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**ELIZABETH**

**CHOE:**

So today is the first screening of your rough cuts. And the way this will work is I will show one of the videos, and we'll all watch it. You guys can take notes on it while you watch. And after each screening we will give general high-level feedback to the creator. And that's what-- we'll just go through the whole class and do that for the first half.

Now for the second half, there are a couple options that we could proceed. The first being what I usually do with Science Out Loud, which is to basically do Google Docs for detailed comments. And this is really useful because it's sort of like a check box when you're going back through and looking at feedback from another person when you edit.

So this was for George's farts video. And I made some notes about where we should add some animations, where we should add overlays. So this is one option that we could do. Basically break you guys up to where you will end up commenting on at least two people's videos, and we would know who you would be assigned to.

The other option is that we could just go ahead and pair you guys up or group you guys up, and instead of doing the Google Docs feedback, you can just talk to each other one on one. Do you people have preferences on how we do this?

**AUDIENCE:**

Google Docs.

**ELIZABETH**

**CHOE:**

Google Docs. Anyone else? All right. So we'll do Google Docs. And I will give you the details on how that's going to happen during the second half of class. Sounds good?

So, as it was for the table reads-- remember that repetitive comments are OK. It's OK if you feel the same sort of feedback that another person has already said because it'll draw attention to the creator and what they need to work on. Also remember that at the end of the day this is your video, so the feedback is for you to take or leave-- hey, Nathan.

And this is probably going to be the most valuable class time the whole month because this is where you're really going to have concrete advice on implementing the stuff that we've talked

about so far. So really take this as an opportunity to give as constructive and meaningful feedback as possible. All right?

Does anyone have questions or comments before we start watching? No? Are you excited? OK.

**AUDIENCE:** We need popcorn.

**ELIZABETH**  
**CHOE:** I thought about making pop-- but then I thought that if people were taking notes on their computers and they had, like, butter on their fingers. We'll pop for another screening.

**AUDIENCE:** --later for a snack.

**ELIZABETH**  
**CHOE:** Yeah.

**AUDIENCE:** That's fine. Maybe we should close the big--

**ELIZABETH**  
**CHOE:** Yeah, I'll close the door. Does anyone want to go first? No? Does that show up on screen OK if I turn these lights off? OK.

OK, well, then we will just go down the line. How about that? So lucky you, Nathan. Do you want to say anything before we screen, or do you want to just go ahead and watch and then talk about your process?

**AUDIENCE:** I'm going to be honest, and I made a pretty bad mistake in putting off filming until yesterday. And so I only got to get in the editing this morning. And it really shows.

**ELIZABETH**  
**CHOE:** Well, let's see what you have. And there is time, that's what tomorrow's for.

**AUDIENCE:** I couldn't get the animations to work.

**ELIZABETH**  
**CHOE:** OK. And do keep in mind that all day tomorrow and all day Thursday is open for you to incorporate feedback. After today's class ends, we're not meeting again until the screening on Thursday at 6:30. So as long as we get videos in by, like-- 6:00 PM's the latest. Hopefully you're not working up until 6:00 PM. You have the rest of the day to work.

**PROFESSOR:** But if you need our help, then e-mail us. And we can meet up if you want.

**ELIZABETH**

Yes. We will be in the classroom tomorrow and Thursday if people need help.

**CHOE:**

[VIDEO PLAYBACK]

-Why does your-- why does your fridge start to smell?

[END PLAYBACK]

**ELIZABETH**

The sound sounds good.

**CHOE:**

[VIDEO PLAYBACK]

-Why does your fridge start to smell? And where does that icky black liquid come from? Wouldn't life just be easier if things didn't rot, if things lasted forever? Well, maybe, but probably not.

According to the USDA, the average American household wastes 25% of its food. And a lot of restaurants are even worse.

So if we didn't have decomposition, what would happen to the food we throw away? Food in landfills normally gets dealt with by bacteria, fungi, and protists that allow the nutrients in food to return to the soil and, eventually, other living things. These decomposers also break down other dead stuff, like trees. In fact, they're pretty much the only thing that can eat wood.

So in a world without rot, while your home may not have to worry about being eaten by termites, who rely on protists in their stomach, pretty soon forests and landfills would be flooded with a lot of dead stuff.

So how do we avoid this problem? Well, basically, in your fridge, on a forest floor, in a dumpster, almost anywhere, there are fungi, bacteria, and protists that live entirely by eating dead stuff.

These dead things can be more or less divided into three categories. Carbohydrates-- sugar and starches. Lipids-- think fats. And proteins, like meats.

All of these are chemically different, so they each get broken down by different enzymes in different ways before being absorbed by decomposers. For example, proteases break down

proteins into amino acids, the cells building blocks. Lipids rely on lipases. And carbohydrates on things like amylase and cellulases.

So how does a perfectly nice broccoli floret start giving off this foul black liquid? Fruits and vegetables are almost entirely made of water. So on the most basic level, you could say their cells are like extremely complex water balloons.

The exterior-- a cell wall-- is made of cellulose, a complex carbohydrate that gets broken down by enzymes into small sugars the cell can get energy from. When bacteria or fungi uses cellulase to eat the exterior of a cell, it's like if I were to pop the balloon. That's the muck you see in your fridge. And that's how you get that icky black liquid.

What about that stink? For fruits and vegetables a lot of time the smell happens after the icky black liquid forms. Other bacteria that weren't involved in the initial colonization move in and start to stink everything up.

Meat gets smelly when lipases break down fat in the meat into glycerol and fatty acids-- two energy sources. And fatty acids are kind of gross.

And so while your food rotting may smell absolutely terrible, because of it the environment's able to recycle crucial nutrients it needs. And, well, that's why we have all this.

[END PLAYBACK]

**PROFESSOR:** Are you kidding? That was awesome.

**ELIZABETH** All right. General feedback?

**CHOE:**

**PROFESSOR:** Well, I want to hear what you think before we give you feedback.

**ELIZABETH** Like what are the things that you like about what you did, and what are the things that you

**CHOE:** already know you want to change or add?

**AUDIENCE:** The audio.

**ELIZABETH** The audio.

**CHOE:**

**AUDIENCE:** The lack of animation. The main things.

**ELIZABETH**  
**CHOE:** What was the hardest part about making this video?

**AUDIENCE:** Actually going and doing the shooting. I kind of put that off as long as I really feasibly could have because I really didn't want to do it.

**ELIZABETH**  
**CHOE:** Was it as painful as you thought it would be once you started?

**AUDIENCE:** Yeah.

**ELIZABETH**  
**CHOE:** Yeah. Well, I will say that the script is very, very tight in this video. And it has come a very long way from your initial brainstorming. And if you come to the screening, you'll get to actually see all the pictures. So, just a plug to come to the screening if you want to.

But the script is super tight. And I know that you spent a long time honing that, and I think that really paid off. It's two thirty-three, which is a great time. So I think that as far as the content goes it's really strong, and I can tell that you spent a lot of time developing that.

Does anyone want to add some more feedback? I mean, I can talk to-- yes, Yuliya.

**AUDIENCE:** I like the transitions. There weren't too many of them, but it was nice to see a change of background and scene.

**ELIZABETH**  
**CHOE:** Yeah. And clean cuts. No funky swirls, no fades. It's nice.

**AUDIENCE:** Yeah, definitely. I was going to say something else, but I forgot.

**ELIZABETH**  
**CHOE:** That's OK. We can come back if you remember. Anyone else? Yes, Andrea. Sorry.

**AUDIENCE:** I really like the pacing of it. It's a little rushed in a couple of places, but that's-- that happens. But I like the pacing in general. And I also like the water balloon example and the different camera angles, and I thought it was just really artistically very well done, very well composed.

**ELIZABETH**  
**CHOE:** What was so terrible about actually shooting? Was it being on camera?

**AUDIENCE:** Yeah.

**ELIZABETH** Yeah.

**CHOE:**

**AUDIENCE:** And also, each one took a lot of takes.

**ELIZABETH** Yeah. I will say-- because I know that a lot of you expressed sort of concern and hesitation about being on camera, and I feel like a lot of this class has been like actually no, you're really great on camera. The opening shot is delivered really, really well. And there are spots where, like Andrea said, you're rushing your words a little bit. And I'm sure you'll see it when you go back through.

And whenever you guys do your Google Doc comments, point out spaces where maybe his delivery changes. It is a little inconsistent between scenes, but there are some scenes where it is delivered so perfectly and so clearly, and you seem really, really comfortable on screen. Yeah.

**AUDIENCE:** I will say-- did you shoot it by yourself?

**AUDIENCE:** I did shoot it mostly by myself, since I put it off.

**AUDIENCE:** Because I found that it was a lot easier to have someone shoot it than, like, when we were doing those first blogs and stuff at the beginning, I thought that was a lot harder doing it by myself than having someone there. I felt less comfortable being alone than with someone. Which is kind of-- I thought it'd be the other way around when I first started the project.

Other than that, like, how I think he used-- went to Star Market. So representing a local grocer too.

**AUDIENCE:** Yeah, yeah. I agree. I like the part where he talked about the smell. You know?

**ELIZABETH** Yeah.

**CHOE:**

**AUDIENCE:** And I like the cut on the fridge.

**AUDIENCE:** The visual, yeah.

**ELIZABETH** What do you guys think about the visuals in general? Because it's always hard to do a  
**CHOE:** chemistry or biology video because the visualizations are always somewhat impossible to do.  
Yeah, Yuliya.

**AUDIENCE:** I think it would be nice to show some of the scientific vocabulary, so we can see it and not just  
hear it.

**ELIZABETH** Yeah, like a label on top or something.  
**CHOE:**

**AUDIENCE:** And then for the backgrounds, like, the plants backgrounds worked really well and, like, the  
fridge and all that. But there was a part where there was just a random penguin or random  
pictures on the wall that maybe could be overlaid with animation.

[VIDEO PLAYBACK]

[END PLAYBACK]

**ELIZABETH** Like this shot. I like that you have the kitchen space as sort of your home base. Because your  
**CHOE:** centered on the question of why things rot in your fridge, and that's what allows you to explore  
decomposition at greater length. But this is doing that whole thing that a lot of web videos do,  
where you center the subject.

And I was talking to Chris [INAUDIBLE] about why it's so common that SciShow does it and  
Vsauce does it. And it sort of gives off an air of it being not as formal. But it's also a little bit  
comical, too. And I think that if you just-- even if you zoomed in just a little bit and got rid of,  
like, this spray thing on the side and the cooking things on that side, it might help with this one.  
Also remember to tuck your mic in under your shirt if you can.

Let's see. But you were talking about this penguin here, right? Yeah, so this-- I mean, you  
could play around with keeping this footage, if you like, and just zoom in a little bit. See if you  
can digitally zoom in on the editing software. If the resolution kind of goes kaput, you may  
have to re-film that part.

But again, I think Yuliya is right in that be careful about having visual distractors when you  
don't really need them there. I do agree with-- was it Andrea? Who said something about the  
pacing? Yeah, I think the pacing of your cuts are pretty good. Like, nothing lasts a little too

long, nothing's too short.

If you have B-roll, it might give you a little bit of breathing room in between shots where you're talking really fast and you have a lot of content. But yeah, like stuff like this-- I don't remember what you're talking about here.

[VIDEO PLAYBACK]

--while your home may not have to worry about being eaten by--

[END PLAYBACK]

**ELIZABETH** Yeah, so--

**CHOE:**

**AUDIENCE:** Comical note on that, I filmed in front of someone's house, and they actually came out and asked me to stop. And so I kind of--

**ELIZABETH** Oh, no.

**CHOE:**

**AUDIENCE:** --gave up on actually filming at home.

**ELIZABETH** Filming in front of a house. I mean, is this in your dorm room?

**CHOE:**

**AUDIENCE:** Yeah.

**ELIZABETH** OK.

**CHOE:**

**AUDIENCE:** That's what my backup idea was, since it's my home.

**ELIZABETH** Yeah, actually, I think that it works fine. And I would say for this one, do a wider shot for this one because it doesn't quite establish that you're in your own place. Like, if you can see you sitting on your actual bed, that might help a little bit more.

So again, it's not a matter of using wide or close-up shots for the sake of using them on principle, but like what the background actually reveals and sets for the audience.

**AUDIENCE:** I was wondering, can you go back a little bit? Because there was-- I was wondering what your

vision was for this.

**AUDIENCE:** Right there. Yes. I'm still missing stock footage.

**AUDIENCE:** OK.

**ELIZABETH** Oh, so this is like a placeholder for the rough cut. I figured that was the case.

**CHOE:**

**AUDIENCE:** --what you were planning to do here. I was like, I'm not sure what I'm looking at. OK.

**ELIZABETH** Yeah.

**CHOE:**

Oh, the dumpster shot. Yeah, I wanted to say something about this, too. If this is something that you decide to re-shoot, I would also maybe scoot back a little bit as well. Because it's hard to tell that it's really a dumpster until you actually say it. Where was this?

**AUDIENCE:** It's down at the loading docks.

**ELIZABETH** Oh, OK.

**CHOE:**

**AUDIENCE:** I had a lot of trouble with the dumpsters I'd planned on going to. By Walker is a bit of a wind tunnel. And the Stata Center, out behind W20 was really noisy.

**ELIZABETH** Which one's W20?

**CHOE:**

**AUDIENCE:** The student center.

**ELIZABETH** Oh, OK. I mean, there is an optimal dumps-- if you guys are ever in need of an optimal  
**CHOE:** dumpster to fill up, let me tell you. Right behind the MIT Museum-- by D-Lab actually-- there are some prime dumpster spots for shooting. And that's where we shot George's farts one, too. So if you need to.

But in this one, I mean, I think it's really matter of the camera angle. Did you shoot this on a tripod?

**AUDIENCE:** Yeah.

**ELIZABETH** OK. Were you limited by how far you could let your mic cable go?

**CHOE:**

**AUDIENCE:** Yeah.

**ELIZABETH** OK. Yeah, maybe think about this one as a potential one to re-shoot. Because I think the

**CHOE:** visual background makes a lot of sense and is a really good transition-- it's a really good change from the kitchen setting. So I would really love to see that it's actually a dumpster.

**AUDIENCE:** And if you are refilming-- only if you are refilming-- something that I noticed is that when you're talking you bounce a little. So just-- like in some of the film when your up close we see that. And it's just maybe something that if you can be aware of that while you're filming. It was just one moment, I can't remember exactly where it was. Where is it?

When you were talking, a little towards the end. And I noticed it a little more, this sort of gentle bounce while you talk. That you don't do all the time.

[VIDEO PLAYBACK]

[END PLAYBACK]

**ELIZABETH** Maybe we can find the--

**CHOE:**

**AUDIENCE:** I'll look at it more carefully, because there was a point where I was like--

**AUDIENCE:** I think it was the end of [INAUDIBLE].

**AUDIENCE:** Do you know what I'm talking about? OK.

**ELIZABETH** Maybe we can note that in the Google Docs, whoever's commenting on Nathan's. And again, stuff like this, I think it's great, but maybe just like crop this framing a little bit more so it's a little more rule of thirds. Because the rule of thirds works really well for this shot.

**CHOE:**

And [INAUDIBLE] pointed out a really good tip. When you do rule of thirds, use the eyes as sort of the point instead of, like, your face. Because there's just a little too much room on the top and right-hand side of this framing.

How did you film the opening? Like, were you by yourself? Was it the first thing that you filmed?

**AUDIENCE:** I was by myself, and that was the-- no, it wasn't. It was like second place I went.

**ELIZABETH**  
**CHOE:** OK. Because whatever conditions you were filming under for this scene, I think you should really try to remember what it was that you did. Because this opening--

[VIDEO PLAYBACK]

--start to smell? And where does that icky black liquid come from? Wouldn't life just be easier if things didn't rot?

[END PLAYBACK]

**ELIZABETH**  
**CHOE:** Like that question is posed actually quite naturally. I think the tendency for a lot of people when they're starting would be to sort of overly cheese that question up. And that's sort of what happened in early readings that a lot of you guys did. But this one just sounds very natural, like how you would actually pose that question in real life.

So whatever conditions that you were under filming this one, really try to apply that to whatever you re-shoot. Were you there with him for this one by chance? Hmm. Maybe it's an energy level thing. Like--

**AUDIENCE:** I think it was I was inside.

**ELIZABETH**  
**CHOE:** You were inside, so you weren't as nervous about filming outside. Yeah, actually, that does a lot to people's deliveries. But yeah, just something to keep in mind. Does anyone have final thoughts before we move on to the next video?

Do you know who we had paired up to comment on Nathan's?

**PROFESSOR:** Andrea and Kenneth.

**ELIZABETH**  
**CHOE:** OK. So basically, for the rough cut thing, we will pair you up with two people. One of those people is going to be the person who helped film your video, and the other person is just someone completely new. So Kenneth and Andrea are commenting on Nathan's. Andrea, do you want to say anything about yours before we screen?

**AUDIENCE:** There are lots of placeholders for stuff, like similar. It's really boring.

**ELIZABETH**

We will be the judge of that. All right. This is Andrea's.

**CHOE:**

[VIDEO PLAYBACK]

-Eating is one of the great pleasures and necessities of life. And to enjoy everything from energy bars to apples, we rely on one part of our bodies to do an important job-- our teeth.

Teeth are the hardest substances in our bodies. They're harder than our bones, and they're even harder than iron or steel. While we chew our teeth experience forces of up to 225 pounds. Hmm.

So why doesn't our jaw just crumble under all of those forces? Between your tooth and your jawbone, there is 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 when we chew, say, an apple, cushioning or protecting our jawbone from our teeth. And inside the PDL there are all kinds of cells. One type, called mechanoreceptors, sense forces of movement or pressure applied to the tooth.

Teeth sound like they're already perfectly designed. But sometimes we really need to force them in a certain direction. Like with braces. As the braces slowly force the teeth to move, the PDL gets squeezed in one direction and stretched in the other, kind of like a rubber band.

Here's where it gets interesting. To make room, the mechanoreceptors in the PDL trigger cells called osteoclasts that actually come in and dissolve part of your jaw to make extra room. The mechanoreceptors also trigger another kind of cell, called an osteoblast, which comes in and builds up part of the jawbone. This allows the PDL to get back into its regular cushioning shape, thus holding the tooth securely in position.

So if braces use osteoblasts to physically reposition teeth for cosmetic reasons, what if we want to use them to replace things in our bodies? Dental implants replace teeth that are damaged or missing to restore chewing function.

And MIT engineers are using the properties of osteoblasts and osteoclasts that are already in our bodies to create a chemical coding for these implants. Just like in a mouth with braces, this

coding helps create natural bone to help lock the implant into place.

Your jaw isn't the only place where these osteoblasts and osteoclasts are altering your bone structure. In fact, this bony remodeling process is happening throughout your entire body. And these implants aren't just limited to teeth. Doctors can replace knees, hips, and even spinal disks.

Right now, these implants are designed to have the exact same functionality as the parts that they're replacing. But in the future, scientists may even use implants to improve our brains. Just like with braces, we could modify our bodies to be more perfect. Once we've tasted the forbidden fruit of perfection, will we still be human?

[END PLAYBACK]

**ELIZABETH** All right. So, Andrea, why do you think your video is boring?

**CHOE:**

**AUDIENCE:** It's really dense with information. It also doesn't have very good settings in it, except for the office. And even in the office, the lighting-- there was just nothing I could do about the lighting.

**ELIZABETH** I think that one of the quickest fixes that you can do, and one that'll make the biggest difference, is that it's very slow moving. And I think it's because you are so conscious of fighting the tendency that most people have to deliver their lines too quickly that you're talking a lot slower than you usually do in real life, in a way that is clearly not you. And you could actually just play with speeding up how fast the video plays.

We did that for one of the people who did Science Out Loud, actually. The same thing happened to her. As soon as the camera started rolling, she would talk just way slower than she normally does, and it just felt really unnaturally paced. And once we bumped up the speed to, like, 115%, it read a lot more normally and flowed a lot better.

And I think in general, look at where you're cutting into new spaces. I think that you erred on the right side for your rough cut, which is to leave a little bit too much room at the beginning of each of your clips. But when you go in, really, you can shave off like a good second, half a second off of some of the clips that you're cutting, too. Instead of having a beat and then your action starting, just go straight into the action already happening. So I think that happen a couple times.

[SKIPPING THROUGH VIDEO]

For this opening shot I mean, just start it like half a beat before you say, eating is one of life's great necessities. I think you take these nice long pauses in between some of your thoughts to really let the viewer gather or comprehend what you've said. But some of the gaps are just really long.

So you can either cut those out and maybe cut to a close up of you talking, or cut to B-roll in those cases. But I think that'll help a lot with just the sense of the movement of the overall video. Did anyone have other comments? Yeah, Kenneth.

**AUDIENCE:** I remember in there you were a little scared to start filming. But I thought you felt pretty natural in front of us, and it didn't feel you were nervous or anything. Apart from the slow speed, I think actually you look quite natural.

**AUDIENCE:** I was going to say that too.

**ELIZABETH** Yeah, David?

**CHOE:**

**AUDIENCE:** I was thinking that one way to cut that down is when you look at a clip or you look at a song, so you cut right before the song. And then it's like a straight line.

**ELIZABETH** Wait, sorry. I didn't hear that.

**CHOE:**

**AUDIENCE:** Plus, when you put the video as well as the sound.

**ELIZABETH** The sound?

**CHOE:**

**AUDIENCE:** The sound wave.

**ELIZABETH** Oh, yeah. The sound wave. Yeah, the sound wave. That's a very good tip.

**CHOE:**

**AUDIENCE:** Then I was thinking that I like the transitions. I find the transition very meaningful, and they help you continue the story.

**ELIZABETH CHOE:** What were you having planned on this big section here? Was it supposed to be an animated section?

**AUDIENCE:** I've been looking for images.

**FEMALE IN VIDEO:** This is when we chew, say, an apple.

**AUDIENCE:** I think one part that will help that felt really slow-- but maybe you put in there for a visual pause-- is the middle section when you were talking about putting on braces, and you did the whole sequence of you like putting on gloves like an orthodontist would. And it's good for comedic effect, but it kind of interrupted the video for me. And I think this is an instance of killing your darlings, where I don't know how long it took to film this.

**AUDIENCE:** So should cut out everything in the office?

**AUDIENCE:** No, I like-- like when we all laughed, that was a great reveal. And I think you can almost cut from this shot to the one with you with braces-- like when you say, with braces. Because you don't even say anything over this part. It was just kind of silent.

**AUDIENCE:** I think she could keep it if she tightened it to like one second. We can get enough out of you just putting on-- starting to put on the glove and then transitioning to the next one. I think it's fun. I think that I agree with you that it's too long, but I think you could tighten it, really, and it would still get the impact.

**ELIZABETH CHOE:** Comedy is really hard to pull off, like George was saying in the earlier workshop. But a lot of comedy that works in these types of videos, and that you'll see in SciShow or Veritasium or pretty much any popular YouTube channel, is that they're very quick. They're quick insertions of someone making a face or sort of an unexpected B-roll shot.

And I think that I agree with Jaime. And you can play around with this. Play around with taking this part out completely, play around with shortening it. But it has a funnier effect when it's a lot shorter, because one, it doesn't interrupt the flow of the video as much. And also just gives a chance for the viewer to be like, wait, what just actually happened? It keeps them on their toes a little bit more.

**AUDIENCE:** For that, I really like that part. The only thing I would suggest is that at the end when you reveal the braces to kind of show them for half a second longer so the viewers can notice that

it's braces.

**AUDIENCE:** Yeah, I think the braces shot was actually a little too short.

**ELIZABETH** And like right here--

**CHOE:**

**AUDIENCE:** How did you do that? The braces shot? Did they just put pretend braces on you for a minute?

**ELIZABETH** It was like a denture.

**CHOE:**

**AUDIENCE:** Oh, OK.

**ELIZABETH** And this is an example of shaving off some of the beginnings of a clip. That is exactly where it

**CHOE:** starts, it's a good half a second. Which doesn't seem like much, but when you're watching a video it seems like an eternity-- half second that you can just take out completely.

**AUDIENCE:** So how close to when the sound starts? Should you do it right there?

**ELIZABETH** I don't have a best practice of do it like 0.2 seconds before it starts. But I think that, in general,

**CHOE:** having it as close to when you start talking is best. Because otherwise, it reads a little bit newscastery. Because you'll notice that on a Dateline special, the host will go, and I'll start talking. And that's what gives it the newscastery feel, versus a lot of YouTube channels and SciShow, they just go immediately as close to the soundwave starting as possible.

**AUDIENCE:** Bring us two frames back.

**ELIZABETH** Two frames back?

**CHOE:**

**AUDIENCE:** I usually go like two and three frames back. And then if that doesn't sound good, then adjust it from there.

**ELIZABETH** And who's doing Google Docs for Andrea?

**CHOE:**

**AUDIENCE:** Nathan and Yuliya.

**ELIZABETH** Nathan and Yuliya. Any last comments for Andrea? I do want to emphasize-- and for the

**CHOE:** people who are just here for today-- it is a crazy amount of work that they're doing in such a small amount of time. We basically spent the first week not really touching cameras whatsoever. I mean, they were doing assignments them, but pre-production takes up so much time.

So I think that the scripts that you guys have are really, really tight and really good. And I know that you're working under limited time and very, very limited resources. Like you were saying, you didn't have lights. And that makes a huge difference in what your final product looks like, so

I'm really happy to see that people can identify-- this is what I think it's off about this video, I think this is what it would have improved. That's the stuff that really is important. And I think the scripts, and you guys really constructing compelling narratives around the topics that you were talking about, they've come such a long way from the first day. So I'm really happy to see that.

**AUDIENCE:** It's ready, but I think you have to refresh the page.

**ELIZABETH** Oh, OK. This one? All right. Any words before we screen?

**CHOE:**

**AUDIENCE:** No disclaimers.

**AUDIENCE:** Yeah, it's good. It's fine, I hope. I just didn't like how I cut it, but I think it still is quite well. I haven't finished the animations, but yeah, some of it's in.

[VIDEO PLAYBACK]

-Imagine holding a party, and then sending out invitations after the party. Wait a minute-- that doesn't make any sense. Are my friends are going to be able to time travel back just so it's at my party? In 2009, Stephen Hawking actually conducted such an experiment to disprove time travel. What exactly is time travel, and how does it work?

It actually has a lot to do with speed. A lot of what we know about time traveling actually comes from Einstein's theory of special and general relativity. We are actually time traveling right now, but not in the manner that sci-fi phi films have depicted them. We are, in fact, time traveling at a pace of one hour per hour. In other words, every hour I experience, the world around me experiences a singular hour too.

Now, it may sound simple and trivial, but stay with me. This is where it gets interesting. Now, the last part of Einstein's theory of special relativity is actually a phenomenon known as time dilation. Effectively, this means that the faster you travel, the slower time passes around you. It potentially means that I could travel at maybe more than one hour per hour.

This phenomenon, however, is only noticeable at really, really high speeds-- speeds near the speed of light. This rocket here, not even close. Say I do a spaceship now that travels at 90% the speed of light. And I have a pair newborn twins. I bring one of them with me on this journey for 10 years.

When I return, one of them will have turned 23 years old while the one with me will have only turned 10 years old. While we have experienced 10 years on a spaceship, 23 years have actually passed on Earth. This amount of time actually increases exponentially as you get closer to the speed of light.

So we could potentially travel forward in time. But what about backwards in time? That's a whole other issue. Now, remember our previous graph. The time that passed on Earth was asymptotic to the speed of light. Looks like we're seeing maybe the secret to time travel lies on the other side of the line. In other words, we may have to travel faster than the speed of light just to be able to travel back in time.

Now, when you do travel near the speed of light, something called relativistic mass comes into play. In other words, as your speed goes up, your mass increases. As your mass increases, you require more energy to move the same object. This might mean that you need an infinite amount of energy just to move an object beyond the speed of light. The more energy you put into an object, the more likely you are to increase its mass rather than to increase its speed. Therefore, to get an object past the speed of light, quite impossible at this point in time.

So why are we still so obsessed with time travel? Time travel does come with its own set of problems. Take for example my party before. If I were to send out my invitations after the party, my friends would have come back in time to attend it. And if they did come back in time to attend it, I wouldn't have sent out my invitations. And if I didn't send out my invitations, they wouldn't be at my party. It doesn't make any sense at all that they are both at my party and not at my party.

This is what we call the grandfather paradox. It's one of three time travel problems that we

currently have. So it seems that we may not be able to time travel yet, based on what physics tells us, at least. For now, if you are planning a party, be sure to send out the invites. Your friends can't time travel yet.

[END PLAYBACK]

[APPLAUSE]

**ELIZABETH** All right, any comments from Kenneth first?

**CHOE:**

**AUDIENCE:** OK, I didn't know that the warp stabilizer on YouTube was like that.

**ELIZABETH** Oh, you tried the stabilizer on YouTube.

**CHOE:**

**AUDIENCE:** Because I new I had to stabilize some of my footage, and they were taking a very long time on Premier. So I just popped it on to YouTube and just let YouTube stabilized it. But I didn't know that it did it very liberally. So I realize a lot of my shots got like this warpy effect, and some of my text got cut out, and what not.

But yeah, and I'm sorry that the audio for this whole chunk just kind of got warped because I had to use my other camera, which I didn't want to.

**ELIZABETH** Oh, you used your DSLR for the middle part, right? I mean it's a trade-off, because it looks

**CHOE:** way better than the camcorders that we have. But the camera that he has doesn't have an input for the mic. Yeah, it's really hard to understand that part. Yeah, PJ?

**AUDIENCE:** With these scenes, though, we were talking about doing this walking down. It was just tough to have a ten foot tether to do some of these. And I thought that came out really good-- that video part.

**AUDIENCE:** Could you try a voiceover?

**AUDIENCE:** Yeah, I was thinking about putting that in.

**AUDIENCE:** Because it's far away enough where I don't think it matters.

**ELIZABETH** Yeah, you could try lip dubbing basically. I have one pair of wireless mics, if you do want to try

**CHOE:** shooting it. I mean, it may be a little too much to throw in at the last minute, because I do agree that this part is--

[SKIPPING THROUGH VIDEO]

It's hard, but I mean, I also think that having that wide of an angle is important in that shot. So I understand using the mic was sort of not really an option there. But I do think that voiceover is a good option. And especially this part. It's a long walk and talk, and--

**MALE IN VIDEO:** --example, my party before. If I were to send out my message--

**ELIZABETH** And the audio is so distractingly unclear, and this is such a crucial sort of inherently hard to  
**CHOE:** understand portion anyway, that I think that it's really important to have clear audio. And I don't know if you can just shoot B-roll to do voiceover for this. Because it's a little-- the setting and what you're saying don't necessarily match up to me right away.

But I also like the feel that you were going for with this walk and talk. I can tell that you were drawing a lot of Veritasium influences with the beginning, and you did the whole Michael Stevens Vsauce head up, which I think are fun. Because you're taking something that is typically a very robust science topic and sort of presenting it in a very casual, like, I'm just your friend talking about time travel type of way that makes it a lot less intimidating. Which I think is really nice. It's a nice feel for the video.

Any comments from anyone else? Yeah.

**AUDIENCE:** It's sounded really well in its complete form. Even though-- like the script, there was a lot of technical detail. It didn't read like that at all. The only part here was that when you were walking and describing the grandfather paradox, I know we also shot the party.

**AUDIENCE:** Yeah, I was thinking of putting that in split screen, but I--

**ELIZABETH** Oh, you actually shot a fake party?

**CHOE:**

**AUDIENCE:** Yeah

**ELIZABETH** I think that it would be a really good option to try playing around with that footage and just  
**CHOE:** using voiceover there.

**AUDIENCE:** I only put it at half a screen, because I'm keeping to the left of the screen so I have it on the right side.

**ELIZABETH**  
**CHOE:** Yeah. Is it super important that you maintain this footage of you talking? Or can you just cut to straight B-roll of the party?

**AUDIENCE:** I thought it would be a nice transitions to walk into the last scene.

**ELIZABETH**  
**CHOE:** Oh, yeah. I mean, I can tell that you were very conscious of how your cuts were being made.

**MALE IN VIDEO:** --the grandfather paradox--

**ELIZABETH**  
**CHOE:** I think that this opening one and some of your pans are really slow. So you could cut the clip right before it lands on you and just speed up the pan. This part especially. It just feels very nice.

**MALE IN VIDEO:** --sci-fi films have depicted them. We are, in fact, time traveling at a pace of one hour per hour.

**ELIZABETH**  
**CHOE:** The script is a lot better here. It's really good.

**MALE IN VIDEO:** --speeds near the--

**ELIZABETH**  
**CHOE:** And this too is a really good visual reference there.

**AUDIENCE:** I really liked whatever you did to animate the graph. I was like, mind blown. I don't know if I could do that. But it looked really nice because it followed your finger and everything.

**ELIZABETH**  
**CHOE:** Yeah, how did you do that?

**AUDIENCE:** I kept a screenshot there, and I imported for the shot that I drew everything over.  
  
This amount of time actually increases--

**ELIZABETH**  
**CHOE:** But YouTube cut it off right at the bottom. OK, that's what I figured what happened.

**AUDIENCE:** Yeah, it was supposed to be nice frame. I don't know why they even warped this.

**ELIZABETH**  
**CHOE:** Yeah, I mean, take the stabilizer out and just do a closeup shot of you. Because that's really nice. Are you going to do it for this part too?

**AUDIENCE:** I was thinking that I should.

**ELIZABETH**  
**CHOE:** I think you should, just because like you're throwing in the graph and you have the asymptote, and it's just such a key part. Something that I didn't know until you read the script out loud to us-- really cool, the idea of looking at the other side of the graph. So, I know it's more work for you, but I think it would look cool. Who's commenting on Kenneth's?

**AUDIENCE:** Yuliya and Andrea.

**ELIZABETH**  
**CHOE:** Yuliya and Andrea, great.

**AUDIENCE:** I really like the ending.

**ELIZABETH**  
**CHOE:** Yeah, the beginning and ending, you book ended it very nicely. Very good. I'm very happy with how people have taken their scripts and really created a point and a story around it. I don't think any of these drafts are instructional videos whatsoever. You've taken all these concepts-- and we talked a lot at the beginning about tying specific examples and allowing a specific instance to let you hit these bigger points. And I think everyone's really done a nice job of doing that with their scripts.

All right, next up we have Joshua. You ready?

**AUDIENCE:** Yeah.

**ELIZABETH**  
**CHOE:** Any comments?

**AUDIENCE:** I haven't put in the animations yet, so there will be a part where there's a blank space. But the blank table is supposed to be the animations.

[VIDEO PLAYBACK]

-Hi, have you found it particularly difficult to find a specific item in your house? Let's say you're looking for a pair of gloves, but you just can't find it and you spend your entire afternoon

looking for it. Well, you've just encountered the same problem that companies like Google or Microsoft encounter every single day. And that's the problem of search.

Just like a house, which stores thousands of different items, Google stores 45 billion index pages of information. When if every page was a sheet of paper and we stick them up real high, we will create a tower 600 times taller than Mount Everest. Well can Google find my results so quickly when I find so difficult to find a pair of gloves?

Well, searching on Google is kind of looking for a person in a big school. Let's say you're looking for James in the row of classrooms. One of the easiest method would be to go to every classroom nearest to you until you find James. There's a better method known as binary search.

Let's say the students were arranged from A to Z in an increasing number of the classrooms. And let's say we head to the middle room first, and if the person in the middle room isn't James, but his name starts with a letter before j, we head to the right. If not, we head to the left. We then approach the middle room in the newly sectioned area.

We rinse and repeat. Eventually we will find James just like the first method, but we find him in a much faster way with the second method. How much faster would that be? Well, that depends on the number of students in the school. Let's say there are 500 students and we're looking for one, it would take about 80 minutes in the first manner, but one and a half minutes with binary search. But let's say they are 1,000 students in the school, it would take 160 minutes with the first method but 1.6 minutes with the second method. Now, that's a whole lot of difference.

So a name is just a word. But Google searches a combination of words, making it a little bit more complicated. So just like how we identify the first letter of each alphabet of the name, Google identifies 200 unique factors making your search terms faster. If you recall, the effectiveness of binary search depends on the prearrangement of data.

And that's why computer scientist are actively looking for ways to sort, manage, and eventually retrieve data fast and better. In the same way, the TV remote goes near the TV, the shoes go to the shoe rack, the coats go into the cupboard and the winter gloves go into the winter jacket. Aha! So that's where my gloves are.

[END PLAYBACK]

[APPLAUSE]

**ELIZABETH** Joshua, what are the things that you like about your cut, and what are the things that you don't  
**CHOE:** like about it?

**AUDIENCE:** I guess I like the opening. But I realize-- there were times where I realized I have a better take, but it's because they clicked it but I started earlier.

**ELIZABETH** So there were takes where you got cut off just at the beginning or something like that.  
**CHOE:**

**AUDIENCE:** So I realize I should have much, much more takes, because you never know what happens. And I had to scrap out an entire scene because I was in a location where they had just started preparing for some event, and then everything became very noisy.

**ELIZABETH** Yeah, so there were like last minute things that came up in your locations.  
**CHOE:**

**AUDIENCE:** I do recognize that the one where I'm supposed to do animations the sound is off, and the visuals are not really there yet.

**ELIZABETH** You mean the one where you're looking at the desk?  
**CHOE:**

**AUDIENCE:** Yeah, at the black--

[SKIPPING THROUGH VIDEO]

**AUDIENCE:** Yeah, there's supposed to be animations here, but I guess this is not probably the best one.

**ELIZABETH** You were going to have your animations come up here with your hotel room-- or your--  
**CHOE:**

**AUDIENCE:** If I have to redo a scene, this scene is the most inconsistent among the rest.

**ELIZABETH** This was one where you were filming later in the day.  
**CHOE:**

**AUDIENCE:** Yes, this one was my first day, but later in the evening. And then the next day the rest.

Everything else in the next day except this.

**AUDIENCE:** I think in this piece, because A, we don't have the animation, but B, your eyes are looking at the animation as opposed to still talking to the screen-- and I think, from my perspective, I feel like there's a little bit more of balance at play there of connecting with the audience a little with your eyes. Like if you're going to reshoot it, for me, I think balancing looking down and still looking back instead of just looking down during the animation and then looking back at the end.

**ELIZABETH**  
**CHOE:** Looking at the animation is good. It's kind of fun thing to do. But again, look and acknowledge the audience as well. I think this one, it's really just a matter of energy level here. Overall, your delivery is very nice. It's a very natural. I love the script. Again, you're taking something that's very hard to visualize, and that's why--

You know, we were trying to figure out what topic to do when you were brainstorming, and there were just no videos on binary search, which was shocking to me. Or there aren't very many good ones. And there aren't very many videos on how Google works, period. And it's because it's very hard to visualize. And I think you've done a nice job.

The only thing is this last scene. The delivery is great. But I almost would like to see this done in a computer lab or something instead of in front of the Microsoft Office. I know that you were trying to work with sort of that Kendall Tech area, but it reads like a little maybe product placement-y. So if you want to reshoot that one if you have time, I would say there are computer labs here that I can help get you into if you want.

Were you going to have animations in this scene?

**AUDIENCE:** This would be just a number that pops up and then a number below.

**ELIZABETH**  
**CHOE:** I think that sparing use of labels will also help this video too, like when you first introduce the term binary search, have come up. When you talk about the numbers. Numbers are hard to keep track of in a video, so just having those pop up.

**AUDIENCE:** So it would just be first measure 80 minutes and binary search 1.5.

**ELIZABETH**  
**CHOE:** Yeah, something like that. Something really simple. And you've got a good background for it, so I would go and take advantage of it.

**AUDIENCE:** You have such a smiley presence that's so engaging on the camera. You have such positive energy up there. It's like you kind of want to smile while you're watching it.

**ELIZABETH  
CHOE:** And again, you're taking something that is a seemingly intimidating subject, which again is why it's very hard to find videos on computer science, and even more rare to find a live hosted video on computer science. All the ones that are out there are usually some sort of voiceover animated tutorial, and I think that having you on screen being the guide for the audience with this is very, very nice. It's very powerful.

**AUDIENCE:** Could you go back to the beginning of that, where you're in front of the desk and about to point at the animation?

**MALE IN VIDEO:** --find James. There's a better method known as binary--

**AUDIENCE:** I feel like someone just told you a joke and we missed the joke. And you're like kind of about to die laughing. I don't know if you guys felt that same way when you saw it. Did someone tell you something really funny?

**AUDIENCE:** I couldn't figure it out. I don't know why I behaved like that. I do remember a joke. I did remember a joke.

**AUDIENCE:** I wanted to be like, what was so funny? There's something funny going on here?

**AUDIENCE:** I must have saw something that he was doing. Maybe he was in an awkward position.

**AUDIENCE:** I mean, I think you're going to refilm this one anyway, but if you do-- it was funny because in this moment I was thinking, there was something funny that must have just happened, and I don't know what it is.

**ELIZABETH  
CHOE:** What was I going to say? For the shots that you did at the Koch Institute, I think you can just center this. Center it close enough. Because I know you're trying rule of thirds here, but there's sort of like-- it's non-homogeneous distribution of this pattern in the background, so it looks a little weird to have all this extra space. So I would go ahead and just center this.

What do you guys think about the music in this video? It's good? It's a little light-hearted. It doesn't play into the whole computer science trope, which is nice. I would bring-- go ahead.

**AUDIENCE:** I thought it was like 1950s suburbia, middle America thing.

**ELIZABETH** I would bring down the levels just a little bit. In the opening it's fine, but as it progressed, I

**CHOE:** would either up your recorded levels for your own audio or lower the music. Once the bass starts driving, it gets a little distracting. Any final comments? Who's doing the Google Docs for Joshua?

**AUDIENCE:** David and Nathan. Also, just as a comment, I think you did a really, really excellent job with the pacing of your cuts. We never explicitly stated it, but I think Elizabeth and I said it in the computer lab last week. You did a really good job leaving a little bit of space at the end of something that you said for people to absorb.

But then when you starting your new scene, you cut it right before you dialog. And so the video itself just felt really, really well-paced because of that. There was never any point of it where I was waiting for something to happen. It was all just like--

**AUDIENCE:** If I were to add, they have that actually I didn't feel-- I cut once, and I felt it was awkward. And then I cut again, until it reached so near to the audio. So it was a few times I had to cut to realize that it awkward. Like even for 0.3 seconds, it would be awkward.

**AUDIENCE:** You have really good instincts to do that.

**ELIZABETH** And I know that I have said this ad nauseum in the emails, but I feel like there's this sense of

**CHOE:** fear. And maybe it's just the training that we have in our traditional educational system, but we all want to measure like 20 times because heaven forbid we cut more than once, right?

And here you're literally cutting. But it's through the process of cutting and trying different things that you learn what feels right and what makes sense in the video. And I don't know of anyone who has ever made a video on their first try. Even if they've perfected the shot list, gotten the best script ever, have their production date down to the second, something will ultimately end up happening that makes you reconsider how you're going to cut things.

And it should. It really should. I mean, I am really happy to hear that that's what you discovered, because I think that that goes maybe a little against how we traditionally go through school. So I'm glad to hear that you try different things. It's OK, do not be discouraged by having to try different cuts. It's a productive process that moves you forward.

OK, any thoughts from PJ before we screen?

**AUDIENCE:** So there's parts of the audio that I'm moving so I can get the--

**ELIZABETH** Oh, you hear a little bit. Yeah.

**CHOE:**

**AUDIENCE:** So yeah, after we do that. And then it was really hard trying to keep it-- there's no-- after watching it, it's like two videos. It's hard because it's in one setting, and they complete their form. And I couldn't find like--

**ELIZABETH** Music is hard. It's so much harder than you initially think it will be. You think, oh you just like slap something on in the background, it'll be fine. But it's very time consuming. So it's very like--  
**CHOE:** - I don't know. It seemed very inspirational at the beginning.

**ELIZABETH** Like inappropriately inspirational.

**CHOE:**

**AUDIENCE:** *Friday Night Lights* kind of thing.

**ELIZABETH** All right. Well, let's see.

**CHOE:**

[VIDEO PLAYBACK]

-When we take complex things and break them into smaller pieces, we find out that we know a lot more about things than we think.

Now let's take this box-- ORCA I-- and create damage below the water line, which I've indicated right here.

As we can see, we've damaged ORCA I right here. Now let's put ORCA I on the water and see what happens.

[GURGLING]

The ORCA I sank due to the weight of the added water. What if the ORCA I contained cargo, or oil, or even people? Now let's take ORCA II and do the same thing.

So we can see that ORCA II did not sink, although it is sitting on an angle towards the bow. So

why didn't ORCA II sink? As easy as it sounds, this simple demonstration is essential to the design of huge complex ships-- ships that are responsible for carrying about 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, why don't we find out?

Here we have ORCA I and ORCA II from before. Although ORCA I and ORCA II don't engage in international trade, they behave just as a 1,000-foot container ship would.

Now, let's take a look in ORCA I. We can see that there's nothing in it. It's just a box. But if we look at ORCA II, we can see that it's subdivided into these watertight compartments by these transverse watertight bulkheads. Now, what that means is that if we were to damage this ship right here, water would only flow into this compartment. It would not go into this one, this one, or this one. That would cause the ship to be angled or trimmed in the water, but it would not cause the ship to sink completely.

We refer to ORCA II as being subdivided, and we can see subdivision in many of these ship's plans. It is unclear when subdivision first started being used in ships, but accounts of 5th century Chinese trade ships indicate that water would be able to enter the vessel without sinking. So let's find out why this happens.

Let's imagine a barge divided into 10 equal compartments. One of them springs a leak from damage. Since the ship is subdivided, only the first compartment floods, and the ship remains afloat, protecting both its people and cargo. Although the added water causes a ship to trim, it still has enough buoyancy to return to port for repairs.

Ships still sink, though. It's both expensive and impractical to try to design the unsinkable ship, especially when these ships will never see that amount of damage. That's why, as naval architects, we use computer programs to help us out with subdivision.

Computers make it easy to simulate certain damage cases in practically no time. With different software, we can damage certain compartments, and see how the ship responds to it. This gives the naval architect a good idea of what parts to improve on the ship, if any.

So even though ships seem like these intricate, complex things, they're really just based on principles that we all already know.

[APPLAUSE]

[END PLAYBACK]

**ELIZABETH** Just out of curiosity, did you shoot this video in sequence? Like, you shot the first scenes first,  
**CHOE:** second--

**AUDIENCE:** So the first scenes were second. The second scenes were first.

**ELIZABETH** Really?

**CHOE:**

**AUDIENCE:** Yeah. That wasn't out of design, it was just because the the only time we could go there was day.

**ELIZABETH** Yeah, it's a location practicality there. Any comments for PJ?

**CHOE:**

**AUDIENCE:** I didn't feel the change of music, as in, it was natural. I didn't feel like there was a sudden change.

**AUDIENCE:** OK.

**ELIZABETH** I liked the second song. I agree that the first one is a little *Friday Night Lights*.

**CHOE:**

[LAUGHTER]

**ELIZABETH** The thing with-- just like comedy, pulling off drama is also really hard to do in YouTube videos,  
**CHOE:** because you're not working with, like, a sweeping epic or a documentary. It's like a little YouTube blurb, and we had trouble with that with *Farts* when he talks about how *Clostridium difficile* kills some thousand Americans a year. We didn't want to have grandpa's banjo playing in the background when he says that, obviously. But it's not like we were going to insert music from *Gone with the Wind* in the background either.

**AUDIENCE:** Well, one thing that I wanted to try music because a lot of the places I was in, there was-- you can see there's a lot of cuts, so where it goes to, and if there's not anything underneath, it's very pronounced. And I tried editing a lot of it out.

**ELIZABETH** Let's see. So I know that you were hesitant about being in front of the camera too.

**CHOE:**

**AUDIENCE:** So natural.

**ELIZABETH** And I'm surprised that you said you filmed them in the rivers, because I feel like the stuff that  
**CHOE:** you have in the end is really, really natural, and I thought that you would have maybe done that second. It's hard to host while you're doing a demo. You just have a million things to think about. But in general, the hosting is really nice. It's really, really natural, especially this part. I can tell that Yuliya and-- who was it-- David was filming with you?

**AUDIENCE:** Kenneth.

**ELIZABETH** Kenneth was filming with you. They probably tried to make you laugh in some of them and  
**CHOE:** smile.

**AUDIENCE:** Yeah, they were really good at doing that.

**ELIZABETH** Yeah. I think this scene is your strongest hosting. Just, like, going back and forth between the  
**CHOE:** computer, this scene just plays out very nicely. And again, taking a seemingly intimidating subject, and welcoming and inviting the viewers in. It's very nice. I would say, in general, the cutting advice that [INAUDIBLE] gave, which is to leave the room at the end of cuts-- or at the end of scenes-- and cut very close to when you start talking at the beginning of scenes, might help with this. There was one--

**AUDIENCE:** Is it the moment where Yuliya's in the picture with--

**ELIZABETH** Oh, yeah. That's, like, a weird insert thing.  
**CHOE:**

**AUDIENCE:** I was, like, who is she? What is she doing here? She needs to get cut out.

**ELIZABETH** In general, I love the speed up walk, and how you open the door into the lab. I love seeing the  
**CHOE:** background. It's very cool. I think you can speed up you damaging ORCA I.

**AUDIENCE:** OK.

**ELIZABETH** And I think, you say something like--  
**CHOE:**

**AUDIENCE:** Let's take this box-- ORCA I-- and create damage below the water line, which I've indicated right here.

**ELIZABETH**  
**CHOE:** Yeah. I think you can actually cut that part out completely, because after you cut it, you say, as you can see, we've damaged ORCA I, so I think that's enough information. And I get what you're saying with the water line, but I don't think it's super relevant to the point of the video, so I think it's OK if you cut that out entirely. Oh, yeah, when you go from this scene--

**AUDIENCE:** --in the weight of the added water. What if the ORCA I contained cargo, or oil, or even people?

**ELIZABETH**  
**CHOE:** Yeah. The music here is, like, it's like trying to pull out my heartstrings.

**AUDIENCE:** Now let's take ORCA II and do the same thing. We can see that ORCA II did not sink-- ORCA II sink. As easy as it sounds, this simple demonstration is essential to the design of huge complex ships. So why didn't ORCA II sink?

**ELIZABETH**  
**CHOE:** So this is an example-- it happened one other time where you leave a gap in between some of your sentences, and the gap is a little long. So you can cut to a digital zoom of the same shot to clean up the gap a little bit. Because I think that you were doing it to help you host, and, like, help you get through the lines, which is totally OK and understandable, but I would just hide that gap a little.

**AUDIENCE:** I stuttered here, and I kept looking back to the boat, so it was weird, like I was using that almost as my crutch, that I had this prop that I could kind of like square up.

**ELIZABETH**  
**CHOE:** I think you actually were-- your delivery was fine here. I wasn't distracted by it.

**AUDIENCE:** --It did not sink, although it is sitting an angle towards the bow. So why didn't ORCA II sink?

**ELIZABETH**  
**CHOE:** I like the way you ask the question. That's, like, how you would normally.

**AUDIENCE:** As easy as it sounds--

**ELIZABETH**  
**CHOE:** And see how that gap feels just a little bit too long.

**AUDIENCE:** --this simple demonstration is essential to the design of huge complex ships-- ships that are responsible for carrying about 90%--

**ELIZABETH**  
**CHOE:** Do you have B-roll or pictures of some of these ships? That was the one thing I was thinking throughout this video was, like, I would love to see what the things look like in real life.

**AUDIENCE:** I could probably do something like that.

**ELIZABETH**  
**CHOE:** I think this would be a great place to cut to B-roll or pictures. You can just keep the audio, but that would help mix up the visuals a lot too.

**AUDIENCE:** --of all our stuff is--

**ELIZABETH**  
**CHOE:** OK. So this cut was a little-- this was what I was talking about with the line of sight when I gave the editing lecture. In the one scene, you're kind of sitting like this, right? And you have, like-- this is a terrible drawing. But you have your boat in the water, and it's sort of, like, a weird semi-bird's-eye.

And then you cut, and you're not quite in a different enough position, so it feels just, like, slightly jarring. It feels like someone just tipped the camera over a little bit. So either cut to a closer shot of you like that, to hide that a little bit, or do B-roll there. If you're coming out of B-roll here, then this transition won't be as weird, and my comment is totally irrelevant, but just something to think about.

**AUDIENCE:** I mean, so-- sorry, I'm, like, 10 steps ahead of my head, where I am in actual reality. You never put your Coast Guard outfit on.

**AUDIENCE:** Yeah. I felt like if I wanted to try to make it seem like less, like, me talking, that would have just put on a whole different persona. So I kind of, like, I'm wearing boat shoes, so that's hard to do.

**AUDIENCE:** OK. I just wonder if at the very, very last scene, where you have your finale comment about a very simple concept as floating, if ever there were a moment to put that hat on, and have your awesome Coast Guard outfit on, that would be it.

**ELIZABETH**  
**CHOE:** If you don't want to shoot it now, we're going to make you do it next week when we shoot season 3, OK?

**AUDIENCE:** Yeah. Got to go to the dry cleaners.

**ELIZABETH** Yeah, that's a good comment.

**CHOE:**

**AUDIENCE:** The thing that you have that's so cool is, I mean, we talked about the fact that you actually, legitimately, are out there in the Coast Guard. And you say that, but showing us that in your film is really powerful. And even if, at just the very end, you tie that real life application back, I think that would be really, incredibly cool.

**ELIZABETH** Just for the last sentence too. And again, like, time permitting, right? Because I know that you guys don't have a ton of time to incorporate all this stuff.

You've already gotten plenty of footage of you talking in this setting, so it wouldn't be very jarring to have you say the last sentence, like, out by the sea, or by the boats.

**AUDIENCE:** Or even if when you say, like, I'm a Coast Guard, whatever, even if you quickly have a picture of even photos of you in uniform, to just put-- I don't know. I don't know how that would look. But just something that shows us, and doesn't tell us this totally authentic side to yourself would be cool.

**AUDIENCE:** So do you have access to the base here?

**AUDIENCE:** To the one in North End?

**AUDIENCE:** Yeah.

**AUDIENCE:** Yeah.

**AUDIENCE:** Because one of our--

**AUDIENCE:** They have shirts there.

**AUDIENCE:** Yeah. I mean, one of the Sloan fellows is also an officer.

**AUDIENCE:** OK. [INAUDIBLE]?

**AUDIENCE:** [INAUDIBLE].

**AUDIENCE:** No. He's based in there.

**ELIZABETH** So again, I know it's short notice-- you'd have to do it between today and tomorrow, basically,

**CHOE:** so it's OK if you can't do it, but something to think about, if you want to do it for Science Out Loud.

All right. Yuliya, you ready?

**AUDIENCE:** Yeah. So there are-- the beginning and the end, we filmed outside. There's a lot of wind, and I couldn't connect the mike, because I was standing far away. So I tried to do voiceover. I don't know how it sounds, because honestly, I was just tired of hearing my voice at that point. And then, there is this, actually, like the thumbnail, this is where the animation is supposed to be. So the white screen is animations.

**ELIZABETH** Yeah?

**CHOE:**

**AUDIENCE:** David and Kenneth are the ones who are Google Doc commenting on this.

**ELIZABETH** Thank you. And we'll go through it again if you guys forget.

**CHOE:**

[VIDEO PLAYBACK]

[MUSIC PLAYING]

-Hi. What do snowflakes and cellphones have in common? Well, let me start by drawing a snowflake first.

I draw an equilateral triangle, divide each side into three parts, and draw another equilateral triangle on top of each one. Then take out the middle, and repeat the process, this time with 1, 2, 3, 4 times 3, which is 12 sides. Eventually, the shape will start looking something like this. In mathematics, this is called a Koch snowflake. If I repeated my process again and again, I would see this same pattern anywhere I looked.

This is a Koch snowflake, this time drawn on a computer. Such neverending patterns, that on any scale, on any level of zoom, look roughly the same, are called fractals.

Computer scientists can program these patterns by repeating an often simple mathematical process over and over. In the 1990s, a radio astronomer by the name of Nathan Cohen used fractals to revolutionize wireless communications. At the time, Cohen was having troubles with

his landlord. The man wouldn't let him put an antenna on his roof. So Cohen designed 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 antenna, this time using a fractal called the Menger sponge. 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 your sponge's holes, except the water is Wi-Fi, and the soap is, say, Bluetooth.

The fractal's infinite sponginess allows it to receive many different frequencies simultaneously. Before Cohen's invention, antennas had to be cut for one frequency, and that was the only frequency they could operate at.

Without Cohen's sponge, your cell phone would have to look something like a [INAUDIBLE] to receive multiple signals, including the one your friends use when they call.

Cohen later proved that only fractal shapes could work with such a wide range of frequencies. Today, millions of wireless devices, such as laptops and bar code scanners, use Cohen's fractal antenna.

Cohen's genius invention, however, was not the first application of fractals in the world. Nature has been doing it the whole time, and not just the snowflakes. Natural selection favors the most efficient systems and organisms, often of a fractal form. The spiral fractal, for example, is present in seashells, broccoli, and hurricanes.

The fractal tree is relatively easy to program, and can be used to study river systems, blood vessels, and lightning bolts. So many natural systems previously thought off limits to mathematicians can now be explained in terms of fractals.

Mathematics allows us to learn nature's best practices and then apply them to solve real world problems. Much like Cohen's antenna revolutionized the field of telecommunications, other fractal research is changing medicine, weather prediction, and building design here at MIT and everywhere in the world. Look around you. What beautiful patterns do you see?

[END PLAYBACK]

[APPLAUSE]

**ELIZABETH** All right. Any thoughts from anyone? Should we dive right in? Yuliya, what are your favorite  
**CHOE:** and least favorite parts about this cut?

**AUDIENCE:** Let's see. There was some scenes that I liked better than others. That's mostly because of the lighting and the sound. I think the one in the classroom had a nice sound and nice lighting. So I guess the indoor scenes were a lot easier to shoot.

**ELIZABETH** So I think, in general, again, very nice script. This came such a long way from the initial  
**CHOE:** ideation phase, and I think it is, like computer science-- I mean, my favorite thing about all the videos that you guys have done is the topics are so unique, and so different than what people normally get in school. And they're taking all these concepts that they've learned in school, but just putting it in a very different context. And it's hopefully because you're talking about the things that you're excited about. And so I'm really happy with how you've transformed, like, math, which is, again, a very hard video to do if you don't do it in the style of Vi Hart, and putting your face and hosting it. It's done nicely.

I think, in general, the video has a very fast pace to it, and I don't know if it's because the cuts are happening so frequently, or you're naturally a very animated person, which is nice, but leave a little bit of room, like, a little bit of breathing space to compensate for that. I think maybe the reason why it was hard for me to follow a little bit was the opening seemed a little too short. And I know that you had edited it from the last time I had seen it, but let's--

[VIDEO PLAYBACK]

[MUSIC PLAYING]

-Hi. What do snowflakes and cell phones have in common? Well, let me start by drawing a snowflake first.

[END PLAYBACK]

**ELIZABETH** Yeah. It seems like it's so overly condensed. And I know you had brought it down from  
**CHOE:** something that was a little bit bigger, but I think that it's just so, like, it comes out of nowhere, like, hi. What do these have in common? It's like, wait, what? Like, I wouldn't have had that question. And even getting rid of the hi helps with that.

It's a nice question. What do snowflakes and cell phone antennas have in common? But

there's not enough of a lead into you going into describing what a fractal is, yet fractals is on the title. I think that maybe you could do a little bit with the transition there, and I'll brainstorm with you, because I can't think of anything off the top my head. Do you guys have any suggestions for that opening? Yeah, Andrea.

**AUDIENCE:** Maybe like, I don't know exactly how you could do it, but almost like the first shot, where you're saying, what do snowflakes-- and then you see, like, sort of an image of a snowflake and cell phones, and then it sort of zooms out, and you realize that the picture is on the cell phone.

**AUDIENCE:** Maybe.

**AUDIENCE:** Sort of have in common. And then, you're-- and then you.

**ELIZABETH  
CHOE:** I mean, I think it's OK to introduce the idea of fractals, as long as you set it up a little bit more. So something like, what do snowflakes and cell phones have in common? Neverending repeating patterns called fractals. And then do a little bit of a slower transition into you at the blackboard here. Something a little bit more like that. I think the visuals help a lot.

I know that you had filmed up in Stata, because eventually you talk about how it affects architecture, but I don't think that this location is super vital to the opening, and I think you can get cleaner audio if you do VO, or if you just re-shoot it with you on the table, and then you have a picture of a snowflake that comes up in a picture of a cell phone, or something like Andrea said.

But I think having the audience onboard from the get-go will help with the pacing of the video as it continues.

I know that you had struggled with the music too, and I think-- I don't know-- so much of music is personal taste. To me, all I can think about when I hear this music is, like, old Korean soap operas. And so I don't know if it is, like, the most appropriate tone, and maybe I feel that way because of experiences of my parents watching them, but I think you could play around with some other pieces. I like the general tempo of the music, and how it's sort of this same melody on loop in the background, so it's not super distracting, and it's a good volume. But I would play around with a couple other songs, and I can help you with that, if you want to run some options by me.

**AUDIENCE:** I wanted to use this one because it was kind of calming, so kind of to offset the general fast pace and animated talking to something soothing in the background.

**ELIZABETH** Yeah So I think it's a good tone to start with, and again, maybe it's just my personal

**CHOE:** preference, but something about it made me fixate on the music more than on the text. Did anyone else have-- maybe it really is, just, like I can't get over how much it reminds me of Korean soap operas.

**AUDIENCE:** It stood out for me at the start, like, especially for this scene, it gave me the feeling like it was going to something romantic. I don't know.

**ELIZABETH** It's very sentimental, like the music evokes something very sentimental, just like the opening of

**CHOE:** the ships one evokes a mood that's very different from what you're about to go into. And especially if you open with something like that, if you'd open with a banjo thing-- or not the banjo-- whatever you had for the second piece, I think it would have been fine. But something about opening with music that sets a tone that's very different from what you're intending to achieve, it threw me off a little bit. But luckily, it's something that it's easily fixable. You can easily play around with different types of music.

**AUDIENCE:** Because for me, you give us, because there was a Digicom video, and there was the idea that you could use something calming, so I tried to use something calming, but as you see, I didn't choose that, because I realized the calming one will make my video feel very monotonous. But when I observe the Digicom audio closer, I realized there was some percussion notes, so that helped. So maybe you could find something similar to what you have right now, but with a little bit-- not too much-- percussion here would help with the pacing.

**ELIZABETH** That's really good. And again, with music, there's no hard and fast rules with what works and

**CHOE:** what doesn't. I mean, a lot of it is just, like, your gut feeling when you hear it, if it makes sense, or if it doesn't. And obviously, my gut feeling was very different from everyone else's. Yeah, Jamie?

**AUDIENCE:** First of all, compared to where we started, this is isn't, like, oh my goodness. This is way, way more awesome than I ever thought was possible, with our first conversation about it's not real, so this is like-- and what I loved with the fractal piece at the beginning, where you really explained, because we gave you that feedback in the last time, was you need to set us up for success in explaining what a fractal actually is, and I thought you did a really fantastic job.

One think that you may want to think about is you have a very sing-songy voice. Your voice is

high, and it's kind of sing-songy. And at the beginning, you set up this-- I don't know if you've ever seen *Mrs. Doubtfire*, but it's this movie where Robin Williams is dressed up as this old grandmother, and is just kind of this hilarious figure. And I think there's an unintended humor to your sing-songy-ness at the very beginning that makes me feel less credible wanting to watch you. And I think there's a very simple fix, which is just grounding your voice in a lower register.

When you talk with your voice later on, just listen to that as you watch yourself. I notice that the times when your voice is a little lower is when I don't notice that as much, and so since you are thinking of reworking this first scene, you may want to think about consciously grounding your voice a little bit more in your chest, so that we don't, like, unintentionally think it's funny when it's not intended to be.

**ELIZABETH**

**CHOE:**

And I know George had said the camera calms you down, and in general it does, and you compensate with higher energy, but again, this is what I saying before, and oftentimes, hopefully, this stuff that we were saying earlier in the class makes a little more sense after you guys have gone through it, but sometimes the tendency is to compensate or equate higher energy to higher pitch, higher volume, like, higher everything, and it's really not that at all. A lot of it is just the mentality of, like, I'm going to be really present here, right now, and really give it 100% here.

**AUDIENCE:**

There's actually a really good TED Talk that's about how to speak to be listened to. And it's basically, you do these little vocal exercises, and they both relax you, and they'll drop your register down, like, just going through them. And I had to do those prior to doing-- I learned something similar when I was first learning public speaking.

**ELIZABETH**

**CHOE:**

It's a great thing to think about not just with making these videos, but when you're giving talks later on. Again, like, when you're nervous or excited, your tendency is to talk a lot with your hands, which I know I do, and talk really high pitched. So it's just a good thing to think about, in general, after this class.

**AUDIENCE:**

Number two.

**AUDIENCE:**

At the beginning of those voiceovers, I was trying to match the video in my room. And it did feel a little bit off as well. I wasn't sure how to--

**ELIZABETH**

I think you could do the opening, like, just you set up a tripod, and sitting in your room or

**CHOE:** something, just something really simple. What do this and this have in common? Well, it's actually neverending repeating patterns called fractals, and then you go into fractals.

**AUDIENCE:** On a very practical level, like, I do a lot of helping of people get ready for talks in my lab, and just, like, grounding your feet wherever you are, feeling like you're grounded to the earth, and then getting a really deep breath, like way from in here before you speak, that will help you fight that tendency to go way up high.

**ELIZABETH**  
**CHOE:** And I think the animations here will look really good. Again, like, visual cues, anything that you're going to add, even if it's just still pictures will make a big difference.

And I would play around with the ending too. I like that you do the review, but again, the audio is hard when you're that far away. And you may be able to shoot this in the same room that you shoot the opening in-- or you re-shoot it, and then, I don't know, have a picture of Stata just pop up next to you. I think that's a way to compensate pretty easily.

What is the world background for?

**AUDIENCE:** It matches the world at the very end.

**AUDIENCE:** Yeah. And it was just a nice background for titles.

**ELIZABETH**  
**CHOE:** Oh. I would just go black, honestly. Just a black background. In general, I think simple reads more professional. Oh, I don't know. Professional's not the right word, but simple is better, I think. And I didn't make the connection of, like, look at the world when I saw the background. It's such a minor thing, though. I mean, it's just your credit, so it's OK, but just something to think about. Any final comments for Yuliya?

**AUDIENCE:** I thought that one scene in the dorm was really good, where you inadvertently had all the stuff behind us. I didn't know that it was going to turn out like that.

**AUDIENCE:** Oh, the one in the lounge.

**AUDIENCE:** Yeah.

**AUDIENCE:** Yeah. And I think it was the best lighting, too, of all of them.

**AUDIENCE:** That's great.

**ELIZABETH** All right. So who's going to comment on Yuliya's?

**CHOE:**

**AUDIENCE:** PJ and Josh.

**ELIZABETH** All right. Last one, and then we'll take a break. David, do you want to say anything before we

**CHOE:** screen? Your video will just speak for itself.

[VIDEO PLAYBACK]

[MUSIC PLAYING]

-If I went out for a run now, dressed like this, you'd probably call me nuts, right? Because it's so cold outside that I'd probably die of hypothermia.

However, in 2009, Wim Hof managed to run a full marathon in minus 20 degrees Celsius, wearing nothing but shorts. While most people would probably die, Wim Hof has survived.

So what makes Wim Hof able to survive where others can't? The research team were suggesting that they subjected him to an icy bath for almost two hours. While most people would have their core body temperature drop to below 35 degrees, causing hypothermia to kick in, Wim Hof's body temperature dropped to a merely 37.4 degrees Celsius, staying surprisingly warm. And the funny thing is that the researchers couldn't find exactly what had happened. Maybe it's his genetic ancestry that saves him. In a sample study, studies have found that individuals with cold-climate ancestry, have been found to have mitochondria that can produce more heat and less chemical energy.

Mitochondria is like a mini-furnace that burns the sugars from the food you eat into chemical and heat energy. Individuals like this are better able to survive the cold, however, scientists haven't fully studied Wim Hof's genome, so we don't really know.

Wim Hof practices g-tummo, a Tibetan form of meditation and breathing, which allows him to double his metabolism. Remember those mitochondria I mentioned before? Wim Hop can produce enough heat through these mitochondria with special breathing, and massive contractions that can produce enough heat to body warm.

Well, you might be tempted to believe that this is wishy-washy nonsense. However,

participants in a study at NUS have been shown to increase their core body temperature using g-tummo, and they had no prior experience. Now, why is it so? Strong increases in brain waves were noticed, and many have theorized that this enables the body to effectively heat the center as well as distribute it to the extremities.

We do not fully understand Wim Hof's methods. Although some have tried to follow in his footsteps, you would be unwise to do the same. And Wim Hof even claims that he can control other parts of his body. Now, if this is true, and scientifically a fact, who knows what doors could open.

And since science hasn't figured it out yet, and I, myself, don't practice these methods, maybe I'd better be off donning more jackets.

[END PLAYBACK]

**ELIZABETH** David, what was the hardest part about filming this video?

**CHOE:**

**AUDIENCE:** I think it was following the script.

**ELIZABETH** Following the script. Just, like, remembering it when you were shooting.

**CHOE:**

**AUDIENCE:** Yeah. I really think that was the hardest, because trying to say everything while looking at a camera felt very, very real.

**ELIZABETH** Yep. That makes a lot of sense. And again, like, using your partner to the fullest extent when you're filming can really help with that sort of humanizing the mechanical element of production, trying to talk to the person behind the camera. I think that you didn't look uncomfortable on camera.

The only thing is, in general, you talk really fast, and with the music that was in it, I think that you can take some of the music out, or drop the volume a ton, or play with, like, less busy music. But having someone who talks naturally fast, and then, like, very upbeat music in the background is just, like, exacerbate, it's, like, constructive interference.

**AUDIENCE:** [INAUDIBLE] calm music, but I felt like I put calm music in.

**ELIZABETH** Yeah. I mean, you can also experiment with not using music in certain parts of the video. You

**CHOE:** guys don't need to have music the whole way through. It's OK. And I think because you talk so fast naturally, the music can be-- remember, with music, first do no harm, right? It can be hard to understand just the sheer amount of content that you're saying when the music is so upbeat and so loud.

**AUDIENCE:** I think the music was, at least for me, personally, it had the same effect as when Elizabeth was showing the choices for the heart video, where at the beginning, it was a little bit too much for me, and I got the giggles. I don't know what about you putting on running shoes, and, like, just the loudness of that music, it just seemed a little bit ridiculous, that I wasn't mentally ready for some serious facts at that point.

**AUDIENCE:** I wanted to make it upbeat. I wanted it to be like I was going to run in the cold.

[VIDEO PLAYBACK]

[MUSIC PLAYING]

[END PLAYBACK]

**AUDIENCE:** It's good, like, until the point where you ask the question. From, like, instead of being, like, oh, OK, it's OK to be, like, oh, this is me when I'm running in the cold. But then as soon as you switch to actual explanation--

**ELIZABETH** Yeah. I would just duck it out after you ask the question.

**CHOE:**

[VIDEO PLAYBACK]

-If I went out for a run now dressed like this, you'd probably call me nuts, right? Because it's so cold outside that I'd probably die of hypothermia.

[END PLAYBACK]

**ELIZABETH** And also there, I mean, everyone's done this, where they take pauses in weird parts of their sentences-- I mean, if you wanted to make it funny, I don't know if you do.

**AUDIENCE:** She's making--

**ELIZABETH** I am so sorry.

**CHOE:**

**AUDIENCE:** I think it's one of my favorite things--

**ELIZABETH** The last time this happened, I was thinking, oh my gosh, this happens to be more than I would  
**CHOE:** like to admit, but I was, like, I hope this doesn't happen during the class, and it ends up on the internet, but now it's going to anyway.

[LAUGHTER]

If you wanted to make it funny, you could zoom in-- as you-- nevermind. Don't make it funny.

**AUDIENCE:** So if you wanted-- I was going to say-- every time you pause, cut out that pause, and then maybe a little bit closer to your face, like, what if I die? And then, like, zoom in, I'm cold. That's really comedic.

**ELIZABETH** It's kind of like the thing that we did, and it's not very good, like the extreme zoom, and you  
**CHOE:** could make it, like-- with comedy, going big or going home works the best, because you really have to commit to it, so if you want it to have a huge comedic effect, you would, like, zoom in really close, and you would have, like, a weird sound effect. I'm so sorry, you guys.

**AUDIENCE:** I think it's really funny to you.

**ELIZABETH** But if you don't want to make it funny, which I would recommend, either cut out the gaps and  
**CHOE:** alternate between zooming in and out like Hank Green does on SciShow. There's one other time that happens, like, right here. In general, like, if your gaps are happening in places that are not at the ends of scenes, really be conscious of how long those last. And having two other people look at your video today will help, because sometimes it's hard to tell when you're watching yourself if something looks like it's lasting too long or not. But if you have gaps that are too long that are in the middle of your scenes, you can use the trick of digital zooming in and out to hide the cuts.

Does anyone have general comments? Yes, Yuliya.

**AUDIENCE:** I like the delivery. It was really natural. And the music was sometimes distracting. Another thing that had that effect were some of the backgrounds, so like the one where you're holding a trashcan, and there's a person, and then there's a trashcan. So I wasn't sure, like, did that mean the person was in the trashcan, like, what happened, and, like, yeah, like, this scene.

And then there were some others, like the lab. I wasn't sure why the lab was there. Even though it was really cool.

**ELIZABETH**

I know that you held up the trashcan because you were trying to say, like, he was in a bucket.

**CHOE:**

But again, with the music, it's hard to hear that you're explaining the bucket thing, so I would just cut to the picture of him before you hold up the trashcan.

[VIDEO PLAYBACK]

--team were suggesting that they subjected him to an icy bath for almost two hours.

[END PLAYBACK]

**ELIZABETH**

Yeah. I mean, in general, that line is spoken so quickly that it's hard to follow what you're doing.

**CHOE:**

**AUDIENCE:**

And it's not just the speed. I think you need to put a little more diction in between your words, so that, like, what I hear happening in they're kind of slurring all together, so it's not just a matter of speed, but it's that I'm having trouble actually separating this word from this word, and therefore, there are chunks that feel like one big long word, that they're actually made up of four or five words.

I think there's a piece of slowing down, but then also, forcing yourself to use over-diction to clarify your words. That'll help a lot too, more so than you think, because it will help clean up those little spaces in between the words to then provide me with a little more, like, OK, I'm with you every single step of the way, if that makes sense.

So if you are going to do any retaking of videos, try really hard to really tighten up the way that you say the words, in addition to slowing down a little bit. I think that'll help people.

**ELIZABETH**

I think if you do that, that'll inherently help you slow down, because you're going to think about each word at a time.

**CHOE:**

I like the use of pictures here. It's really helpful, because this is an instance where we just don't have access to shoot any of this. I would play around with, in general, zooming in and out, when you're doing long takes.

I forgot to mention this, but I thought that was a really nice thing that Yuliya did in her video, was-- because we had talked about this last week-- how to clean up some of the gaps-- and

she does some nice work with cutting into, just like her hand drawing the fractals, and I think that, in general, people can take more advantage of that technique.

Oh. So here you're cutting in between closeups, but this is another thing with the iTrace, where in the first scene you're on the left, and on the second scene, you're on the right, and you're also not in the same 3D plane of field as you were before. So in the previous scene, you were close to the bench, and here, did you scoot up forward? So it's not terrible-- it's not like the end of the world or anything, but it's, like, a little jarring, and I guess I'm subconsciously taking time to adjust my sense of space and where you are when that cut happens. I don't necessarily think you have to re-shoot it, but I would either-- let's watch it.

**AUDIENCE:** And they had no prior experience. Now, why is it so? Strong increases in brain waves were noticed, and many have theorized that this enables the body to effectively heat the center as well as distribute it to the extremities.

**ELIZABETH** Is there a B-roll that you could use there? Because I think that's a really good opportunity to--  
**CHOE:** it's a key point that you're connecting what someone is doing with their mind, and how that's legitimately connecting to the rest of their body.

**AUDIENCE:** [INAUDIBLE].

**ELIZABETH** Could you even just use pictures of the brain, and then, like, the human body? Again, this is a  
**CHOE:** really hard thing to visualize, and I know you're not working with a ton of resources, but I think that's an opportunity to maybe try voiceover with the technique that Jamie was talking about, because it's such a crucial bit to the video, actually. That's where you're actually tying the science into something that seems a little pseudo science.

**AUDIENCE:** Keeping that in mind, as you watch your video-- and whoever's talking over with you, really connecting it and grounding it in the real science too. Because I liked your furnace metaphor, but then I was distracted by the burning exploding boxes, and if I've never heard of mitochondria before, or cellular respiration type things, that wouldn't be very distanced. I would think explosions rather than this is grounded in my biology type things. And so maybe think of places, where you can include images like the circulatory system, things like that. Just, like, keep grounding it.

**AUDIENCE:** When you cut from the guy doing meditation to you sitting cross-legged, was that purposeful?

**AUDIENCE:** Yes. I'm supposed to be doing meditation.

**AUDIENCE:** OK. That's what I thought. Because I was like, not 100% sure, but I was pretty sure that was a choice that you made. There's no comment. I just had a question.

**ELIZABETH** Any other thoughts for David?

**CHOE:**

So you guys want to do Google Docs versus just talking one on one with people? Is that the consensus?

**AUDIENCE:** Could we do both?

**ELIZABETH** Yeah. You can totally do both. So the rest of class time is for feedback for each other, and this  
**CHOE:** is a super, super crucial, critical part of the production process.

During the break, I will post a link onto the Tumblr that has all the Google Docs that I will finish making for everyone. So for example, Yuliya, your two commenters are Joshua and PJ. So Josh and PJ, just go into your corresponding page, and on the time code, just leave your comments. I will comment on everyone's rough cuts as well. And again, don't worry if you're repeating the same remarks as other people are doing.

How about we spend-- after the break-- doing the Google Docs stuff, and then whenever you guys finish, I guess, in the order of people finishing, group up, and give one on one feedback as well. And we can help facilitate that too. Does that sound good to everyone?

The hardest part is over. The hardest part is just getting the first cut. It's getting the first script out there. And hopefully, moving forward, going to Thursday, it'll be easier.