Introduction to Research
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Lecture – 19
How to Make a Technical Presentation

Hello, in this class, we will look at how to make a technical presentation. So, I will begin, first, by telling you that there is no specific single way in which you make a technical presentation. What I am going to do, through this class, is show you what are the several of the best practices, so to speak, in a how to make a technical presentation, and also, several of the mistakes that have commonly seen in presentations. So, these are things that I will highlight to you and so that would help you make your talk better. This is especially true if you are a first time presenter of technical content, there are common mistakes that you make, and I hope that this talk will help you make your first or initial presentations better than what they would be if you had no idea of what was involved okay.

So, this is a talk about talks so to speak and so that's how I am going to present it. So, many of the aspects that I am going to tell you, I am also going to show you that even in this talk we are following it. So, one of the aspects that we need to focus on is time; this is a fifty-minute talk - intended as a fifty-minute single talk on how to make a presentation, and we will see how well we pace ourselves through this talk okay. So, that is the way we will go about it.

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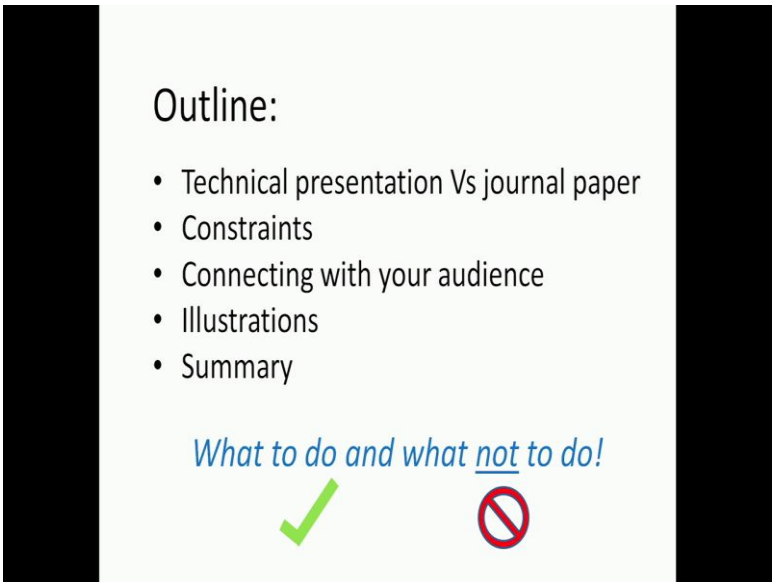

So, first thing we do is a good practice is to have an outline, and which is what we have here - an outline for our talk. And this outline helps us accomplish several things. Our listeners or viewers or, you know, people who are attending our talk get an idea of what are all the major aspects that we are going to cover in the talk. You can see here there are five major aspects that are listed and so that's what we are going to cover. The audience gets a sense of, you know, what are things that they need to focus on. So, for different people in the audience, there may be a particular aspect of your talk that is more interesting, and so they may pay more attention to that aspect of your talk relative to the rest of it. So, an outline helps them understand that.

So, for example, here we have five items listed here. The first is a technical presentation versus a journal paper; this is interesting for us to know, because these are activities that most people in the technical field do, and there are some variations and differences between them, and so that's something we will look at. Constraints is the next item we will look at; that's sort of the boundary, so to speak, of a technical talk. What are things that sort of define what you should be trying to do, so that's the constraints. The most important thing perhaps then is connecting with your audience, because that's what we do. There is an audience sitting in front of you, they have to feel comfortable with the material you are presenting, and that's the purpose of your presentation, and so you need to connect with them; so, that's something that I will highlight.

An important aspect of any talk is illustrations, and we all routinely put up illustrations. What I am going to show you is that there are varieties of illustrations that we can put up, that we do put up; and if you are aware of it, you can choose which is the illustration - type of illustration - that you wish to put up, and what are kinds of details that you need to look at. And finally, we will do a summary, which is the good thing to do for any talk, because a towards the end of the talk, it's nice to show in just may be a one slide, one slide is pretty much all you should put up, maximum two slides, but ideally one slide in which you sort of summarize the key aspects of your talk, so that people who finish listening to your talk are able to, you know, quickly get an understanding of how various things relate to each other. So, this is what we will do.

And throughout the talk, the idea is to tell you what to do and what not to do; so, that's what I will highlight through this talk. And just to emphasis it further, whatever it is that is worth doing, I will put a tick mark like this on that slide which would tell you that that's a good thing do; good practice to do. And where there is something that you shouldn't be doing, I will put this symbol which basically indicates no, and so that when you review this material, you will have a quick understanding of what is the better practice to do and what is something that you need to avoid okay.

So, with this we will start. So, by the way, one of the good practices to do is to have this outline slide, and to flash it a few times through your talk, so that people can again, you know, recalibrate themselves with respect to where you are in your talk, and so that's what we will do here.

You can see here, we are now going to focus on the first point, which is technical presentation versus journal paper. And based on the software you use, based on the package you use for making your presentations, there are different ways in which you can incorporate or put in your outline slide with the rest of your talk. Right now, I am just going to flash the slide a few times, that helps us to keep, you know, some kind of a frame work through which you are proceeding with your talk.

So, the first point, we will look at is technical presentation versus a journal paper, because both of these are activities that researchers do, and, typically, we are using the same kind of data. You are working in a lab, you are generating data, and sometimes you

make a technical presentation using that data, sometimes you publish it a journal. So, we just see what is the difference between them.

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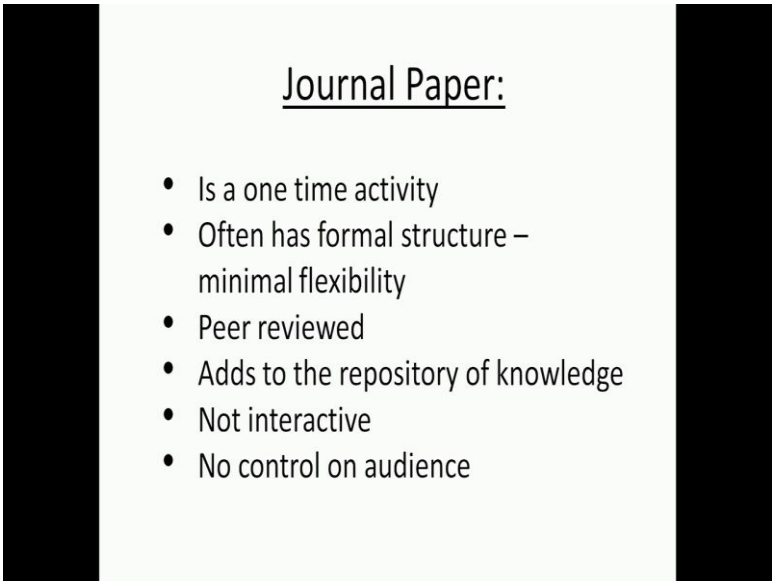

So, in the journal paper, some of the aspects that makes a journal paper activity unique relative to a technical presentation are listed here. So, the first is that it's a one-time activity with respect to that data. So, with respect to that body of the data it's a one-time activity; you send it to a journal; you are supposed to sign an agreement saying that you have not published it anywhere else, they look at it okay. And it often has a formal structure; there's very minimal flexibility in it, because the journal will have some guidelines and some constraints saying it cannot be more than so many words or not more than so many pages; there may be restrictions on how many figures you can include and so on; and there is a certain style that they will expect their articles to be presented in - certain aspects of the information should be presented first, some aspect should be presented next and so on. So, there is usually a very rigid structure that you have to follow with respect to every specific journal. So, you should, when you decide to publish you have to contact the journal, get their style and then follow that style.

The other important aspect of a journal paper is that it is peer reviewed. Okay so, peer reviewed means it has been looked at by at least two or three other experts in the field - independent experts - and they agree that what your presenting is something unique, is something new, is something valuable to the field, and only then it ends up being a

journal paper. So, it is peer review. The general idea of a journal paper is that it adds to the repository of knowledge in the field, and therefore, it's something that goes there and joins the body of information that people can look at for several years. In fact, journal papers are around, I mean, and you know, a permanent record of what work has been done. So, you look up papers which are, you know, one hundred years old which are classic papers in that field and they are still available for us to see.

May be the two other major things that you need to understand about a journal paper are these last two points here - that it is not interactive and you have no control on audience. It's not interactive because you write it and you leave it out there, people read it at their own time, you are not present when they read it. So, if they have doubts they cannot just like that ask you, and that's part of the reason why it has such a rigid structure to it, and so that you sort of cover all the aspects so that person reading it can independently read it. So, it's not interactive; so, that something you should aware of. And you have no control on audience; you could have a high school student reading it, you could have a undergraduate student reading it, a postgraduate student reading it, a post doc reading it, a professor reading it or even a senior scientist reading it. So, you have no control, so you have to keep it reasonably complete, you have to sort of decide for whom you are pitching the paper and do it okay.

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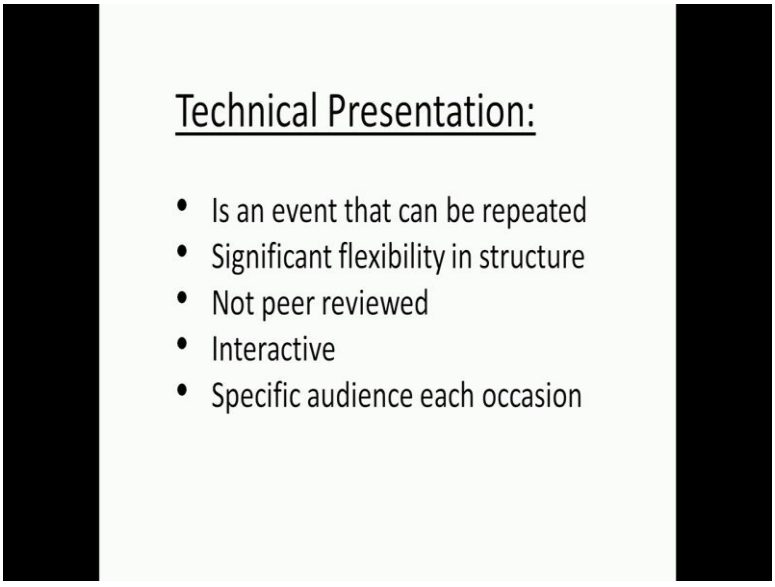

Technical presentation is quite a bit different, even though it's pretty much the same work that you have done in the lab, which you are now presenting as part of a technical presentation. First and most important thing about it is that it is an event. So, it happens at a certain instant of time, there are people around you, you are present, and then, you make the presentation. So, it's an event and that is repeated. So, today you may make a presentation in your group, tomorrow you may make a presentation in a conference, a few days later you may visit a university and make a presentation to an allied group there, you may go to a funding agency make a presentation and so on. So, there is a lot of possibilities of repetition and the audience can change. So, your presentation changes based on your audience.

There is significant flexibility in the structure because you decide how you want to present it based on the audience that is present. You may highlight specific, you know, may be there are three slides that you want to highlight for one audience, you may add couple more slides when you present it to another audience, you may completely change the format of presentation when you go to a third audience. So, there's a lot of flexibility. It's not peer reviewed in general, any time you present it, I mean, you are just there, you are discussing with people in front of you, and you are presenting it. There are no three experts who look at it first before you come and present it in front of the audience; so, there is no peer review there.

It's typically very interactive; there are people who will ask you questions during the presentation, they may ask you questions after the presentation and so on. So, you have to mentally prepared for the fact that it is interactive. And as I mentioned, there is a specific audience in each occasion. So, you have to be prepared for the audience and pitch it at that audience level okay, so that they stay with you. So, these are the main aspects; we will look at them again as we go along and keep track of … Some other slides will help you relate to some of these aspects as we go along.

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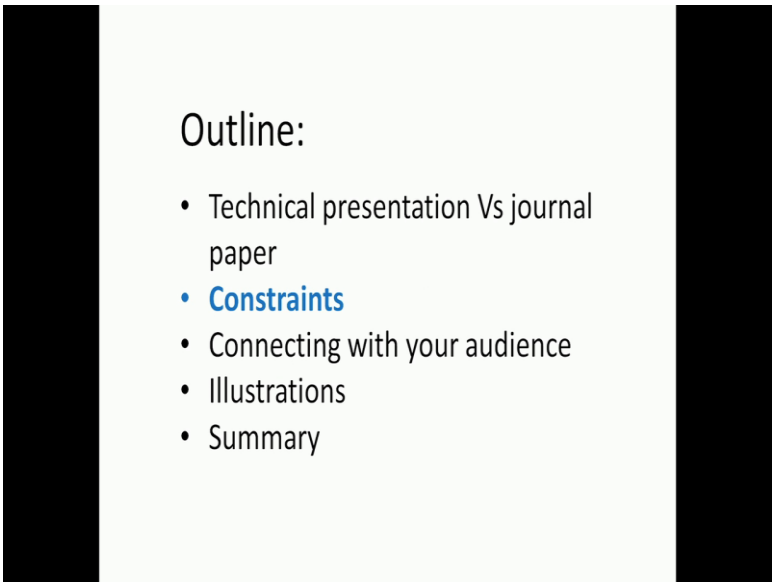

So, we are back to our outline now - just to show you that we have completed the first topic that we wanted to look at which is technical presentation versus a journal article. As I mentioned, our intention is to do this over fifty minutes, we have five topics here: one, two, three, four and five. So, at first glance, one way to pace ourselves is to set about ten minutes for each of these topics, and as you can see, we have just about completed ten minutes, we have looked at that first topic. The summary may not take ten minutes; so, we can allow us ourselves a little extra time on these other three topics. Another way to pitch your self is to also look at the number of slides but that we will look in just a minute, but I think with respect to topics is a better way to pitch ourselves, pace ourselves, and somewhere here, we should be in the mid-way mark okay.

So, now, we will look at constraints, which includes the duration, which we will see in just a moment.

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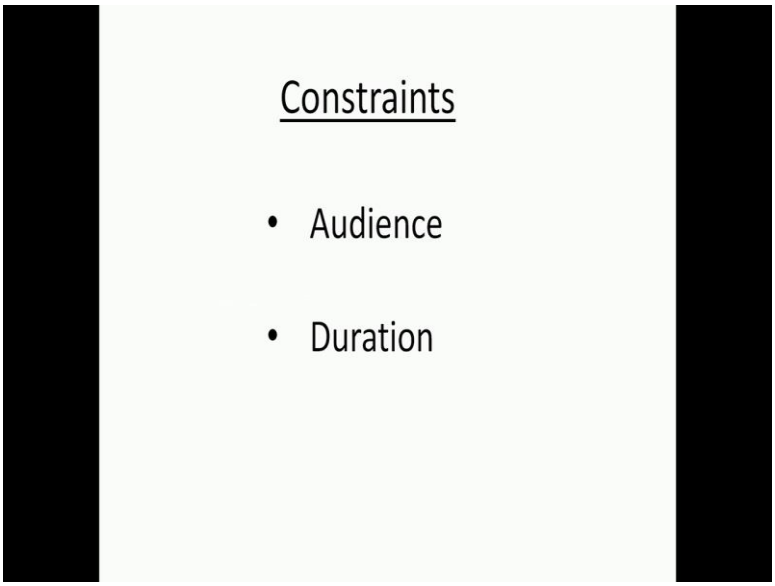

There are really two constraints for a technical talk: the first is audience and the second is the duration okay. So, these are two things that we will look at and highlight a little bit more.

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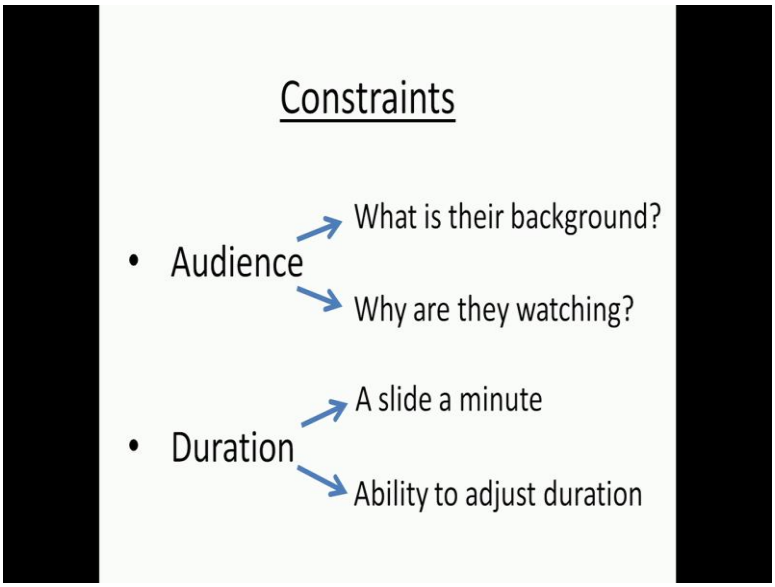

So, the most important thing with respect to the audience is - what is their background? Okay so, you are a technical researcher, you are a researcher in a lab, you are in a university, you go to… maybe you go to your high school when you visit your home and your school teachers may ask you to make a presentation to say the tenth-grade students

or tenth standard students in your school. So, you should go ahead and make a presentation there. So, that audience is very different; they are interested in knowing what are new things in science that people look at and also get a sense, and they should be able to relate it to aspects that they are already aware of. So, you cannot just make the same presentation that you make in a conference to your school audience. So, you may have just returned from a conference, you have a presentation ready from the conference, you cannot just directly show that to your school. You have to make enough modifications, you have to ensure that there is enough time to explain technical terms if necessary, enough time to highlight the kinds of things that the audience may be interested in. So, it's very important to understand what their background is, so that you can pitch the talk at the right level okay.

The other thing that you need to understand with respect to the audience is - why are they watching? So, if it is a funding agency that's watching your presentation, then you have to highlight what is unique, that new aspect that you are going to study - which is what you need to highlight. If it is a conference, again you have to highlight after doing some bit of background presentation, you have to highlight what are the new results that you have got which are, may be, different from what other people have obtained or highlight a new aspect of that area of work which other people have not explored; so that's something that you need to highlight. As I mentioned, if it is your high school, then you need to highlight those general concepts that are interesting in that field which students can relate to, and which they can be enthused by, so that they may also consider a career in technical activities okay. So, these are the various important aspects that you need to keep in mind when you look at an audience, and try to see what it is that… how you need to reposition your talk with respect to that audience.

The other important aspect, as I mentioned, which forms part of the constraints which sets, you know, the framework within which we make the presentation is the duration. So, keeping track of duration and paying importance, showing importance, to time is a very valuable characteristic that is expected of any presenter okay. So, it conveys that you value the time of the audience who are listening there, sitting there and listening to your talk; it also conveys that you value your own time. So, it's very important that you, when you are called to give a talk, to discuss with the person who is your host to figure out how much time you have for your talk, and prepare your talk accordingly. So, this is

a part of the customization of your talk for the audience. So, you have to customize it for the audience, so that you pitch it at the right level; you have to customize it for the occasion because you have to pitch it within that time, you have to stay within that time. So, these are two important constraints that you need to keep track of. You cannot, it is not appropriate for you to just show up there and start talking indefinitely. So, you have to really pay attention to it, give importance to this aspect.

So, one general rule you can use - rule of thumb - is a slide a minute; that's a very reasonable starting point. But actually, if you get more and more confident with what you are presenting, and you have a more valuable, I mean, important things to say about the specific aspects of your work, you can actually have less number slides and more number of minutes; then you can actually stay on a slide, allow the audience to absorb what is on the slide, discuss the slide in greater detail. It is not a great idea to keep flashing slides very fast. So, this is one thing that we need to keep in mind. So, slide a minute is the good idea. So, in this case, for example, it's a fifty-minute talk, we have about thirty-five slides. So, that is what we will work towards - fifty-minute talk and thirty-five slides we have. So, we have more than a minute per slide, but I am also looking at it from other perspective, that we have five topics, and we have fifty minutes, so we are keeping track of that 10 minutes by topic kind of constraints.

The other very nice thing that a presenter should learn over the years of the presentation, which you should get, you know, prepare for mentally is that you have to have the ability to adjust the duration of your talk okay. So, this means, first of all, you have to be confident about the content of your talk. The most important aspect of all your work is your content of your presentation, all the other things help you make it a make it, present the material correctly, appropriately, and so that the audience can absorb it, but content is most important. The more confident you are about your work, you will be able to adjust the duration of your talk very easily without much trouble okay.

So, for example, you arrive at some place where originally, they told you that you are supposed to give a forty-minute talk. And then, for some reason, there is some other aspects, may be there are technical glitches in the system before you get started with your talk, and suddenly your down to 25 minutes, and it turns out that your audience is unable to extend the closing time of the talk, the hall is required for something else, so you have only 25 minutes. So, you prepare for 40 minute talk, you now only have 25

minutes; you should be able to comfortably reassemble your talk as you speak, reassess your talk, and represent your talk, so that in 25 minutes you have conveyed the essence of your work.

So, ideally, if you know your work very well, you should be able to present it in 5 minutes, you should be able to present it in 20 minutes, you should be able to present it in one hour. Naturally, all the information that you present in one hour, all that information you will not be able to present in 5 minutes or 20 minutes, but you should know what are the key things that you need to highlight. So, if it's a 5 minute talk, you should be able to pick 2 slides, may be 3 slides which capture the most important things of your talk, present it, and be done. If there's a 20 minute talk, may be take 12 slides and complete your talk in about 20 minutes. If you have a 50 minute or one hour talk, you can, you have much greater of flexibility, you can look at 30, 35 slides. So, but it's important to remember that when you suddenly move from a one hour talk to a 5-minute talk, you shouldn't take the same 50 slides, and keep hitting enter very fast, so that you flash all the slides. It's very important that the people understand what you are trying to say and quantity of information you provide is not as important as the ability of the audience to accept that information.

So, I will give you a simple example. I can take a book, many people - many first-time presenters - make this mistake, they try to show too much and that's not a great idea. And a simple way you can understand that is if I take a book, and I simply flash the pages of the book in front of you, I just, you know, twirl the pages of the book in front of you; I cannot just finish of by saying - look, I showed you the entire book, now you know the whole subject right; it doesn't work that way. You have to have time with each piece of data, you have to have time absorb the data, understand the how the data relates to something that happened before, and something that's you are going to present next and so on. So, you have to give audience time with the information you are presenting, and therefore, you have to keep a certain a reasonable number of slides that the audience can see okay. So, these are the major constraints. So, we are done now with constraints that I wanted to highlight.

We are back to our outline slide. We are doing quite well with respect to time; we spent about 7 minutes or so, on our previous topic on constraints. So, we still have about 32 to

33 minutes left on our talk, so that gives us fair bit of time to look at connecting with our audience and illustrations okay. These are two important aspects of a talk.

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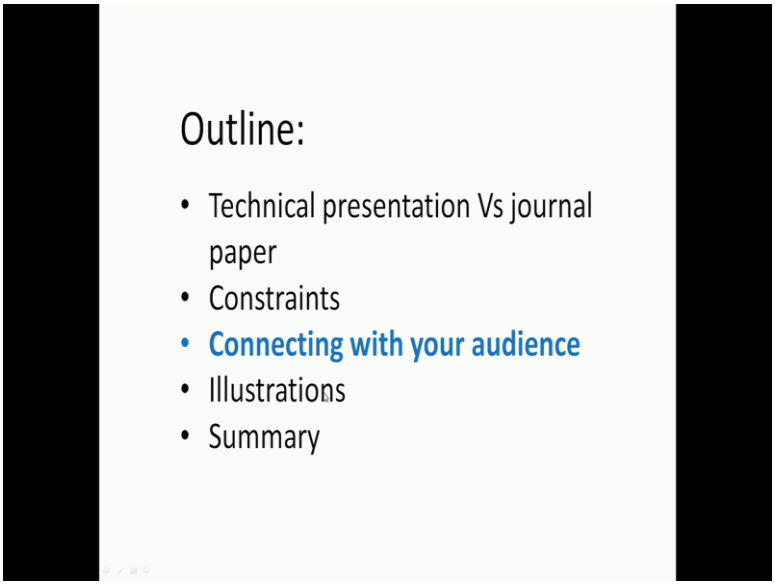

So, we will now look at connecting with your audience. In particular, I will try to highlight aspects that you should avoid, so that it helps you connect to the audience better. So, how busy is your slide? It's a very important aspect of how well you can connect with your audience okay.

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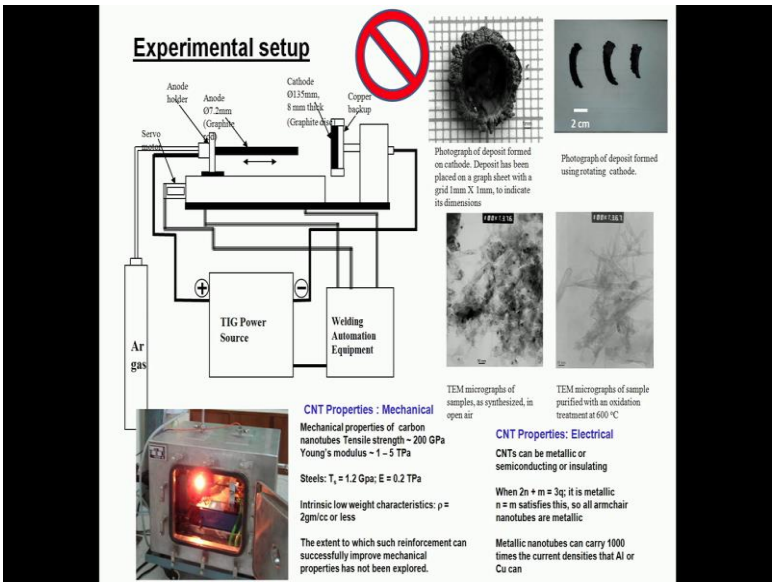

So, we will look at that. Take a look at this slide. It's from a work that I have done. I have deliberately made the slide very busy; primarily to highlight that this is not the way to do it. You can see the no sign that is out here. So, what do we have here? We have here the sketch of an experimental set up; it's all well abled and so on; we have a photograph here which is part of this experimental set up, part of this region of this experimental setup. Then we have some photograph of a sample produced, photograph of another sample produced, electron micrographs of these two samples. And then, there is something on mechanical properties of the material synthesized, and we have properties of electrical properties of the material synthesized. This is a very busy graph; a very busy slide. There are way too many things on this slide; although, in principle, you can put so many things on the slide.

What you need to understand is just because you have a slide it does not mean you need to fill it from end to end; open space in the slide is particularity useful, it helps people focus on something that you are trying to show, it helps them understand that concept better. So, just filling it with too much material is very similar to the previous analogy I showed you, where I am just flashing the pages of a book in front of you; it does not work. So, for example, the same slide that I am showing you here could have for easily been four or five slides, there could have been one or two slides on just the experimental setup, may be a slide on the samples produced, slide on characterizing the samples, the electron microscopy of the samples, and then, a couple of slides on - one on the mechanical properties, one on the electrical properties. And these would have to be reorganized, so that they form a certain flow in the information you present. So, these four or five slides of information here; it's not a great idea to show so much in a single slide. So, you should understand and spread it out across a few slides, so that people can focus on one - a specific concept - in each slide, accept it, understand it, and reflect on it, before they see the next slide.

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Judicious use of special effects okay; something that I want to touch upon because I think first time presenters make this mistake, they put in… much of the software that we have enables us to use a lot of special effects. So, I will just show you one quick slide just to…I mean I have exaggerated it just to show you all sorts of special effects that can be thrown in into a slide. Please take a look at this.

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I will just repeat it for you. So, this slide has a lot of special effects. I think first time presenters may be tempted by this idea that there are lot of special effects available in

software which you can throw into your slide and so on. In a technical presentation, it distracts from the presentation. So, in a technical presentation, the focus of the presentation should be the content - the technical content - that you are presenting; special effects tend to distract from it. So, ideally, it's a good idea to avoid putting in too many special effects; some special effects may add value to your slide because they may highlight something interesting that you have got there. So, flashing some information may be a good idea, but you have to use this very judiciously, pick only those specific things that you want to use and use them.

Also, you can see on the slide, I have used few different font and so there is lot of different font that is available in the software. So, there is a tendency to try out various fonts, and various fonts in different slides; that is also not a good idea; please stick to standard, you know, one or two fonts, and then, use them through your slides. So, judicious use of special effects is a good idea; it's a better practice to do and so that's something that I wanted to highlight.

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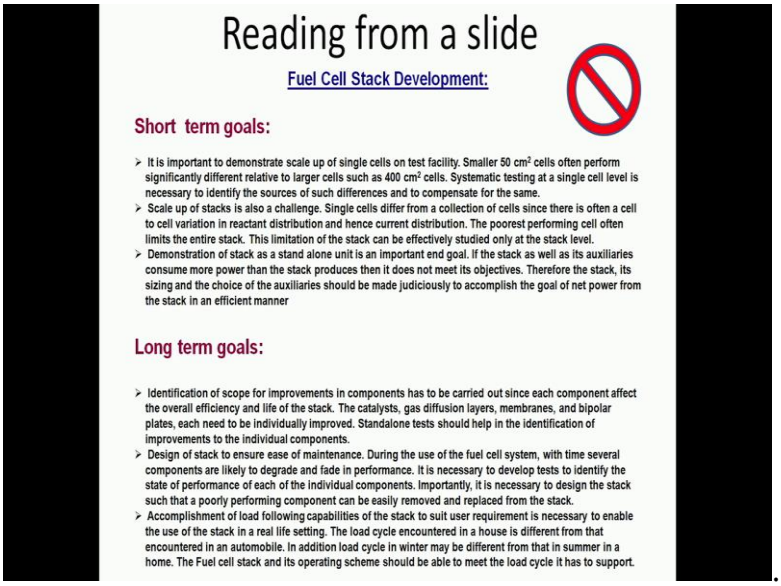

Reading from a slide okay. Again, this is what I have put up here is a slide that is not the right way to do it. So, you see the no sign there. Again, first time presenters, just to be sure that they are not missing out on a point, have this tendency to write everything that they want say on the slide, and then just read the slide, and that's not a great idea. So, first of all, when you put everything on a slide, the size of the font becomes very small.

So, it's not at all readable for somebody who is even sitting, you know, 10 meters away from the slide. And then, it's very monotonous; if you just look down on the slide or look at the slide and not look at the audience, and just keep reading.

So, for example, if I simply read – it's important to demonstrate scale up of single cells on test facility. Smaller 50 centimeter square cells often perform significantly different relative to larger cells such as 400 centimeter square cells. Systematic testing at single cell level is necessary to identify the sources of such differences and to compensate for the same. Doing this, this would be a one way of presenting it, which we will just look down on this slide and you keep on reading it; that's not a good idea; it's a very poor way of presenting; it more or less ensures that you don't connect with your audience. All these are points that I am indicating with respect to connecting with your audience.

Important aspect of connecting with your audience is to look at your audience, face your audience, not face away from the audience. So, if you have a slide up on the wall, you should not be showing your back to the audience and only reading that slide; that's not a good practice. You should face the audience, you should look at them as you talk, and so, what is there on the slide should simply be pointers on what concept you need to talk about, and then you elaborate - you conversationally elaborate on that point. You should feel comfortable to conversationally elaborate on it. Don't worry about the exact words that you are using; if there's an error you can always correct it; you should conversationally elaborate on the point. You look at the audience. If you see them nodding and they understanding, you can look at their eyes, you get a sense of, you know, how well they are staying with you, if necessary you elaborate a point a little more, if you want you can speed up a little bit. So, these are things that you can do, and so, you need to do that.

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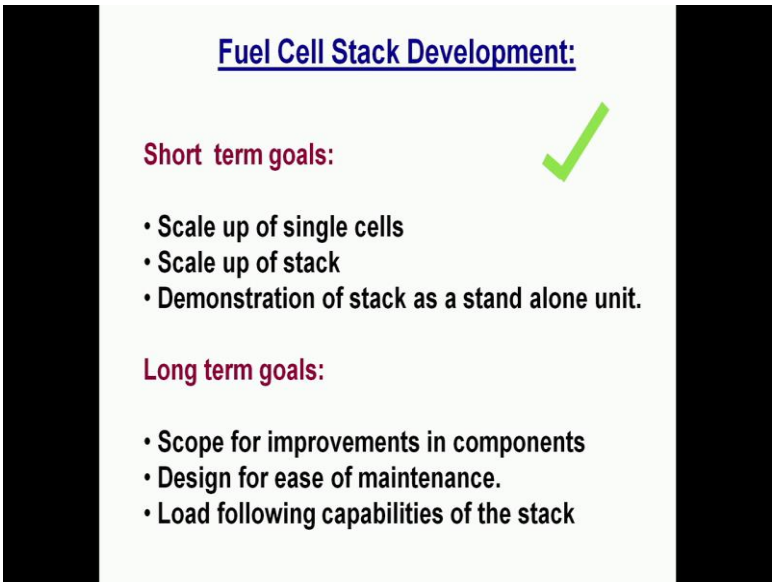

So, for example, a better way to present this exact same slide where it says, you know, fuel cells stack development - and that is an area I have work on - is to put up something like this. There are only some short-term goals that are presented, and then there is an another topic called long-term goals, and there are just three points on each of these under these headings. And so, that's very easy for somebody to look at and get an idea that those are three points that you are going to look at under short-term activities and then long-term activities - three points. And that just gives you a hint on what you want to talk about; so, you go ahead and talk about it. So, this the right way to do it; you can see the tick mark on it and that's a right way to go about it.

Right so, now we are on to our… we are halfway into our talk. Actually, we have sort of about completed 25 minutes for our talk. We are moving into the illustration section of our talk, which is a very important aspect about what you do in a talk, because most of our talk we have slides, there is some text, and there are some illustrations. So, that's the thing that we need to look at and we will do that.

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So, with respect to illustrations, there are two major aspects that we need to look at - the first is choosing the right type of illustration okay. So, what we will do in the next several slides is to look at different types of illustrations that you can put up and that itself is something that we need to be aware of. Because, sometimes, a software comes with a certain illustration - type of illustration - comes as an output and we simply use it; we don't apply too much thought on it, and I would like to alert you that you should apply some thought on it - on what kind of an illustration to put up. And then, the other important aspect is for every type of illustration that you put up, you have to pay attention to details. In the illustration, there are specific details that you should pay attention to. Many first-time presenters, many students who present - make presentations - often miss out on important details that need to be looked at. And if you look at those details your presentation automatically looks a lot better okay. So, what do we mean by choosing right type of illustration. So, in the slides that follow both these points I will touch up on and highlight specific aspects in each of those slides.

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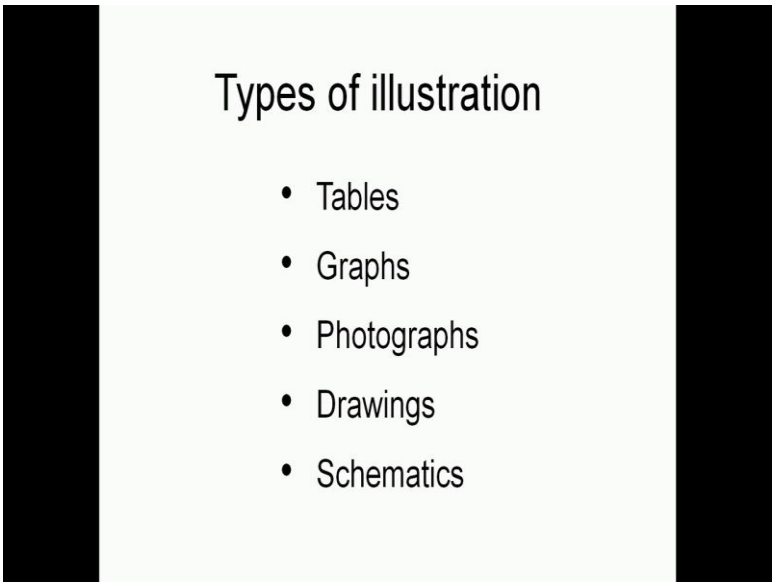

So, for example, there are tables; different type of illustrations are all of these things that I am listing here. There are tables; you can have a table which shows different data for different, different samples. There are graphs; you can draw graphs with the data that you have and graphs again there are wide range of data - you can have a line plot, you can have, you know, just a scatter plot, you can draw pie chart, lot of different things you can do with graphs. There are photographs - actual experimental equipment you photograph and you put it up; so, that is something that you do. You can make drawings; drawings of an experimental setup or drawing of a flow that is happening etcetera. You can have schematic; the schematic of some system that your putting together. So, lot of different things you can do, that you have choice of.

Now, the point to remember or the point to keep in mind is that when you are trying to make a presentation, you are trying to convey some information to the audience. You want to do this effectively; you want this when you show something and you are trying to make a point, the illustration should help you make that point; so, that is the purpose of saying that you need to select the right kind of illustration. Whatever illustration you put up should help the audience understand the point that you are trying to say okay, and ideally agree with you, but even if they have a disagreement, they should able to look at the plot and then discuss with you what is that they are disagreeing with okay.

So, for example, if you simply have, you know, you want to show that a wide range of samples have been studied, and specific, you know, values have been obtained from these samples, may be a table is fine; may be a table may be able to convey that information very well. On the other hand, if you want to convey that, you know, in the range of experiments that you have done, a certain parameter has a low value for some set of experimental conditions, then it reaches a maximum, and then it comes down again to a lower value, and the purpose of your presentation is to highlight that there is a maximum for that parameter; in that case, a table is a very poor way to present it. A table does not very nicely convey that there is a maximum; you cannot just a look at a string of numbers, and then, mentally make up in your mind that there is a maximum. So, it helps to then draw the graph; so that you can see immediately that, you know, there is a difference between what can be shown on a table, and what can be shown on a graph. Even though it is your experiment, it's the same set of numbers that you have and so on, but definitely to show certain features the graph is much better than a table is. So, similarly for photographs and drawing; photographs sometimes show you the actual object, so we will see that, but there is a choice. So, you have to make that choice. I will highlight that a little bit more in our next few slides.

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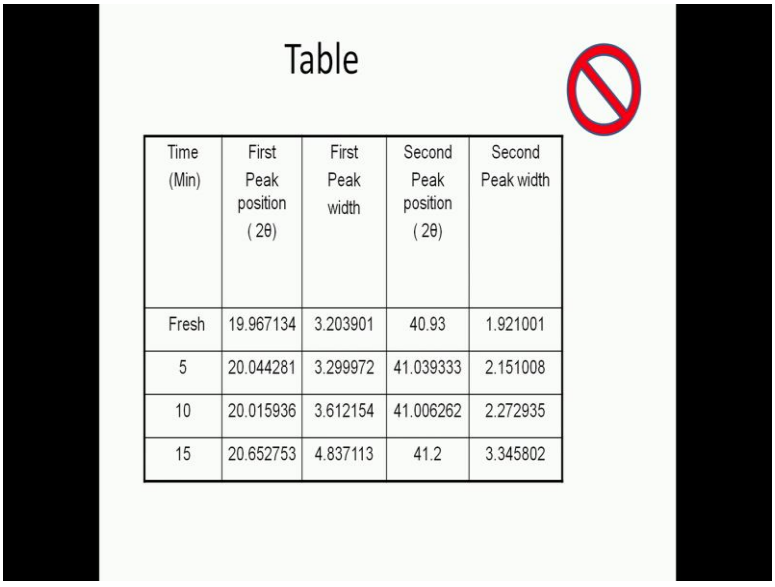

Time (Min)	First Peak position (2θ)	First Peak width	Second Peak position (2θ)	Second Peak width
Fresh	19.967134	3.203901	40.93	1.921001
5	20.044281	3.299972	41.039333	2.151008
10	20.015936	3.612154	41.006262	2.272935
15	20.652753	4.837113	41.2	3.345802

So, for example, look at this table, I have put a NO sign against it, mainly because it has some errors. I want to use this table; deliberately it has some errors, and I am going to use this table to highlight that for you okay. So, for example, if you see here, somethings

are ok; you do have heading, you have a time, first peak, first peak width, second peak, second peak width positions here, and some timing listed here, and then some values put down here. So, few errors that are there immediately are that, you know, not all of them have the headings, not all of them have units. So, any time you put up something on a slide, you should put up the appropriate units. Please remember you are making a technical presentation, so attention to details such as units is important, because that conveys something… that conveys the actual information that you are trying to convey. So, there must be units; so, that is missing here.

And you also see here a common mistake that many students would make in their first-time presentation; look at the number of significant digits out here; it's a very large number here. So, you have, for example, after the decimal point, you have six digits here. So, it is not that automatically six digits is wrong, but you need to look at your experimental process, you need to look at your data analysis to understand if showing so many digits after your decimal point is appropriate or inappropriate. So, for example, if you are using a ruler to make a measurement and in the ruler the least count is 1 millimeter. So, in principle, you can measure a quantity which say a 19.1 millimeter. You may be able to gauge with your eye and say it is 19.15 millimeter, but that is about it. If you are write nineteen point… now, for example, although this is two theta position, if you actually write 19.967134 centimeters, then that's a very absurd piece of information to present using a ruler okay, your standard ruler.

If you say my experimental set up is to measure something with a ruler and you give the final value as 19.96 something 7134 or something like that centimeters that's completely absurd. So, you need to ensure that the data that you show on your table is consistent and meaningful with respect to the experimental process that you have got, so therefore that is an error; that is now a second error that you see in this that table. And even then, over and above that, you have stay consistent. So, for example, look at the quantities on this particular column. So, here you have the number of significant digits is actually different for each of these values that is shown here. So, that's again not a good practice. Ideally, if you are using a similar kind of experimental set up and so on, you should actually put them up to the same number of significant digits. If for some reason, you know, technically you were unable to get it to the same number of significant digits, you should put an explanation below saying why some quantities are now precise to some other

value and some others are not to the same degree of, you know, precision; so, that is something you would like to convey. So, these are all various aspects which it is wrong, the units are wrong, the number of significant digits is wrong, consistency is not there. So, these are all at least few different ways in which this slide has errors okay.

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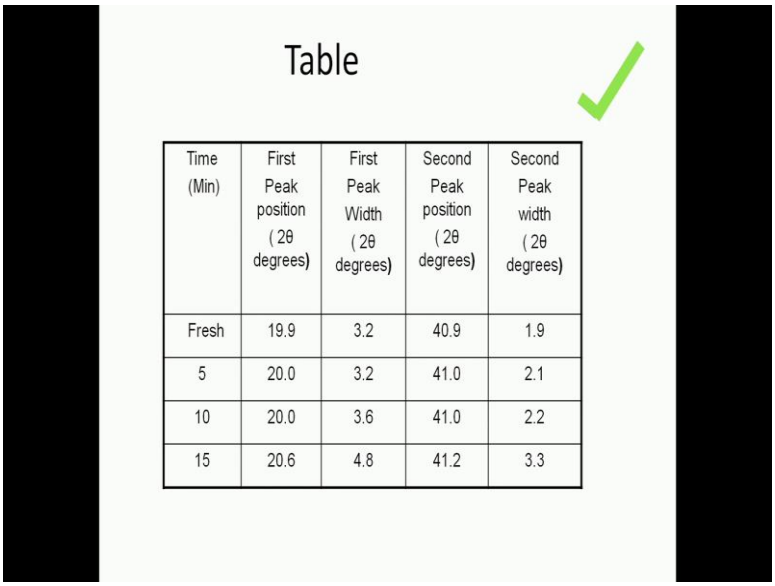

So, the same slide is now being presented in a much more elegant way with lot of things corrected. So, for example, you do have minutes, you have 2 theta degrees, 2 theta degrees, 2 theta degrees, 2 theta degrees. And the number of significant digits is limited, it's consistent. I am not saying this value, this is just an example that I am giving you, there may be experimental conditions where you can show vastly more significant digits than what I am showing here. I am just showing you that this is… there is something consistent about this whole table, which was missing in the previous table. So, if you do select to show some information using a table, you can, there may be specific kinds of data for which a table makes sense but there are things that you have to pay attention to. So, the choice of a table as a form of, you know, illustration is yours, the level of detail and attention to detail that you need to pay are some of things that I have highlighted on these two slides that you have just seen. So, table is one way in which you can illustrate something. Now, we will move to the next one.

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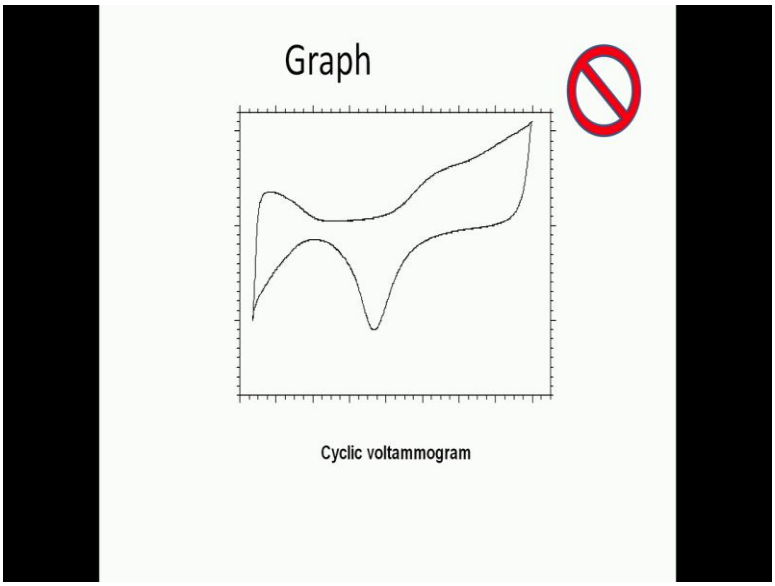

Let's take a graph right. So, again I have put a NO sign on this particular graph; many things are missing on this graph; and that something that I wish to highlight. So, if you look here, whenever you put up a graph okay, so a person looking at a graph should first and foremost know what is the quantity you are plotting on your x-axis and what is the quantity plotting on your y-axis. So, that basic piece of information is already missing on this graph. So, you have got some plot here, there is some shape that shows up here, but there is no idea what's on the y-axis, no idea what's on the x-axis. So, you have put that up. Then, you also have to put up what are the values, what are the values for these x component values that are here, the x-axis values and the y-axis values. So, there is no sense of, you know, how big a value it is or how small a value it is or even what value it is. So, this is significantly wrong with this graph right; so, that something we need to correct.

And this is a common error; actually, students put up a graph without even thinking that they, you know, because they just look at raw data from some experimental setup, and they just plot the graph without realizing that they have to do some additional work with a graph, so that is there. Sometimes, in fact, strangely enough, in some conferences you will see, people who come from a may be some R and D setup or where they are very secretive about what they are allowed to show, and therefore, because the constraint from by the their employers, they may show you a graph where only the shape of the graph is visible, no values are visible. In my view, that's extremely bad practice to do that,

especially in a formal conference of any sort. So, it is better that you don't show the data rather than show it without having any values or any units or any numbers on it. So, that's something that you really have to pay importance to, because you have an audience in front of you, you don't want them to feel that, you know, you are just wasting their time. And when you show a graph with no values on it, no units on it, then you really are wasting their time.

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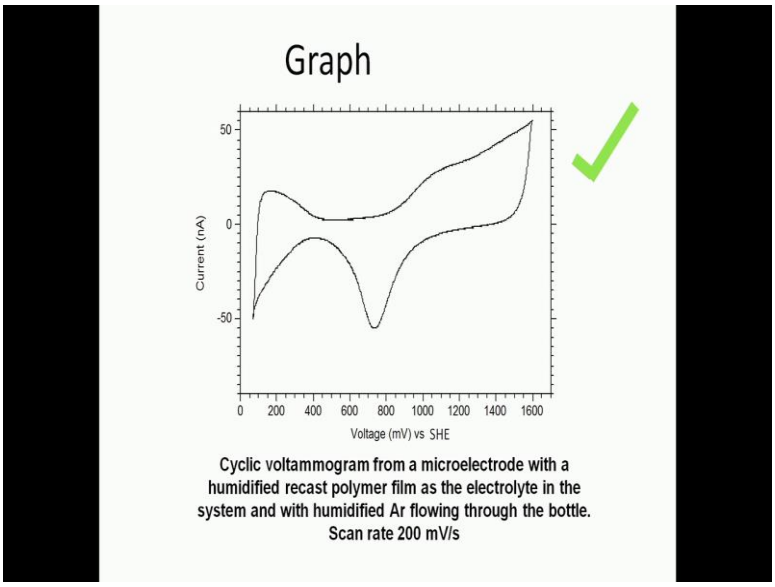

So, the same graph with many things right about it, so that you get a sense of what's correct. So, you do see now here that there is current, and it says here nano amps, nA current in nano amps that is on your y-axis. And then on your x-axis, you have voltage, in millivolts, and it says against S H E that's a standard hydrogen electrode, and so that's important from an electrochemical perspective, which is what this data is presented in the context of that electrochemical perspective. So, it's not simply voltage, it's voltage versus some reference electrode; so, that detail is also highlighted there for you. And therefore, it gives you some information about your setup - it says cyclic voltammogram from a microelectrode with a humidified polymer film. So, some description of what the setup that's being examined here. And you are also given the scan rate, which is a very important parameter to give in the context of this data.

So, when you present a graph with this level of information, your graph is quite complete okay. So, somebody looking at this graph can really get many of the points that you are

trying to convey. And also, it's a good idea that whenever you present an illustration, I mean from the perspective of say the legend that you put up, in this case there's only one plot that I am showing; if there are multiple plots there should be a legend saying what is which sample. So, using the legend, using the title, using the, you know, caption that you have below it, using the label on the y-axis, using the label on the x-axis, using all these parameters which are now available at your disposal, you should make that slide complete, so that a person looking at it already has all the information up there. You are, of course, there to present and to talk and discuss it and so on, but having all that information helps the person focus on it better. Because you may be talking about something, they may be still stuck on some other aspect of your the graph that you are showing, and having all this data on that graph really helps them have a better sense of what you are trying to convey okay. So, this a much better way of showing a graph.

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The next example, I am going to show you, is a photograph. A photograph has a great sense of conveying something visually that, you know, this is really what the object is. So, for example here, this is a bicycle that's powered by a fuel cell, an area that I work on. And I am just showing that there's the fuel cell placed out here on top of this, you know, carrier rack that is back there. And the two things that I am trying to highlight here are - that there is a fuel cell there and that there is a hydrogen storage tank which has been mounted here; that you can see. So, that's the layout of these two devices which are necessary for the cycle to work in, and so, that's what is highlighted.

I would say, the main thing that you should keep track of when you put up a photograph, which again, first time presenters forget, is that not only should you be aware of what is visible in the photograph, you should also make an effort to ensure that extraneous things are not seen in the photograph. This is a common mistake many people make who are not familiar with how photography is done or what you should pay attention to. So, you simply go to a lab, and you take a photograph. In the lab, lot of other things may be going on; there may be a beaker in one table wherein one experimental setup which is running, some analysis going on; you may have some other instrument, you know, flashing some number which represents some current it's measuring and all that. And in front of it, if you keep this bicycle, and you take this photograph, how does that beaker relate to the bicycle; how does that current value relate to this bicycle - these are all questions that someone who first glances at the photograph may get distracted by right.

So, you should ensure that you do not have extraneous things in your photograph. So, you should move the object that you are trying take to a location where nothing else is there; may be just the wall or the floor or even put a sheet of paper, so that that's all the object they are looking at. So, that's something that I wanted to highlight. So, in fact, in the next photograph I am going to show here little bit of other things in the lab will be there, primarily, to alert you to the fact such things happen. So, in the next photograph is simply a close up of the fuel cell.

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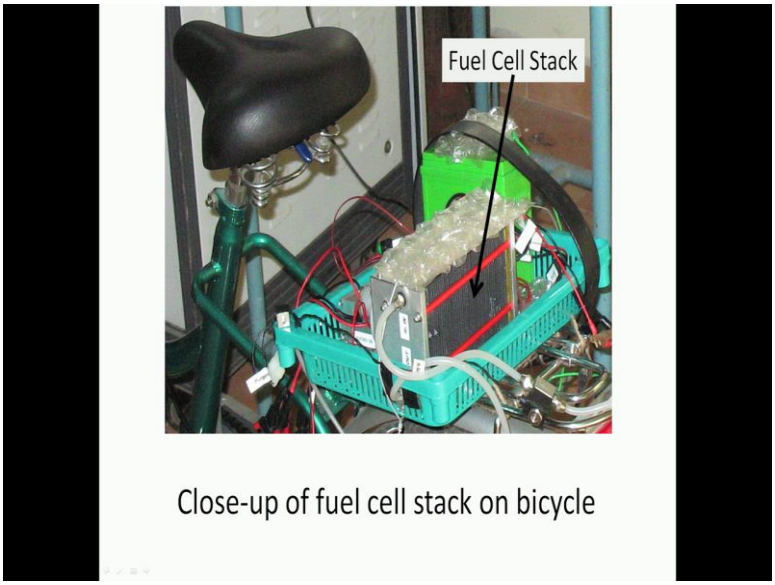

So, you can see here a close up of that fuel cell. Again, I have marked a fuel cell stack, you do see this seat of the bicycle, so you know how it is relates everything else that you previously saw. But you can see in the background, some other, you know, there is this experimental setup that is there, there are no values flashing, but there are a few other things that are there in the background. Ideally, this is not a way to take this photograph. You should again reposition the bicycle, so that you are able to take the same shot without anything else from the lab appearing in the photograph. So, this is not the ideal way of taking it, even though they are not as distracting as some of the things that I was mentioning okay. So, it helps to have… so that's something that you need to be aware of. And in a photograph, as you can see, it's also good idea to have both an overall photograph and a close up of what you are trying to show. So, that's the overall photograph and this is the close up of what you are trying to show right. So, a few things I have highlighted here.

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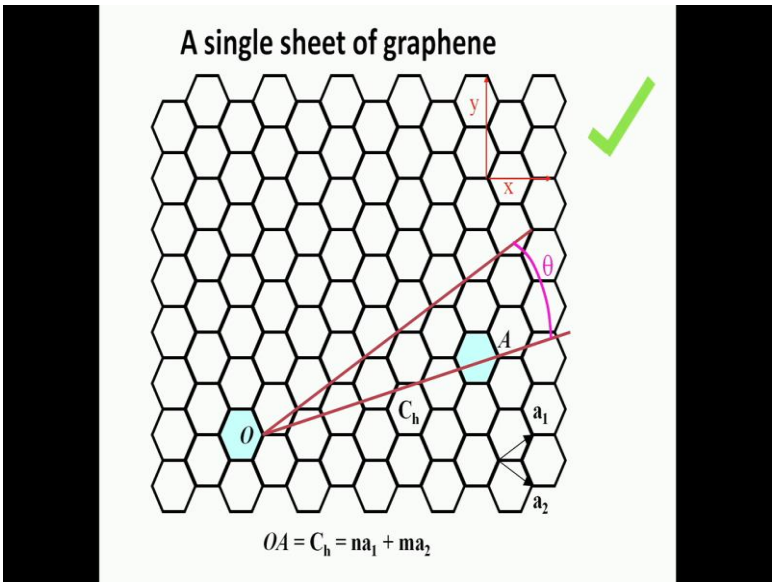

This is for example, a drawing of say a graphene sheet here. And this is a nice way in which it has been done. This is another way in which you can illustrate things. This is an illustration at an atomic level; a drawing of something that's present in an atomic level, in a very visual way which somebody can relate to. So, all the… many things are right about it. I just want to highlight it and that's why I put the tick mark here. You can see the y-axis and the x-axis marked here. You can see the unit vectors a 1 and a 2 marked here. You can also see location marked as O, and if you follow this vector here, you see

another location marked as A, it's a vector which is marked as C h indicated as C h designated as C h. And you can see here OA equals C h and how it relates to a 1 and a 2; n times a 1 and n times a 2. So, this is something that relates to how people analyze how a graphene sheet is, and how it can be folded and so on. So, this is a illustration, sort of a drawing which shows you at an atomic level how things are laid out and how you can relate to various quantities. This is a good way to make a drawing of this nature.

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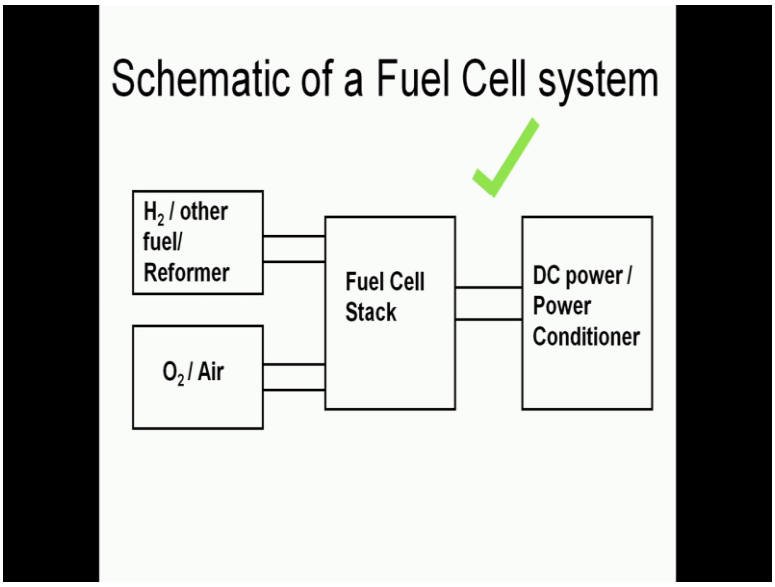

Another nice drawing that you see here is a schematic of a fuel cell system. The previous drawing was at an atomic level, this is at a, you know, much larger scale system level. You can see here the central part is a fuel cell; there is a fuel stream that's coming in; there is an air stream that's coming in; both of these feed into the fuel cell stack and then you get DC power out. So, the flow of, you know, how these things - various major components of a fuel cell - relate to each other are very nicely indicated in this schematic.

And, by the way, as I always mentioned, we need to keep track of our time; we are now down to about 10 minutes of our talk; we have finished about 40 minutes. We are just under 10 minutes now, and we have progressed quite significantly through our talk. We are talking of illustrations which is the major aspect of our talk as we move towards finishing this talk.

So, this is a nice way of doing a schematic. So, I have just shown you a drawing at an atomic level and I also shown you something at a much larger scale. So, these are good ways to present some data.

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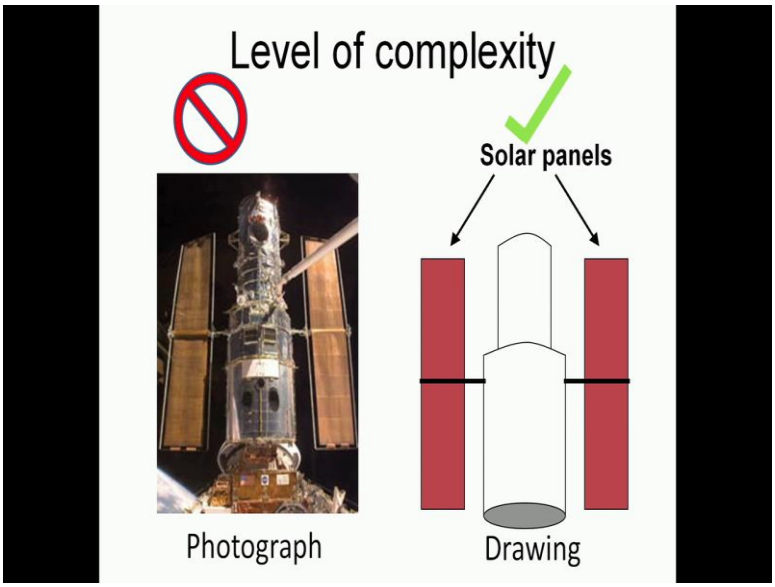

Another detail that you need to pay attention to is the level of complexity that is there in your illustration okay. So, I am showing you two illustrations here; both are the Hubble space telescope; this is a photograph of the Hubble space telescope; this is a drawing. Now, I have put a NO symbol here and a tick symbol here, primarily to indicate one particular point. If, let's say, the purpose of your talk is simply to say that the Hubble space telescope uses solar panels to power itself okay. So, when you show this photograph, it's not that it's completely wrong, but there are certain aspects of this photograph that make it distracting. And that's because you see this space telescope here, you see the robotic arm that connects it to the space shuttle, you see part of the space shuttle here, you see a little bit of earth here, you see the sky there and you also see the two solar panels; so there are many things that are there in this photograph and so sometimes it's not immediately apparent what you are trying to highlight. Even on the telescope you see lot of, you know, wiring, you see ports, and lot of different things are there.

So, a photograph has the nice aspect that it shows you the real object. So, people can really relate to it, because here you are seeing the real object, but it has this issue that it

can be distracting because there are way too many things that are visible on a photograph. On the other hand, if you make a drawing, you can really, you know, simplify all the rest of your telescope and you really highlight your solar panels. So, if the whole purpose is to just show that there are two solar panels on a space telescope, then a drawing may be a much better way of conveying this information.

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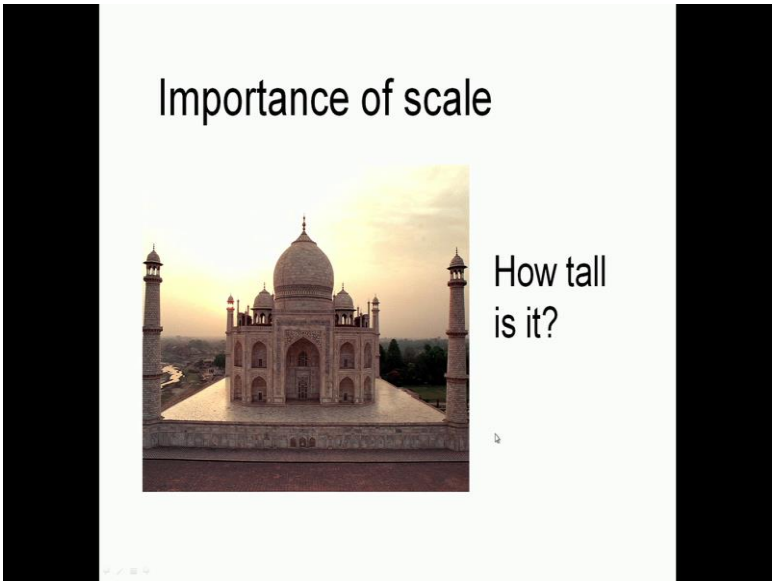

And the other major aspect, I would say the really important aspect from a technical perspective, which many students miss out on is the importance of the scale. So, here we have a monument which I have taken. I am going to show you both from the perspective of a general monument that we can easily relate to and also a technical perspective what we mean by importance of scale. So, I have managed to find a photograph where you don't seem to see many other things around the Taj Mahal which would indicate any sense of scale. So, if you have never seen it before, if you have never visited it before, a fair question to ask is, basically how tall is it? How tall is it going from base to top? And let's say, you have no sense of how tall it is, and so when you just look at the image, may be this conveys that these, you know, these features here look like they are windows, this feature here looks like it's a door and it has some four windows around it, and so, this door is, let's say, you know 2 meters high. So, may be this is may be 4 or may be this is 8 or 10 meters tall - is one, you know, perspective that you may get, if you have no sense of scale right, because there is nothing to relate to; so, that's one issue that we face.

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Let's look at another photograph of the same monument. Now we have a sense of scale, because you see a lot of people here; there are a lot people here. And we know that, you know, they are all about, say, one and half meters tall, one and half to two meters tall; so, that is how tall they are; so, that's one and half to two meters tall people out there. So, if you actually scale with respect to them, you will find that this monument going from, you know, from the base all the way to the top is something like 75 meters tall okay. So, that's quite a tall monument relative to our previous estimate about 10 meters tall. And, really, the major difference between the previous slide and this slide is that we have something that we can relate to in terms of scale. In both cases, you saw the same monument - a world famous monument that most people would be familiar with, but because we have a sense of scale, we are able to identify what we are talking about, and so that highlights the importance of scale. Any time you put up a photograph or an image always try to make sure that at least there is a ruler there or some familiar object that people can look at to see what is the sense of scale.

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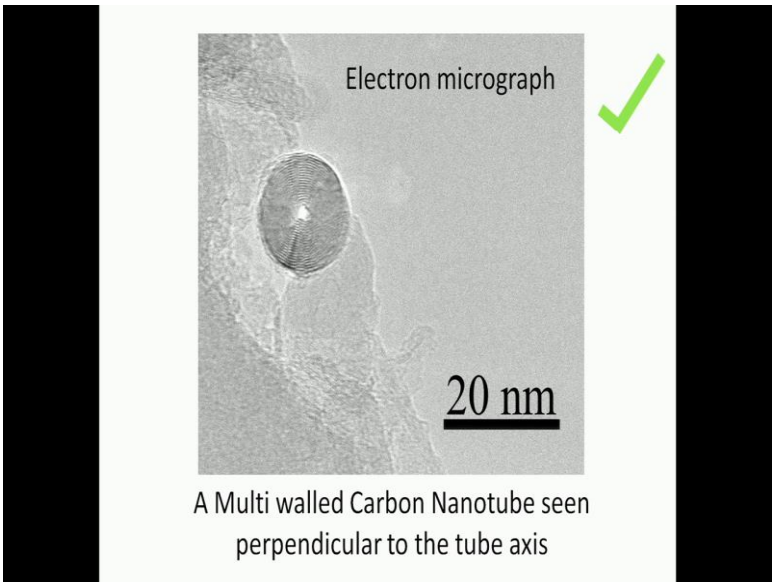

From a technical perspective, for example, this is carbon nanotube seen head on. So, you can see the rings of carbon tubes and you see that this is about 20 nanometers across in scale; so, this is, may be, the actual nanotube is may be 17, 18 nanometers across. And then, you can see this central tube, you can see all the concentric tubes; if you want, you can use this scale to find out the interplanar spacing okay. So, this is something that we need to pay attention too. So, these are the major things - aspects - associated with illustrations and the types of illustrations, and the kinds of things that you can pay attention to, how you select between various forms of illustrations, the particular details that we need to pay attention to.

So, how are we doing with respect to time? We are down to our last five minutes; we have completed all major aspects of our talk and so we are doing perfectly fine with respect to time.

So, what do we have remaining? We come back here to our outline slide and we find that we have completed all the four major aspects of your talk; you are down to the summary. So, we are doing perfectly fine.

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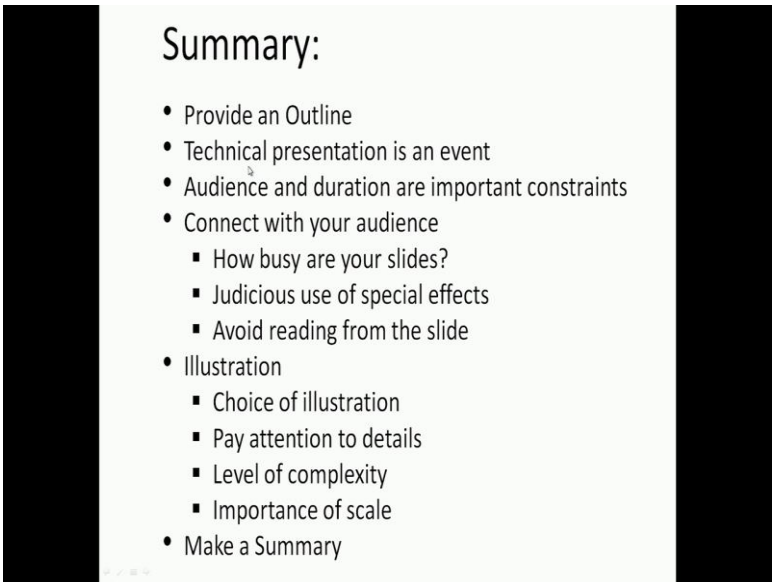

So, let's look at the summary. This is a talk about talks. So, the summary conveys that to you. We need to provide an outline which we did. And we used that outline at several times during this talk to keep track of, to convey, where we were in this talk. We spoke about technical presentation being an event; how it contrasted with the journal paper. We discussed, you know, how audience and duration are important constraints; that you have to tailor your to talk the audience, and therefore, you cannot simply present the same talk everywhere. And you should understand that you can present the same content with different levels of detail, and therefore, you can adjust your talk to differing durations. And I also pointed out you should be agile; you should be agile in the sense that if somebody gave you a 40 minute slot; and suddenly changed it to a 20 minutes' slot, you should show your presence of mind and represent it in 20 minutes. And the audience would be much more impressed when you do that; so, that's important.

We spoke about connecting with your audience. I pointed out that you need to pay attention to how busy your slide is; if you put up a very busy slide, then that throws off the audience. So, the amount of information you show on your slide should be reasonable and that's something that you should look at. You can use special effects to highlight a particular aspect of your talk, but you should be judicious on how much special effects you use, because that can otherwise become very distracting. You should avoid reading from a slide; again, that's very boring and monotonous. This slide for

example, has a lot of text, but that's because it is a summary slide but otherwise we would try to avoid a slide which only has so much of text.

We spoke about illustration - a major aspect of any talk; certainly a major aspect of technical talks. I told you that we have a wide range of choice in terms of what kind of illustration we can show. And therefore, you should be… and each of them has certain positive aspects to it and may be certain short comings; graphs show certain trends which are not visible when you see tables; photographs give you a sense of realism of some event or an object, but they may have too many details which can be distracting; drawings may simplify things and may help you highlight specific aspects.

I also pointed out that in terms of paying attention to detail scale is very important; choice of what illustration, level of complexity, and scale. Without scale, it's very difficult for people to understand what you are trying to present. In a graph, you should pay attention to what are the quantities you are presenting, what are the units, what are the, you know, values that they have. So, all of these things that you have to look at. In a table, you have to look at, you know, number of significant digits and so on; so, many things. So, we have a choice of illustration you need to pay attention to details, a level of complexity, and importance of scale.

And finally, you need to make a summary which is what we have done here; so, that in this single slide all the major aspects that we discussed in the 50 minutes of this talk are all captured here. So, just when you look at this slide, and you look at this discussion, it quickly helps you recollect all the major things that we have discussed okay. Again, how are we doing with respect to time? We are now down to a minute in the half. So, we have done perfectly well with respect to our time.

And so, I would like to finish by just showing you this slide, which is thank you; thank you for paying attention. Mainly again this is a very cultural thing in I think in Indian conditions, people do put this up quite a bit.

Thank you for paying attention and have a great day.