Creating a Gas Chromatography Animation
MP4 Video Transcript

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Event: CHEO Discipline Panel Faculty Professional Development Workshop – By Design: Taking ALL Allied Health Students Across the Finish Line
Date: May 15, 2015

So yes, and since I was in the middle of a few other things, I told Sue, why don't you just come up with a title for me. And so, Enhancing student understanding by developing animation of the dynamic process showing how polar and nonpolar molecules are physically separated on a gas chromatograph column. Or another way of putting it is, How I made a chemistry animation. So whichever one you prefer.

And so I just want to go through the ins and outs of what the goal was, how I went about doing it, what the ultimate result was, and then, areas of improvement that I see. So now that I have this extra time on my hands during the summer, hopefully get things changed around. So first off, what did I use for animation?

Well, I didn't use something that was a dedicated piece of animation software. I ended up using Camtasia, which I had already been using and quite a number of other faculty out there in the educational system use for doing screencasts in order to capture their lectures, sometimes both a combination of video and audio. What I really like about it is that it's a really easy to use interface, while at the same time, it has a lot of good post-edit capabilities that aren't too hard to master after you've gotten some practice.

So in addition to the editing capabilities, you also have the ability to add visual properties or, in other words, animations to any particular media objects that you put onto your screen. And so I really explored is, can I use this rather basic form of animation, to get across the point that I want to convey to the students who have a hard time visualizing how molecules move across a gas chromatography column. And like I said, easy to use for the beginner, without all the bells and whistles that come with, say, for example, something that might come from Adobe.

So where do I begin? So I volunteered to do this, and once I sat back and thought about it, I said, OK, no need to reinvent the wheel, start from scratch. I'm not going to go too extensively into graphics. Number one, I'm not the best artist in the world, and there's actually a lot of stuff, data, already out there on the internet. So like I was saying to Paul yesterday, after being inspired with all the Creative Commons content that's out there-- you're actually able to find a very large depository of images, be it from Google or from Flickr, couple other options there. But as long as it was Creative Commons, I grabbed it and put it into my bin of images that I used to construct this GC animation.

And then, I took a look at what others had done, because there are a few YouTube videos out there, folks that had shown how gas chromatography works. Some of them are really elaborate with their graphics, but not so elaborate with their animations, or vice versa. So it gave me an idea of what has been done, what hasn't been done, and what approach do I want to use to try to get this conveyed to the students.

So in a nutshell, I decided, OK, don't make it too elaborate. And for those who are familiar with this acronym, Keep It Simple Stupid, so that was the approach there. If I keep it simple, not too elaborate, there'll be less opportunity for confusion with students, and they can get the main point across. They don't have to be interested in all the intricate details. As long as they get the main concepts of what we want them to get from this lab, mission accomplished.

So what do I want the animation to show? So conceptually, what do I want to give them an idea of? Well, first off, the overall setup. What are the components of the gas chromatograph? What parts are actually involved in-- what parts are used in the actual lab that they are conducting remotely in this NANSLO lab?

Secondly, can I also, at the same time, go down to the microscopic or nanoscopic view, down into the level of molecules, and actually show from an animation point not exactly how they move, but theoretically, what's supposed to be happening as molecules move through the instrumentation? And how do I show that the molecules are moving at different rates? So how can I show, over the course of this chromatography column, that due to interactions with the column, some molecules are going through it rather slowly, others are going through it rather quickly?

So I used Camtasia for the animation, like I said. I wasn't, again, too elaborate with how the animation was done. But just so you know from what Camtasia is capable of, I can move in the x, y, or z-axis. I can actually show the molecules moving on both a large scale, like the GC column zoomed out, and perhaps a small portion of it zoomed in. So people can see how these animated molecules move around.

One challenge that I found, though, was that if I'm going to show two different perspectives, zoomed out and one zoomed in, everything had to be timed out just right in terms of as soon as I get to the zoomed-in portion of my animation, I have to make sure that the position of them is correct, the timing of where they're moving through the zoomed-in portion still coincides with that zoomed-out view. So that was a little bit of a challenge, in and of itself.

So this, right here, is just a quick little snippet to show-- I believe it might or might not, we'll see-- a short little video just showing you what Camtasia is capable of in terms of animation, on a very basic scale. So here, I have our logo for our college, just because I'm biased. And I went ahead and just showed how you can change around the x position, you can change around the y position. You can either do this by dragging the actual object with your mouse or you can actually enter in numerical data, if you wish to, on the pane on the left-hand side. Either is acceptable.

I started off using the mouse. But then, as I was trying to time things out in terms of those two scales, I actually had to use the numerical one, to make sure everything was positioned just right. You can also rotate x, y, z, with regards to rotation-- not so much something I used for this time around, but it is something you can do if you're wondering what else Camtasia is capable of.

I'm trying to remember what else I had on here. So I see rotation. Why rotation? Oh, I'm showing how you construct an animation.

So what you actually do for an animation is you tell Camtasia where you want the end of your motion to be at, add that animation in, and it will put this arrow in place where it shows, hey, the animation is going to begin at the beginning of the arrow, and at the end of the arrow is that final position that I told it it was going to be at.

And you have two options for how the animation is going to move, or flow. There is one way that involves easing, and not easing. No easing means just it goes from point A to point B at the same travel rate. To ease in and out of it means to start off

quickly out of the gate, and then, it actually gets up to speed, and then, it actually gradually slows down as it gets down toward the end of the path.

So some advantages there based on what am I trying to convey motion-wise. So I believe I kept everything to non-easing, just because I didn't need things slapping around, back and forth a whole bunch, and make it seem like a pinball game in slow motion.

So here's my first iteration. I wish I would have had more time to construct this, but with the pilot for this lab being done in a couple weeks, I had to get down and dirty and actually make this as quick as I could. So again, just showing the overall construction of the whole instrument, I zoomed down to the individual column itself, gave some information about what the column consisted of, this nonpolar compound that it's packed with.

I show, hey, here's this polar, nonpolar molecule. We'll pass through it, and we're going to have them start off, out of the gate, in the column at pretty much the same time, because they have similar boiling points. And my first approach involving just the nonpolar and polar molecules bunched up together-- And when I first sent this out, I got some good feedback on it from the other Dan, Colorado Dan Branan, who said, this is a good place to start, but things don't actually flow nice and smoothly all the way through. Could you, perhaps, show them bouncing off the column and actually the nonpolar ones traveling much faster through-- or sorry, the polar ones passing through much quicker and the nonpolar ones actually slightly sticking and slowing down?

And then, I don't know whether you'll notice that here, with the final rev with this. But he said, oh, and we don't need to show the carrier gas, because there's no actual inert gas that's hooked up to our GC units that we use for the NANSLO lab. These actually run off of just pure air from the surroundings, which is a big advantage to using that system.

So the same type of beginning to the animation, but now, when I go into the zoom-in on the actual column itself, now, I'm not going to actually show things-- ooh, I've got something to fix there. It looks like it jumped-- show what the column was made up of. But now, when I show the polar, nonpolar molecules passing through the column, now, I'm going to show a lot more motion and interaction with the contents

of the column themselves and the polar or nonpolar molecules actually coming back and forth across from each other.

So here's probably a better representation of what, in reality, is actually happening down the column. Maybe there are a few molecules in there that are easing in and out. I'll have to check that.

[LAUGHTER]

I tried. I tried. So this actually ended up being the version that I did upload to YouTube, provided the link to. And this was part of the pre-laboratory assignment that the students did, prior to actually doing the NANSLO lab themselves. So at least conceptually, they could understand how some molecules are retained in the column longer, because they interact with the contents of the column more than something that might have a quite different polarity to the contents of the column.

So that's what I ended up posting up. But anyway, I don't know whether you could tell, but there was no sound to any of this. And that was the very first feedback that I got from my students and the other students who took it from other colleges, was I thought there was something wrong with the sound on my computer. I didn't know I was going to watch a silent movie. Stuff like that.

So I was like, yeah, I should probably put a little maybe background music in there or, even better yet, couple the background music with actual narration, just not too elaborate, again, just something very simplified explaining what the setup is, what they're looking at, what the animation is trying to convey. I know the animation can convey a little bit enough, in and of itself, as long as they read up on the concept beforehand. But if I were to show this to somebody who hadn't done any reading whatsoever, and probably just watched the video, which, let's face it, that could happen, then having some narration on top of that would definitely help out with their level of understanding.

I have something scripted, so I would like to do a version 3.0 with this over this summer and get that as a revamped version, before this grant runs out. And then, maybe, because I am, on the side, learning some more about Adobe After Effects, do something that's maybe a little more elaborate with the way that the motion is animated. But that would definitely be a long-term goal, that if I had a week to myself to actually sit down and go through After Effects and spend some time with it to get familiar, I'm sure I could take the animation to the next level. Which not only

would benefit this lab, but other labs in the future, where we could possibly see animations enhancing that learning experience of taking something that's beyond text on a page, and put something that's really abstract and an airplane black box, and turn it into something that's a concept that actually the student can digest and doesn't seem so difficult, in the first place.

Because I know what it's like. As a student myself, I took analytical chemistry. I felt like you were just, hey, you inject the sample, in here, and this stuff spits out on the other end. And I analyze it, and yet, I had no idea what happened in the middle. And so this does a good job of, at least, being a starting point to start to understand that. So thank you very much.