cold, essentially. Like why is that happening, it's because your body can't keep up with burning enough fuel. So you're talking about the whole furnace concept in that reason, but you're not taking the time to separately explain it to people.

And then-- so you have the example. You have the huge question. You go into the details of explaining the core concepts. Then go back out to the research question again. Does that makes sense?

AUDIENCE: I think the really critical part of what [INAUDIBLE] just said that's not in your video right now is explaining what happens when people die of the cold. Because that'll really drive home your big question, how will we survive the next Ice Age. How people died in the cold in the first place. So what happens when these systems that generate heat fail. And what about them fails.

AUDIENCE: And this may be too much. So as author, totally feel free to ignore this next idea, but at the very beginning you talk about putting clothes on as a way of combating that cycle. What are the ways that we-- and I don't want you to dive deeply into this, but it might be a nice beginning of a wrap up. What are the ways that we can fight the cold given our current cellular structure.

So I'm born this way. This is me in the world. What can I do right now to fight the cold. Obviously I can put on another jacket. What's my jacket doing, fundamentally.

PROFESSOR: And you talk about that right now in scene two, but do you see that makes much more sense in the context of Jamie's example? So you don't have to take the time to say, let me define shivering. Let me define blood constriction. Let me define metabolises. Don't take the time to define those things separately from a context. Just seamlessly integrate that into the examples you're already talking about.

AUDIENCE: Or would eating a big spoon of peanut butter help me. I would want to probably know some concrete things at the end, just wrapping up, along with the scientific. As someone who used to do some pretty extreme outdoor stuff, I know that eating a spoonful of peanut butter actually will help, but why? And just bringing it back on that very concrete level to your audience, to be like, because of carbohydrates here. So next time you're about to stand out and watch a football game in the cold, eat a huge bar of chocolate or put on an extra layer, or something concrete. And not a lot of time. Don't waste a lot of time. That might tie it back to the concrete for your audience a little bit.

PROFESSOR: I wouldn't end it that way, though, because that's a little too simplistic for what you could do. So end it by tying it back to the big question, for sure. And that's what I meant when I said in your comments, like what type of research is going on. Because there must be people out there who are studying ways to sort of trick our bodies against the way we're naturally hardwired beyond just putting on another jacket.

So if you can talk about those things, I mean that's another opportunity to differentiate it from a traditional textbook content. So right, now the way your script is structured, is simple question, facts, background facts, a bunch of research questions, and then really good question. That's like a very standard five paragraph format. I would say restructure it so that you open with one of the anecdotes, Iceman. Open with the big question.

Go into the details in the context of the example. Then go back out to the research question. Then you can do what Jamie says, which is like well, if some people, like Iceman, just are better off, like what about for the rest of us? What are researchers doing or what can we practically do to sort of trick nature. And then point it back to the big question again. Does that make sense?

AUDIENCE: It might be worth it to-- hibernation's like a hot topic right now with all the space travel and stuff that they're thinking of. So that's like-- I mean that's addressing eating a lot, low metabolic, it kind of, I think, gets all of that. [INAUDIBLE]

PROFESSOR: But also they're doing that for space research, too, right? There are a lot of resources at your disposal, so you can talk about things that have never been talked about before. That's the whole point of these videos. That's what I mean by don't leave them as instructional tutorial videos, because anyone can make those, but we have current research at our disposal. There's so many things that we can talk about that just haven't been talked about yet, so I really want you to spend most of the time of your videos on that.

AUDIENCE: And you might be able to find-- I mean I have no idea who does this on campus-- but I bet we could probably do some research to figure out is anyone in [INAUDIBLE]. I don't know, someone. There might be someone on campus that you could talk to that's doing some research on this [INAUDIBLE] thing. If you could add a little of that it would be cool. What's the pacing that you're planning for this?

PROFESSOR: Pacing for today?

AUDIENCE: Like how many people are we hoping to get?

PROFESSOR: I was going to try to get as many people as we could. Tomorrow I'm going to do my last lecture to give you guys more time to work on your video than we had originally planned. Yeah, so just as many as we can get through today. Whatever we don't finish we'll do tomorrow.

AUDIENCE: We should probably give people a chance to break soon.

PROFESSOR: Yes, absolutely. Let's do one more and then take a break. David, do you have any questions about that? About all of our feedback?

DAVID: [INAUDIBLE].

AUDIENCE: So for example, one section I think could be condensed to a single sentence, like 3A. So you have this really big paragraph. It's like a paragraph in your essay. You have a citation and everything. But that section can just be reduced to some people have different mitochondria, which generates more hear and less chemical energy. Like that's it. That was the essence of section 3A.

DAVID: [INAUDIBLE].

AUDIENCE: You are-- you are a reliable narrator, inherently, in your video. So this is a citation to something, as something you can include in the video description below. And oftentimes a lot of educational channels do. It's like, if you want to do further reading on this, you can include it in the description. But if you say a statement like that, that because of genetics, because of the hard-wiring of our DNA, some people's mitochondria is more efficient in this way, less efficient in this way. They're accepting this.

And I think because you're a scientist and because you're making this at MIT, that adds to your reliability. And the fact that, for your more dubious claims, which in my opinion are the mediation stuff, because psychology is inherently a more dubious field, like anything with people's brains, we have a very, very loose understanding of brains. Because that's where if any citations go on your video, that's where you should start referencing researchers, because that's where people are going to go, hm, this kind of sounds like pseudo science.

But people have heard of mitochondria. People know what mitochondria do. So if you make a claim that some people's mitochondria, not everyone's, acts differently, then that's an acceptable fact.

PROFESSOR: David, I know this is not what you want to hear, but what I actually recommend you do is write a script from scratch. Write your next draft. Because you have all this knowledge in your mind already, so it's not like you need to look at it to rewrite it. But approach it from this completely fresh, new structure, of opening with an anecdote, connecting that to the big question. Explain the anecdote. And in the process of explaining it, you can hit the definitions of why people-- or how your body shivers, or how many Iceman, when he meditated, maybe his blood vessels constricted.

I'm totally making this up. You have to fact check all this. Then go back out to how this could affect our survival rate in the Ice Age. If you approach it from-- because this is going to take a completely different structuring. So I almost don't want you to even look at this when you try your next draft, because you're going to have the habit of thinking about it in the same five paragraph structure that you did before.

Send the next draft that way. I think in the process, you will end up not including things just naturally. But if you try to look at this draft and say what do I need to take out. What do I need to put in. What do I need to move around. I think it might be a little confusing to you, does that make sense. All right. And I will stick around after class today, if people want to talk more about their scripts. But I wanted to give everyone a chance to read it out loud to people.

Oh, when you are reading also, this is a tendency that a lot of people have. And I just noticed it because you read last. But carry your words through. You're going to want to talk a little bit slower than you usually do naturally. And you don't want to drop the ends of words off like this. Because the effect that that has is you sound robotic on camera, and it's really hard to understand the ends of words. So that's it for everyone, just make sure that you carry all of your words out to the end of the sentence.

All right, let's do one more and then take a break. How's everyone--

AUDIENCE: [INAUDIBLE].

PROFESSOR: You want to take a break right now?

AUDIENCE: [INAUDIBLE].

PROFESSOR: All right, let's do a five minute break and come back.

AUDIENCE: And I need to make a quick phone call, so I'm going to be late coming back in. [INAUDIBLE]

PROFESSOR: Go for it.

All right, Nathan, take it away. And remember, read it like you would actually try to host it.

AUDIENCE: What does food in your fridge start to smell, and where does that icky black liquid come from?

Wouldn't life just be easier if we didn't have to worry about that? Well, to answer these questions, let's talk about decomposition. Wikipedia says that decomposition is the process by which organic substances are broken down into much simpler form of matter. Well, what does that mean?

Basically, in your fridge, on a forest floor, almost everywhere, there are fungi and bacteria that live entirely by eating dead things. These dead things that make up food can be more or less divided into three categories, carbohydrates, which are like things like sugars and starches, lipids, like fats, and proteins, like meat. All of these are chemically different compounds, so they each get digested in a different way.

Enzymes like amylases, which yields us starches, and cellulases, which deal with cellulose, the main component of plants, create sugar from complex carbohydrates, which cells can easily get energy from. Lipase has split lipids into two parts, glycerone and fatty acids, both of which can produce energy. Lastly, proteases break protein into the amino acids that they're made of, which both releases energy and provides a bacteria and fungi with crucial building blocks.

So how does a-- so how does a perfectly nice broccoli floret start giving off this foul black liquid? Well, fruits and vegetables are almost entirely water, so one the most basic level, you could say a plant cell is an extremely complex water balloon. The elastic outside is the cellulose cell wall, and the [INAUDIBLE] inside is the intracellular fluid. When a bacteria or fungi use a cellulases to break down the exterior of a cell, it's like if I were to pop the balloon.

But liquid and other materials that come are what cause the muck you see in your fridge. And so what about that smell? It depends on the food type. Basically, if a meat starts to get rancid and smell bad, it's because when lipases break down the fat and the meat, a lot of the fatty acids you end up with aren't too pleasant. If it's a fruit or vegetable, [INAUDIBLE] all the time, the smell happens after that icky liquid forms.

Other bacteria that weren't involved in initial breakdown, move in and start to stink everything up. So looking at this all, wouldn't it be easy if we didn't have to deal with decomposition, if things just lasted forever? Well, maybe but probably not. The USDS found that the average American household wastes about 25% of its food, and a lot of restaurants are even worse. Sure, that number could go down if there's no decomposition. But other factors can affect how good a food is, too, like moisture and exposure to air.

And if we didn't have decomposition, what would happen to all that food we throw away? Food items in landfills are dealt with by decomposes, and allow the nutrients in food to return to the soil and eventually other living things. If things just sat idle in landfills, we'd end up with a crisis on our hands, eventually. Aside from just food, bacteria, fungi, and protists are responsible for breaking down other dead things, like trees.

In fact, they're more or less the only things that can do it. So while your house would never have to worry about termites, who rely protists in their stomachs, the forest would pretty soon be flooded with dead stuff. So decomposition, while maybe annoying when you can't eat that now fuzzy peach in your fridge, is essential to the continuation of our world as you know it. And it's pretty darn interesting, too.

PROFESSOR: Just so you know, that was also exactly five minutes. but keep in mind, the pacing of your reading is a lot faster when you're reading off of a script. And then you got to account for all the b-roll that you're going to put in there. So it's clocking in at a little bit over five minutes. For this one, let's look at the script altogether. And I'm going to go ahead and make my first point in the interest of time, if I can find my cursor, which is that this script has the same issue that I was talking about with David, which is that I think the coolest part about your episode is this whole part right here, these two paragraphs.

What would happen if we didn't have decomposition, and why it's actually super vital. But it doesn't come until you've gone through all this stuff. And I wonder how much of this stuff you actually need. Like this whole sentence, and actually this one, I think you could take out completely. Go from why does the food in your fridge start to smell, wouldn't life be easier if we didn't have that to worry about. You could just say, well, in your fridge, or on a forest floor, there are fungi and bacteria that survive entirely by eating dead things. And they're responsible for turning your broccoli into the black mold.

This stuff is informative. I don't think anyone here suffers from the inability to be informative. This is all very factual. But I personally don't care about it as much as the stuff at the end. How do you guys feel? Yeah.

AUDIENCE: I was kind of zoning out when there was the amylases.

PROFESSOR: Yeah. It's OK to use technical terminology. But I think this gets a little too jargony to the point where people are going to have a hard time understanding why they need to know what a protease is. This is what I meant by David's structure. We're so used to writing stuff in this is form, where you have the question, and you have the background. Then you usually go into an example or an anecdote. Add then you have some sort of conclusion where you say-- your conclusion is, so that's why decomposition is important.

In a video, this is your money shot, usually. This is the thing that looks cool. Have you guys ever seen that-- it's a commercial for Sprint where they have the people cutting their bills in half. Have you guys ever seen that before? I find that a very weird commercial, because it takes them such a long time to get-- they interview people about how much they're spending on their monthly wireless bill.

It's not until halfway through the commercial that you get the part where they're actually cutting all their bills in half. And I'm like, it they just opened the commercial with those shots, then they could go into the interview stuff. But whoever produced that commercial was like, no, no. We have to establish that people hate their current cellphone plan. And we have to get them to talk about who they are before we can show that stuff.

That's not true of video. You can start with the example. You can start with the big question. And instead of having a conclusion, you can have a connecting-- instead of this conclusion, oftentimes you revisit the question instead. So I think you should move your example up. You should move it up right after the question. And in David's case, I think you should actually do the example, and then the question.

You should talk about Iceman and then say what is it about certain people that give them the advantage. For you, I think you should say why does food in your fridge start to smell? Because it's like a nice, familiar intro into the topic. But then I think you go into what would happen if we didn't have decomposition. And that's not exactly an example, but do you see what I mean by just diving straight into the meat in the bulk of your video?

Were you going to say something, Andrea?

AUDIENCE: Well I just remember when you did your one line or two line summary, which was so amazingly awesome. And I'd love to see that in the script, of well, it turns out that there are lots of other things that like to eat your food, too. And that's the hook.

PROFESSOR: Yeah, I think that is where the video exists. I don't think you actually need most of this stuff, which again I know is like super disheartening for people to hear that the majority of what you wrote isn't actually necessary. But I think that in the act of writing this, you've discovered what the really compelling part of your script and your content it, which is this.

AUDIENCE: I'd said the big problem is that, for me, it's accepting that in the end what I really wanted to make a video about is how it happens. Because that's the part that I look at and when I want to figure it out on YouTube, there's nothing that told me how it happens. And I don't know, that's the problem for me. Because that's more-- I guess that's the issue, is that it's not as compelling what I want to make a video, as what is probably a better video as what I'm not as interested in as myself.

PROFESSOR: Then I think simply by moving these two paragraphs, basically, to the beginning, prefacing all this stuff, you can have the best of both worlds. And I actually think that, you're right, you do want to explain what's happening, because that's like substantive science that people can be learning about. So this is a really compelling hook. What if we just didn't have the thing that seemingly inconveniences us.

What if things could just last indefinitely? Is this crisis unrelated to all the stuff with the enzymes that you were talking about earlier in your script?

AUDIENCE: I think the crisis is more the-- I tried the very in a couple of like-- it's like nutrient cycling and nitrogen are very complex topics. So basically I tried to very succinctly, sum it up that basically you need to have things returning.

PROFESSOR: Then what if you just simply say you need to have things returning to the soil just like you have in this sentence. And then you could say, so what averts this crisis, basically. And then you can go into this stuff, that you have bacteria that break the outside walls of plants. And all the liquid comes out. And that's like the muck. That's what rot is, basically.

But in doing so, drive home the point that this stuff is important and desired. So you set it up with well, what would happen if we didn't have decomposition. You wouldn't have stuff returning to the soil. You'd have just endless material piling up on each other. So what averts this crisis? Well, bacteria do this. And by allowing it to rot and allowing things to go back to the soil, go back to the question of that's why stuff rots in the first place.

So actually, maybe it just needs like a little bit of restructuring more than anything. What do you think you, Julia?

AUDIENCE: I really enjoy your informal language, so saying things like pretty darn interesting. So I think also if you can put the science-y jargon into that informal language, that would make it more fun. Because that's kind of how you talk, and so if you can explain it that way, that would be great. And also, you can add images. So for example, for you saying how does a perfectly nice broccoli florets start giving off this foul black liquid, you could show this black liquid instead of mentioning it or describing it and just say, how does it end up like this. [INAUDIBLE].

PROFESSOR: Yeah, that's a great point. It'll save you a lot of time, too. I actually don't think you need this sentence, personally, because by then you've established that it is interesting, and you sort of highlight it through your tone. And in general, again it's totally a personal taste thing, but I try to avoid observations that a viewer could come to on their own, or ones that I could say quickly in passing in the context of a sentence. I rarely try to have an observation like that merit its own sentence or its own thought.

AUDIENCE: Do you want to touch the concept of recycling at all, like the idea that some things that may seem like waste or dead stuff is actually really useful to other things. I don't want to complicate this.

AUDIENCE: I actually don't know what you mean by that.

AUDIENCE: Like for instance, mushrooms are decomposers. Their job is to help speed up the cycle. And there are other creatures and microorganisms out there that have an important role in this part of the materials cycle, that I'm not sure whether it's worth mentioning that that ooze and that black stuff is actually someone's delicacy.

PROFESSOR: I think that's what you're trying to get at with the whole having the nitrates and everything return to the soil. And maybe that's something that you can hit in just a sentence. Like it goes back-- it allows nutrients in food to return to the soil that's vital to the organisms that live in that environment, and eventually other living things.

AUDIENCE: And this is one where maybe having a visual of the food chain cycle, like that whole-- really hammers this down visually for people while you're talking. As the sun creates-- like just a visual map of just the food chain cycle, starting from the sun and going back to you. And maybe that's all you need with this to hone that biological concept down for people, that life cycle.

PROFESSOR: Yeah.

AUDIENCE: Going off of what Julia was saying a little bit earlier, so right now, the part where you discuss enzymes sounds a lot like the videos I'm making right now for MITx. It's super factual and really concise, which is good for those kind of videos. For these kind of videos, I feel like you need to integrate this information in the greater structure of the story like we were talking about. So jumping off of what Andrea was saying earlier, if you structure it as, we are not the only people who eat our food. Bacteria and protists and things like that also eat our food.

They use enzymes like proteases to break the protein in our food to do this. As opposed to introducing them as list, like these are different enzymes. If you can figure out a way where the outer story is, they also are eating our food and breaking it down. And then bringing up these enzymes when it's necessary to define them instead of just giving blanket definitions of all of them at the beginning, it helps keep that viewer engaged, because then they're still getting the same amount of information overall, but they're getting it in smaller doses, and when that information is relevant.

So they're more likely to remember it later on, because they'll see a picture of the meet. And be like, oh, the bacteria uses proteases to break the proteins down in the meat because they use those as amino acids for themselves, or something like that. As opposed to giving this list of enzymes.

PROFESSOR: Yeah. That's a really good tip for everyone. I think you Julia, that's definitely relevant in your script. David, for sure. Maybe a litmus test is if you find yourself with an entire sentence or an entire paragraph that is just a definition on its own, really rethink how that's being done. Enzymes like amylases, which deal with starches, create sugar from complex carbohydrates, which cells can easily get energy from. Like that's a textbook definition of what enzymes and amylases do.

And you can explain that stuff in your examples of well, it turns out we're not the only things that eat our food. Bacteria do that, too. I don't think it's super accurate to say that enzymes eat our food. But you know what I mean, never leave an island of a definition out on its own. I guess. Like don't have this random-- don't leave random islands of facts just hanging out in the middle of your script, for the purposes of this video.

I think this is an important idea. I think you can integrate in the context of an example, though. Does that make sense? Is that making sense to other people?

Yeah, what were you going to say, Joshua?

AUDIENCE: [INAUDIBLE] I had the question in my mind that the topic of smell wasn't addressed.

PROFESSOR: Oh, right about here. Yeah, right now you set up sight and smell as two unrelated things. But I think you don't have to separate the smell out. You can say, when the bacteria break down the exterior of the cell, and the crap oozes out of it, it also is leaking out chemicals that cause rancid smells. So you don't necessarily have to differentiate that it is a separate topic.

One more thing, again this is a personal thing, but I just think the word rot is a lot more visceral and a lot more the familiar to people. So I know that you talk a lot about decomposition, but maybe if you open it with why do things rot in the first place. What would happen if things didn't. That might be a little bit more welcoming to viewers. Any final thoughts about this one?

Again, I think in general people are in really good shape with their ideas, and the concepts, and the topics of their scripts. It's really a matter of restructuring it, escaping away from the traditional five paragraph structure and really hitting into money shots right away. That's going to help your videos the most. Andrea, would you mind reading next?

AUDIENCE: Can you pass the mic over? Everyone gets to hear my nice bronchitis voice. I'm going to mime through most of this, too. Mmm, delicious. Eating foods is one of the great pleasures of life. And to enjoy foods from apples to candy bars, we rely on one part of our bodies, our teeth. Teeth are the hardest substances in our bodies-- little animation holding a tooth-- harder than our bones and even harder than iron or steel.

While we chew, our teeth actually experience forces up to 225 pounds. That's like having a mountain goat jump up and down on our teeth hundreds of times each day-- little animation of a mountain goat. So why doesn't our jar just crumble under all of those forces-- explanation graphic. Between your tooth--

PROFESSOR: Are you guys following along on your script?

AUDIENCE: Between your tooth and your jawbone there's a specialized piece of tissue called the periodontal ligament, or PDL for short. The PDL can easily absorb the normal forces that a tooth experiences while we chew, say, an apple, cushioning or protecting our jaw bone from our teeth. And inside the PDL there are all different kinds of cells. One type, called mechanoreceptors, sense forces of movement or pressure applied to the tooth.

If the force is large enough, such as biting into an apple seed, these receptors tell your brain to stop biting down-- graphic. But what if we want to force teeth in a certain direction, like with braces? As the braces pull on the tooth, the PDL is squeezed in one direction and stretched in the other, kind of like a rubber band. And here's where it gets really interesting. To make room for the PDL, cells called osteoclasts come in and dissolve a little bit of the bone in your jaw.

Another type of cell called an osteoblast comes in and then builds up the jaw bone so the PDL cushion can get back to its proper shape holding the tooth in its new position. Cut to image of the entire body with the skeleton highlighted. Your jaw isn't the only place where these osteoclasts and osteoblasts alter your bone structure. In fact, this bony remodeling process is happening throughout your body all the time.

When braces-- where braces use osteoblasts to physically move things around that are already in our bodies, what if we try to use them to replace things in our bodies, like implants? Implants are kind of like spare parts for our bodies. And MIT engineers are using the properties of osteoblasts and osteoclasts that are already in our bodies to create a chemical coating for these implants. Just like in a mouth with braces, this osteoblast coating will create natural bone to help lock the implant in place.

And this is a new section. Right now, implants are designed to have the same functionality as the body parts they are replacing. But in the future, scientists could make implants that work better than the original body parts, using bone remodeling to make us lighter, stronger, and faster. And then, at a certain point, like at the end, I'm actually wearing this weird cyber thing over my eye. That's the end.

[APPLAUSE]

PROFESSOR: So you're clocking in at about four minutes, which is good. And I thought the delivery was also a really nice, too.

AUDIENCE: I got so much more out of it than reading it, which is funny because I don't usually process things that way. Yeah, but the way that you did it was so slow and dramatic, like the way that you emphasized, it was helping me process it. It was really good.

PROFESSOR: I like the way that you emphasize the word same. Lot of people would do the same thing. They would just sort of accent the word the same. But you sort of linger on in it, it's same thing. And I actually really like that. I think it's a delivery that is not necessarily intuitive to a lot of people, but it works really nicely in that context. All right, so this has changed quite a bit from your original idea, which was the first on how braces work to more about bone remodeling and rebuilding. Does anyone have comments off the bat about the script? Yeah, Julia.

AUDIENCE: I really enjoyed it, especially at the beginning when you're talking about our teeth are stronger than steel. And you kind of demand the attention. And also when you mentioned this is where it gets interesting, so I kind of, oh, I should listen to this is the reaction. The only thing I kind of wanted to learn more about was how can you withstand the mountain goat on your teeth. That was something very-- it had a large wow factor. And to me that was like, oh, how does that actually happen. That's the only thing I wanted to know more about. But other than that I enjoyed the information. And it made a lot of sense because it wasn't very scientific, as in didn't have a lot of jargon.

AUDIENCE: I did get great feedback from Elizabeth, and [INAUDIBLE], and Jamie, and George. I think the crumbling job was Elizabeth.

PROFESSOR: I agree that you did a really nice job. You don't start with a money shot, necessarily. Like you don't start with the big picture question, but I think it works in the script because she has so many shareable facts off the beginning. And it's not a traditional five paragraph set up where she talks a lot about defining what the PDL was, which is kind of what your earlier iteration of the script did.

But I think this is a great example of not necessarily defining every single fact that you need to know about dentistry to get the point. I want you to follow along because you're setting up sort of-- it's sort of establishing characters. Like the PDL is a character in the story. And what all of these shareable facts do is that it creates the persona of the PDL as being something really strong, and something really robust.

And the fact that we're now, as humans, going to try to manipulate that, it establishes the challenge in that, which I think is a really nice thing that it does. This section is not as related to it, but I think the video is short enough to where you can include it, because it's just kind of a cool fact. Do you guys find that distracting? Or do you think it's OK to leave in there?

AUDIENCE: [INAUDIBLE].

AUDIENCE: I have a different question to go with that. So there's something that's kind of missing at the end, which is the four minute question. I don't know that this is actually a four minute one, because if you add on my comment, it might add some [SOUND] to the end. I feel like the end ends kind of abruptly for me. And so I think we get back to your question once we know where we're ending. But part of me wants-- you asked some really good questions at the very end about what if we manipulate the body to be better, stronger, lighter, all of those things.

Then it asks all these moral questions, of like, is that OK. I mean, what about the Olympics. What does that do for people who have replacement arms and now they can throw faster. There's all this world of questions that have nothing to do with the actual physicality of pulling it off, but it makes you wonder about this super human race that could be created by replacing a lot of our functional parts with things that are better, faster, stronger. All of the above.

But aside from even going there, I feel like I want you to tie it back to the apple at the beginning somehow, and teeth. So I don't know if it's possible to allude to all of the moral questions that this might bring up without having to go deeply into it, because we don't have to answer that. We just have to get people thinking. And maybe tying it, somehow, back to the teeth, somehow, because that's what we started with. I'm not sure what that direct [INAUDIBLE] is yet.

But that, to me, would feel-- so you start with-- and the apple is very central and the teeth are a very central part of the story. And then we sort of go forward. But forget why we started there at the end. And I'm wondering maybe you guys have a clever way to tie it back to that concept. But I feel a little unsatisfied leaving that apple at the front and not coming back at all.

AUDIENCE: Maybe if you added [INAUDIBLE], not just in the future can scientists do that. But they're already kind of doing that with braces. And then it goes back to the teeth.

AUDIENCE: There you go. Right. And just bring it back to the idea that they're doing all these crazy things. Think about your arms, your legs, your nose, or whatever piece of your body that you might want to trade out and upgrade. But every day people around you are doing that with their teeth and we take it for granted. Just something that-- just a quick tie back to that.

AUDIENCE: Also, and that kind of goes along with the goat thing. The fact that these implants work better make people want to replace the bones in their body. Just I want stronger arm bones, or something like that. So I think, for me, that's another question that I had, what are the implications of these implants for our society?

AUDIENCE: Are they, right now, are they prohibitively expensive. Are they-- you don't have to go totally out there. But I think you're right. And as an audience member you're wondering, oh, I love running. Maybe I could run faster if I just traded my legs for different ones. Like why couldn't I do that? Are we ten years away from that? Ten thousand years away from being able to do that?

PROFESSOR: The only thing is I'm worried that this is opening up a huge can of warms at the end of your video. So maybe a quick way to sort of gloss over it, and maybe this is a little cheap, but what I would do if I were trying to fix or rework some of the ending-- and endings are so hard to write. I don't know if you guys have experienced this before, but I've always found the ending to be the hardest part to write in the script.

But what if you went, your jaw isn't the only place where these osteoclasts and osteoblasts alter your bone structure. In fact, this bony remodeling processes happening throughout the entire body. And where braces use osteoblasts to physically move things that are already in our bodies, Engineer use the properties of these cells to replace things in our bodies. Now the idea of building ourselves as bionicle people and replacing our bones with stronger ones may sound like something out of science fiction book. But when you think about it, that's what the things that most teenagers have to use do as well. Then add an ending sentence that I can't think of right now, crunch, into your apple.

So that way you've kind of reduced--

AUDIENCE: Yeah, that's what we need. It doesn't need to be long, but it needs to tie those concepts. Yeah, I like that a lot.

PROFESSOR: And I can talk to you more about it afterwards because I can't ad lib a great script impromptu. But that way you're sort of condensing all this down, because I really love the example of the implants. But I want your focus of the video to be on braces, basically, so that way you're just sort of hinting at it and then tying it back to the beginning with the apple.

AUDIENCE: Do you-- people know that if your braces come off and you don't wear your retainers they go right back. Which I just wonder if someone who's listening to this is like, well, if you follows Andrea logic, my teeth have permanently rebuilt their cellular structure in this new space. Why would I need to do that?

PROFESSOR: That's a good point.

AUDIENCE: Like if understand what you're sharing in this from a cellular level is actually going on, I shouldn't have to wear a retainer, because my cells have-- things have ground together. And a change has actually happened in my mouth. It's not just the movement, but it's physically changing my mouth, right? So why should I have to wear a retainer if my mouth is actually changed because of my braces?

PROFESSOR: Can you just add a line in there after you say that the PDL cushion gets back into its proper shape. And then having a retainer make-- because bone remodeling and rebuilding happens constantly. I think that's the one fact that isn't in there that might be the crucial point here, that even after you get braces your osteoclasts and osteoblasts are continually remodeling your jaw. That a retainer make sure that the osteoblasts and clasts reformation is happening in the right place.

You can just throw in a quick sentence there, or a quick afterthought to that sentence. And I think that clarifies that.

AUDIENCE: I think another thing to point out is that your descriptions of the science that goes behind it don't seem very heavy. So if you wanted to add more science, maybe, I think that would be OK in this video. I wasn't distracted by the science that was there. So if necessary, to add more about the PDL, that could be done.

AUDIENCE: Well, I originally had a lot more about the PDL and I ended up cutting it out.

PROFESSOR: I mean the reason why I suggested that you take some of the stuff about the PDL out is because the video was really starting to seem more about the PDL and less about bone remodeling. So I agree that the way you've worded things, it's not too jargony. So if you wanted to add more about remodeling and rebuilding, and more about the osteoblasts and osteoclasts, maybe how that bone remodeling happens to you in your leg bones all the time when you grow. I think that's a perfectly nice place for that addition.

If you want to make room for it, I do think that-- what is it-- the mechanoreceptors part. It's a neat thing that I'm OK with having in there. But if you need to make room for more science about the osteoblasts and osteoclasts, I think it's OK to take out, too. But I would hesitate to talk more about the PDL, because then you're really getting into a different type of video. Which if that's what you want to pursue, that's totally fine. But I think to me the video is really more about bone remodeling than it is about the periodontal ligament.

So that's my only hesitation with adding more facts about the PDL. Does that sound good? All right, any last thoughts Andrea's? No. All right, Paul, do you want to go next. Or PJ. Paul is actually a PJ, as discovered last week at the end of class.

AUDIENCE: My parents told me the other day that I didn't have a first name for the first three days I was born.

AUDIENCE: Wait, so you're formally PJ?

AUDIENCE: No, I'm formally Paul. But it took them three days to [INAUDIBLE].

AUDIENCE: But everyone calls you PJ?

AUDIENCE: Uh, it's 50-50.

AUDIENCE: OK, because I was like, gosh, why didn't we know this sooner.

PROFESSOR: Yeah, this was my reaction last week, too, at the end of class. Oh yeah, the doc is gone. Siri's updating it-- or Sari. Sorry, I don't know why I keep doing that. Wait, so your parents knew that you were going to be a PJ, they just didn't--

AUDIENCE: No, no, they didn't know what my name was going to be.

PROFESSOR: Oh, ok.

AUDIENCE: It's amazing how many people do that. Did they know you were going to be a boy?

AUDIENCE: No. They did it old school. [INAUDIBLE] No, I don't. I'm the youngest [INAUDIBLE].

AUDIENCE: You run out of names.

PROFESSOR: Is it up now? Refresh. Yeah, it's still showing up blank for me. Do you mind reading it from your Google doc while Sari figures that out?

AUDIENCE: All right.

PROFESSOR: All right, laptops down. And remember, read it like you would host it.

AUDIENCE: Let's take the small foam box, Orca One, and cut a hole in it. Now, let's put this box in water and see what happens. As you can see, the box unfortunately sinks due to the weight of the added water. Now what if that box contained cargo, or oil, or even people. That would make for a very bad. Now let's take Orca Two and do the same thing. You can see that Orca Two do not sink, all though it is sitting at an angle. So why did Orca Two not sink?

As easy as it sounds, this simple demonstration is essential to the design of huge, complex ships, ships that are responsible for safely transporting 90% of all our stuff. As naval architects, how do we design ships carrying our stuff to make it into port safely and not sink? Well, let's take a look inside. Here we have Orca One and Orca To from before. Even though these boxes do not engage in international trade, they behave just as 1,000 foot steel cargo ship would.

If we remove the top the boxes and take a look inside, we see that Orca Two is divided into compartments by these walls, called transverse bulkheads, while Orca One is not. These compartments are water tight, meaning even if damage-- [INAUDIBLE]. So these compartments are water tight. Even if damage occurs in this part of the ship, water rushing in won't go into other compartments because the damage is isolated.

We refer to Orca Two as being subdivided. It is unclear when subdivision started being used in boat building, but accounts of Chinese trade ships as far back as the fifth century indicate that water would enter ships without sinking. So how exactly does this work? Well, when we divide the ship into water compartments, we are limiting the amount of water that can enter the vessel. If we divide a ship into 10 equal watertight compartments, and one compartment sprung a leak, only that compartment would take on water.

This would likely cause the ship to heel and trim, but it would not cause a complete loss of shipping cargo. And the ship would be able to hobble back into port and get repairs. But why is it so important, you might be asking. Because ships are huge and they carry a ton of stuff. A ship the size of more the four football fields can carry 715 million bananas, that is about one for every European.

Also, US takes in almost $2 trillion worth of goods every year through ships. So by subdividing ships, we're ensuring the safe delivery of our stuff and the health of international World Trade. But sadly, even with subdivision vessels still can sink. It is both expensive and impractical to design a ship that can withstand any amount of damage, so Naval architects consider the likelihood of damage in writing ship design regulations.

Also, the use of computers in naval architecture allows us to simulate a likely damage scenarios, so we can better prevent them from happening. So the next time you use your cellphone or eat a banana, remember the amount of engineering that went into safely delivering it to you.

PROFESSOR: You are good on time. It was about four minutes. It's up now? So you guys should be able to access the script now. Does anyone have thoughts about this off the bat?

AUDIENCE: PJ slash Paul, there have been moments in class when I feel like your personality has come out and I've your eyes sparkle and your voice-- I feel like there's two versions of you. There's probably serious coastguard man. And there's like [INAUDIBLE]. And I think the thing that we need to make sure we tap into is not super serious coast guard man, because when you read that just now, I was like, he's talking like this and I'm kind of board.

AUDIENCE: That was me inflecting.

PROFESSOR: Remember that you have to exaggerate in front of the camera.

AUDIENCE: You're smiling. You're dynamic. Your voice is alive. I know it's in there because I've seen it. And when we talked about giving fifth graders pornography, it was definitely there.

PROFESSOR: Wait, what?

AUDIENCE: Teaching faux pas that I had back in the day. So I know that that personality in you is totally there, regardless of the content. I feel like you need to find a zen way to channel that part of you, being whatever video content you do, because there's something innately very fascinating about this. Like content's really cool. The fact that you have this is really awesome experience that none of us have and I totally think is amazing.

But if you gave it the way that you gave it right now, you would kill us. So we've got to figure out how to get that energy in your being.

AUDIENCE: I agree with you.

AUDIENCE: What was your two line summary of the whole.

AUDIENCE: So my initial one was wasn't that great. But like it's pretty much taking something simple that people know how to do, like floating and sinking, and how there's a lot of complex things that are designed and built to carry a lot of really important things that we depend, based off very elementary principles.

PROFESSOR: I will show you your two sentence pitch.

[VIDEO PLAYBACK]

-Yes.

-It feels a lot like a document.

-What do you mean by that?

-Kind of like the image I get like kind of walking through a museum. [INAUDIBLE]

-Tell us what it is.

-So it's about subdivisions, subdivision in ships. So if you take something that floats, like a shoe box, and you put a hole it in, it'll sink. But if you divide that shoe box into watertight sections, this one compartment might not cause it to sink. And how we've advanced to a time where a ship can be extensively damaged and still stay afloat. And people won't die.

[END PLAYBACK]

AUDIENCE: Sort of like the first little section that you gave about it, it's almost like I'd like you to say that and then say hey, we can just do this experiment live right now. Why don't we just do this, right now. Let's take this-- and here's a small foam box, that I've decided to call Orca One.

AUDIENCE: Right. OK.

PROFESSOR: And I think again, I mean the showing not telling is really hard to script when you haven't actually worked with the video stuff that much. And maybe as you shoot, you'll realize, oh, I don't actually need to say, as you can see. I can just say the box sinks. And you don't need to say-- you don't put any contractions in your script, which I think is interesting. And when you deliver the lines, you're not going to say do not. You're just going to say it doesn't sink.

AUDIENCE: I say let's right there.

PROFESSOR: Oh, OK. One apostrophe.

AUDIENCE: Doing this, you're probably going to ad lib based on what happens, just like the crazy Russian hacker guy who's like, OK, that didn't [INAUDIBLE]. And that's what gives it, kind of, your personality will come out as this is happening.

AUDIENCE: So with the introduction I was-- Elizabeth and Sari's comments kind of allude to there's got to be some sort of like-- just to know what we're talking about. So I did that. And then that turned out to be bad. It was a bad introduction. So the George said, just get right into. Just get right into the box and how this-- so I'm kind of confused, though, what--

AUDIENCE: What you just said was perfect.

AUDIENCE: With?

AUDIENCE: We all know that some things sink and some things float. But it's actually not that simple. And this fairly rudimentary concept is something that naval architects use every day.

PROFESSOR: Wait, but that was the original-- do you mind if I pull up the Google doc that you sent me before?

AUDIENCE: I just felt like it started really abruptly. And you needed just a little, little, little bit.

AUDIENCE: Yeah. Even just having a mock Navy ship smashed and then watching it sink or float. Because like, what you're talking about is the grey zone in between sinking and floating. And you want us to get in that grey zone quickly with you.

PROFESSOR: Yeah, I like that you're starting a right away. Like I know that we had talked about-- Josh had mentioned that during his workshop, like to start in the action. But I think that your intro itself is visually interesting enough and topically foreign enough to most people, to where that in itself is a bit of a hook, too. And by setup, we don't mean like an entire paragraph. I think like that one sentences is fine, actually.

And when you guys shoot, I really challenge you guys not to use a script, which sounds terrifying. And often times that'll just mean, what line do I have to say here. I'm going to say this line. And you put down your script. And you deliver it ad lib. But it's going to come out so much more natural that way. When you talk in real life, you turn your head a lot, that's what makes you seem like a human, versus a humanoid. Not saying that the delivery was this time.

But there are a lot of things that people do naturally that they don't realize. And so I think it's fun to point it out to people, because when you're shooting in front of a camera, it's very hard to remember those things. It's really hard to be natural in front of a camera, basically. But like all of you guys were saying-- or some of you guys were saying, like I'm not good in front of the camera.

And I watched some of the raw footage from class. And you guys are all great. And it's technically in front of a camera, right? So you're just not looking and not aware of it. So it's somehow being able to extrapolate how you are in this classroom and carrying that over to when there's a camera right in front of your face. And I do think that it's the little things, like sometimes you tilt your head. Sometimes you look off and not directly in front of the camera.

Blinking is a big thing. I don't know if I mentioned that in earlier classes. But if you look at your footage and you're like I seem off and I don't know why. I feel like my voice is fine. I feel like my pacing is fine. Try to notice how many times you blink. A lot of times people will keep their eyes for a really long period of time. And they don't blink where it makes sense in their speech. And so they're just talking like this.

AUDIENCE: [INAUDIBLE] who does this. When he gives presentations it's totally creepy.

PROFESSOR: Yeah. Yeah so--

AUDIENCE: I'm like, dude, you have to blink.

PROFESSOR: Blinking, head tilts, looking off to the side like you would normally, those are little techniques that you can think about when you're hosting. And it's sort of counter intuitive to force yourself to be natural, but sometimes that's what you have to do.

AUDIENCE: I really recommend, if you haven't already-- I think most of you have already. But for your reflections, think about doing a vlog, because vlogging is like the basest form of video creation in that you like literally stare at your computer. And if you want to get comfortable with the idea of a camera, you can set up your camera as though you were recording yourself for your video, or something like that. And just talking to it. Because we have no expectations for your daily reflections.

You can be like, I was really scared going into class today. And then you can stop thinking. And you can look off camera. And you can say um. And we won't judge you at all. And it gives a good reference point for when you do have a polished video. It's like do I have even some of the quirks that I showed my vlog.

PROFESSOR: Yeah.

AUDIENCE: And it just gets you more-- I don't know, I was really uncomfortable in front of the camera. And I still kind of am. But vlogging and doing that process and seeing how, oh, if I make a mistake, like forgetting what I'm going to say, I can just cut that out and seal it together. It really gets you a lot more comfortable with just seeing your face on the screen, which is a really foreign experience for people.

PROFESSOR: I think the overall format of the script is pretty strong. I don't think you need to change a whole lot in terms of the format. Adding a little bit of context at the beginning would help. Stuff like this sentence, though, I don't think you would ever say these two sentences in real life, in your speech, right?

AUDIENCE: That's what I said. I think while he's doing it, he's going to be ad libbing.

PROFESSOR: And again, you don't have to script it. It's OK if you deviate from the script a little bit when you actually deliver your lines. But this sentence, that would make for very bad day, or the one that at the end of your video, you know, that's why we can't enjoy-- or decomposition is awesome. You don't necessarily have to say that out loud to people, they're just going to kind of know already.

The one comment I wanted to make was that the context-- I think introducing a little bit of context at the beginning will help with this issue, because right now without it this jump seems really huge all of the sudden. Talking about sinking and then talking about economy and money, all of the sudden. I don't know if any of you guys felt that way, too. But it seems a little like, oh man, first we were talking about cardboard boxes, now we're talking about trillions of dollars.

And I think it's a good point to make. Because you do want to take people out to the bigger context. Yeah, but it is a little abrupt. And instead of saying, but sadly even with this subdivision, I think you can set this up as a question. So we have the subdivision, why do ships still sink?

AUDIENCE: And last comment, then I have to hit the road. But if any of you didn't get feedback from me and you want it, because I have to leave a little early. Just email me. My [INAUDIBLE] address is not the one that grants me access to Google Docs. So if you want, just email me and I'll give you my gmail account so that I can actually read it. The naval, ship is such a cool thread throughout this, that I don't think you necessarily-- like if you can use the cardboard box as Navy ships, and not have them me be just abstract boxes. And if the cargo ship carrying bananas is carrying military personnel. You don't have to go outside of that genre in order for this to be a really cool video. In fact, I think it's cooler if you stick with the military theme, because that's something that's actually-- especially to middle school boys who like blowing up things-- that's even more authentically cool than bananas.

And plus, if you can even make Orca, the box, look a little bit like--

AUDIENCE: I already made them.

AUDIENCE: You made them? But even if you just [INAUDIBLE] and put some stars on them. It doesn't have to be crazy fancy to still get the idea that this is like a Navy ship, right? But I think that if that Navy theme hums throughout the whole thing, then it's like that becomes a really cool theme.

PROFESSOR: Yeah.

AUDIENCE: I gotta run. I'm gonna miss my train. But you guys are awesome. [INAUDIBLE].

PROFESSOR: Julia, do you want to say something? Thanks, Jamie.

AUDIENCE: When the football fields and bananas were introduced, that was kind of taking me out of the video and making me think of monkeys. And then at the end, also, you're mentioning cell phones and bananas, but you never mentioned cell phones before that. So I do like the idea of kind of keeping with the military theme. Also some of the-- there was a part where you had to questions-- a question at the end of the paragraph, and that was for two consecutive paragraphs.

PROFESSOR: Yeah, right here.

[INTERPOSING VOICES]

PROFESSOR: That's a good point.

AUDIENCE: Taking out of the video. But other than that, I really enjoyed the content. This is very different from the original draft, but I would very much enjoy watching this video at this point.

PROFESSOR: Yeah, originally you had talked about Archimedes' principle and buoyancy, but I think this is a lot stronger because you're actually getting into why the compartments itself.

AUDIENCE: So just like pretty much fix those questions and take out the whole merchant marine-type thing.

PROFESSOR: Yeah, I think the point that you're trying to make with those examples is basically just the sheer importance of making sure your ships stay afloat. And I think you can do that with other examples that are a little more unified to the theme. I will say that this stuff at the end, like this sentence right here, no, this portion right here. If you want to expand on that a little bit, I think it would be interesting, because it's more of like a current event engineering problem.

And again, like that makes the video more unique than a typical engineering textbook. You're talking about what are the actual problems that I myself as a naval architect am dealing with. And you can talk about the-- I don't think you need an also right here, because this is really a continuation of this explanation. Ships sink because they're expensive to design. So you have trade offs in the engineering of it. But we use computers to simulate the damage, so we know exactly how to subdivide them and what the best way to design those subdivisions are.

And then instead of this sentence, I mean this point is a little bit different than the point that you're intending, which is that very simple principles are what allow huge, seemingly complicated machines to work. So maybe you can somehow revisit that point at the end instead of this sentence. I think that would end it a lot stronger.

AUDIENCE: So was your advice generally to drop the cargo ship.

AUDIENCE: That wasn't even in there. I added all that. It was more, I'd say, the equations and stuff like that.

PROFESSOR: [INAUDIBLE] the draft that he sent us, and there was a big part about Archimedes principle and buoyancy. Which again, is super informative, very accurate. It's the type of material that they're going to learn in school. But it isn't necessarily vital to-- this is more of an engineering video than it is a physics video. And I think that's very valuable because there's actually not a lot of material on this out there. So I think it's more unique [INAUDIBLE]. I'm going to give him a chance to-- like someone who's teaching Archimedes principle may find this video really [INAUDIBLE] in class because it gives them a different context. So you took out this big chunk, but I think that you replaced it with something a lot better for the video.

AUDIENCE: I'm looking at simple demonstration is essential to the design of huge, complex ships, ships that are responsible for safely transporting 90% of all our stuff.

PROFESSOR: Wait, where is this?

AUDIENCE: It says new angle way up at the top.

AUDIENCE: Yeah.

AUDIENCE: I mean-- I kind of thought the container ships are sort of a theme in the entire thing.

PROFESSOR: Yeah, I don't think cargo-- I'm not saying get rid of the cargo stuff at all.

AUDIENCE: OK, because I mean, that's my bread and butter is merchant ships and not-- because I'm not really in the Navy or anything.

AUDIENCE: And then the tie-in with the cell phone thing is that safely transporting 90% of all of our stuff. If you take like a zoom in on a cell and flip it over and it says "Made in China" that's sort of like how did this get from China into my hand.

PROFESSOR: I don't think that you should get rid of the cargo stuff completely. Sorry if it sounds like we're having competing opinions. I think the thing that throws us off is the connections to the examples you make aren't necessarily immediate. So I hear four football fields can carry 750 million bananas. Wait, why is he talking about bananas all of the sudden.

AUDIENCE: I was just trying to say like how-- yeah, I got it. I'll try to revisit that.

PROFESSOR: And maybe it's as simple as adding a single sentence right here, about they carry a ton of stuff, a lot of products that we have to import from other places. Things like bananas. And a ship the size of this can carry 750 million bananas. So it just sets up the example a little bit more clearly, if that makes sense. Any other thoughts for PJ?

So I think that we're at a good stopping point here. I don't want to hold you guys over today. So we have Kenneth and Joshua left, right? So tomorrow we will finish up the table reads with their stuff. And then I'm going to give my final talk on post production. So this is everything from editing, to music, to thinking about what you do with the footage that you take. We'll also tell you tomorrow what groups you're going to film in. Was anyone planning on filming stuff tonight? No? That's fine. Just use tonight to rework your scripts.

As far as deliverables and assignments, I think really reworking your scripts tonight and tomorrow should be the main focus. So I'm not going to have anything particularly due. How about all that footage that you shot last week, I'll let you guys tinker around with the editing of that after I give my editing lecture. Does that makes sense to people? So for tonight, rework your scripts. And for people who haven't, I mean Kenneth and Joshua, if you want to update stuff based off of the things we talked about today, that's fine. And you can just send Sari an update. Make sure to do your daily blogs, though. That'll be really helpful.

And then just come to class ready tomorrow to finish up the two reads and then do some editing. Does that sound good? The first cut of your video is going to be due this Friday. Do you think that is feasible and reasonable? So this would be the first draft of your video, basically. Like you'd have to film everything for it this week.

AUDIENCE: Is there a day where we're submitting the shots--

PROFESSOR: The shot list? Yeah. I would like to see that by Wednesday, if possible. But that's really more for your benefit over mine.

AUDIENCE: And Wednesday, Thursday and Friday will be in class workdays.

PROFESSOR: Friday's the screening. What I could do-- so this weekend is a three day weekend. We don't have class next Monday. If it would help people to use that weekend to film more, I could have the rough cuts due-- or we could screen the rough cuts on Tuesday instead of Friday. Would that help people?

AUDIENCE: My question is, I guess, what are like the things you generally would do between a rough cut and a final cut that would like--

PROFESSOR: So, I will talk a little bit about that tomorrow. I'll actually show you the rough cuts of our old videos. But a rough cut takes all the footage that you've shot and puts it together into a draft that doesn't have music, and may be missing some scenes, or may require reshooots of scenes. So usually what happens between a rough cut and a final cut, in addition to music and maybe better editing, is you almost always end up reshooting something because it doesn't look that good in the context of all your other footage. So the only reason why I had a rough cut due so early is because I wanted to leave you guys enough time to reshoot if you needed to.

But if it's going to be too much work to get the rough in place in the first place, I'd rather you really try to get as good of a rough cut as you can than try to rush one together.

DAVID: [INAUDIBLE].

PROFESSOR: Not necessarily. So if it-- are we on consensus? You guys want rough cut due on Tuesday instead of Friday? Because that totally works for me. Basically, after tomorrow, and aside from the screening of the rough cut, every other day of class is work time for the projects.

AUDIENCE: And that next week it's Tuesday, Wednesday, or Tuesday, Wednesday, Thursday? Because doesn't the class end--

PROFESSOR: The class ends-- so today is the 12th. Yeah, so the class ends that Thursday. It was sort of optimizing like leaving enough time to get the rough cut, but also leaving enough time to give you time for reshoots. Our screening is the evening of the 22nd. Yeah.

AUDIENCE: But then what happens, though, the last week [INAUDIBLE].

PROFESSOR: So the last week of IEP we'll pick scripts to produce for season three of Science Out Loud. And if you guys are interested and if it fits into the casting, then we would produce your video, basically. I'm I'm sorry to the SUTD guys, you have to go back. Yeah. You could stay another week. So that's why we end so early, is because you guys have to go back and then we're producing season three in parallel.

So that's all I have. I'll make the rough cut due Tuesday. If you finish stuff before Tuesday and want me to look over it, I'm happy to do so. Because I know that the turnaround is insanely quick for this. And I know that we're cramming a ton of stuff into these three weeks.

AUDIENCE: Do we need to meet up with our groups to film over the weekend, then?

PROFESSOR: No, and tomorrow we were going to hand out assignments for who your groups would be. If you can shoot stuff on your own, like b-roll, feel free to do that. Like you don't have to just use class time to work. If it's more convenient for you to just catch some stuff on your own, do a tripod selfie type shot, go ahead and do that. But no, you don't have to just only work in class.

Everyone has their own camera and their own equipment, right? OK, yeah. So tomorrow we'll do editing, finish the table reads. You'll have the rest of the week to work. We will screen rough cuts on Tuesday the 20th, then. But that means that you won't get feedback from your peers until Tuesday the 20th. That OK? So basically your rough cuts are going to be so good that you're not going to have to reshoot anything. No, I'm just kidding. It'll be fine.

AUDIENCE: How good does our video need to be in terms of the visuals.

PROFESSOR: I mean I totally understand that you have a week to do this, basically. So if you can't, you know, do a full-fledged animation, you can't fully realize those things, I completely understand that. This is going to sound stupid, but just try your best. Because that's why I have-- creating the rubric for this class was really hard, actually, because I knew that all these constraints were here. And so I couldn't raw scale points, like 10 points it's lit correctly, because that's just unreasonable.

But what I really want is the intent to be there, the thoughtfulness, the understanding and self awareness of maybe what's lacking, what you'd like to develop further. If you can't-- if a film location falls through at the last minute and you can't film there, stuff happens. I totally understand. If you can just maybe write what you wanted to do instead, that's totally fine. But--

AUDIENCE: Same thing with animations. I'm sure some of you have very-- especially with the fractals. Zooming in on fractals, that's a difficult animation to accomplish, especially if you haven't done animation before. Think of using still images, because it's really easy to overlay a still image, or even something you draw yourself. And it would just kind of like-- what Science Out Loud videos do. As opposed to making this really complex, like multiple moving pieces. The more moving pieces you have, the harder it's going to be to do faster.

PROFESSOR: We will be around during class every day. So if people want specific help, like Sari's done some animations herself, too. So we can help you with that stuff if you have specific questions. But shoot for the best you can. Definitely don't be like, well, I'm going to leave this out because I'm just going to justify to Elizabeth later that I couldn't get it. Try to do the best you can.

But I understand the constraints that you're working under for sure. So don't stress out about that.

AUDIENCE: And feel free to email us, because some things like after Elizabeth's editing lecture, there might be something like, you're in the editing program, and it might take you three or four hours to figure out where this tool is and how to do this one thing. Like my audio disappeared, what? But if you bring it to one of us, chances are we've encountered it before it and can fix it in a couple minutes, hopefully.

PROFESSOR: Sari's probably a lot better at that than I am, just to be honest. Does that sound OK to everyone? I do apologize for the quick turnaround. I know it's a lot to cram into three weeks. So I understand the limitations that we're working with. All right, well I'll stick around after class if people want to talk about their scripts more, or have other questions. But you guys are free to go. I'll see you tomorrow.