

Course Name: I Think Biology

Professor Name: Dr. Divya Uma

Department Name: Biology

Institute Name: Azim Premji University

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W12L60_Discussion on Art and Science

Hello everybody. Welcome to the one more series of NPTEL course. Today we have Dr. Ipsa Jain. Ipsa has a very interesting background. Actually she is a scientist.

She got her PhD from IISC Bangalore but she was also very interested in art and incorporating art into science. So she comes with a varied interest, a background in science but she is an artist herself. So we bring Ipsa here today to talk about how to, you know, interconnect both science and art and how to use art in science communication. Welcome Ipsa.

Thank you, Divya. It's a pleasure to be here. If you don't mind giving us a little bit of history about how art was thought and how science and art was thought in earlier days and some kind of a history behind how these two were. So actually to think about it at a point in time science and art weren't really two different things and there was this common idea of looking at the world around us and natural philosophy, art, natural sciences were all practiced together. So I would like to bring up some work, some name.

So this artist called Maria Sibylla Merian, she was a natural history illustrator and what she did was she made observations and documentations and her way to document was drawing. So she went to the forest of Suriname and drew insect life cycles and her skills in art and her skills in natural sciences were both relevant to her discovery that how it is the caterpillars that transform into an adult butterfly and that these are not two different beings. The other example that comes to my mind is that of Galileo. So Galileo is known for a lot of things but then he was one of the first people who drew these intricate drawings of the lunar surface to show craters and their shadows and so on. Before that there was this really sort of idea that moon is that divine pure surface and he was one of those people who sort of broke that idea.

And what's interesting is that Galileo was working with certain kinds of lenses. When we

think about Galileo it's often we think about in context of lenses and telescoping and so on. What's interesting is that actually there were other contemporaries who were working with similar lenses and who saw the same thing but they described that as some spottedness that they couldn't really articulate. Whereas Galileo drew those craters and their shadows and what set them apart was that Galileo was also a trained painter. He specialized in this technique that allowed him to show contrast between light and shadow.

So to see and to document was again possible because he had that extra training that his peers did not have. And this idea of scientific method, the rigid idea of scientific method is something that we ascribed over time that was around Newton's discoveries and his text of Principia. But science as a label, science as a word, science as an occupation, science as an educational trickery is a byproduct of industrial revolution really. So before that all of that was closely interlinked. The one seminal work that tried to sort of question why science and art are two distinct ideas is this 1959 essay called Two Cultures by C.P. Snow. But somehow what happened at the after effect of that provocative essay is that somehow the boundaries became taller even though that was not the intent of the essay to begin with. But I think in the last five of the previous century and this century that we're currently living in, there are a lot of works that are happening that are again talking about bringing art and science together. And in fact, it's almost like a whole new movement, an art movement or a science movement of sorts, which is trying to understand what art, science can be together. It's actually really interesting that you say, because when I read very old natural history records or articles, it's often beautifully illustrated. Whereas if you read papers now, it's just like, OK, you know, this is the information and this is how you replicate it.

I mean, there's methods to it, but there is no natural history and illustration behind it. And it's almost become obsolete, except in textbooks you find certain things. But can you tell us a little bit about how is science visualized in the present day? I will again, like sort of refer to the history that we just discussed to think about how science was visualized earlier and what are we trying to do today? So if you look at this example of Maria Sibylla Merian's drawings or Galileo's drawing, they were trying to show things as they are, or as the natural world is. But I think when technological advancement happened, and especially with the ideas of computers entering in the way the science, images and science are being constructed, that idea changed a lot. So if you think of a pseudo colored microscopy image, it's pseudo colored, which means that the scientist has painted it.

So in creating that image, the scientist worked as a scientist, an inquirer, a technician, a microscopy technician, and also a painter. And the image that has been created is not only a representation, but almost a presentation of what reality is. So we're trying to construct rather than find at this moment. So the contemporary work is about creating the vision or

the visual that allows us to ask or allows us to hypothesize or allows us to discover rather than copying what's already present in nature. So is that, that's the key difference? Like what was there earlier, which was like an exact kind of illustration.

And now with the help of digital media, it's, you know, you're laying, putting layers to it. Yeah. Where your own ideas and your own interpretations are part of it. And that's also part of both the scientific process or this larger idea of understanding what reality is or what reality can be. Yeah, that's really cool.

Yeah. So I would have to acknowledge that this, this idea comes from this science historian and a philosopher of science, Peter Galison. So if somebody is interested, they can look up his writings and read more about this idea. Earlier, I was talking to you about your courses and the different kinds of courses you teach at Sristi. Can you give us one example which you have done recently, which brings arts and science together? And so just in the previous semester, I ran a project, I offered a project where I had 11 students working with me and we called that project a Fistful of Mud. And the larger inquiry for us was that can we create tools of engagement for people to engage with inquiry in public space? So, and we took mud as sort of our core idea because mud is ubiquitous.

It's there everywhere. And it's a material that you can hold and it's accessible. You can look at it in multiple ways. You can manipulate it, you can collect it and so on. And more than art, we use design sensibilities there.

And what we did was we went to the public spaces, we interacted with public, we asked them to look at soil, we asked them to ask questions and that kind of then informed the kinds of projects we created. So at a lot of, you know, at the end of the project, what we had was a lot of toolkits, activity books and games that people could interact with that could either be about the soil or any other science that the particular student who created the project was interested in. And there was this one student Prabhava, he created this game where he essentially created a board game which allows one to have scientific debates on a board. And the interesting thing about that debate is that there is no external agency that's scoring you, but rather you are the opponent that you're playing with, which means that it coaxes you to either come to an agreement with each other or to again shift positions completely. And so his work was kind of inspired by how scientific discussions happen in a lab meeting or in a conference or through time.

And that relates to this Mud, the thing, Fistful of Mud, which started from there. Because the larger idea that we started with was the idea of thinking about inquiry. So it maps to inquiry even if it does not map to Mud as an idea. Yeah, it's really creative. And it's, so these things also can be converted into products and somebody can.

Yeah. So at this point, I mean, I'm still working towards it with my students. The idea is to actually create open access resources that will be accessible on the web. So if somebody wants to try this out in their classroom or in a public space, people can download these activities and try that on their own. We were talking about, you know, how you can mix design and, you know, certain scientific process to kind of bring out scientific process. Can you give us some more example of, you know, how it can be used in education, even at a lower level, like a scientific process is something which at the undergrad level, people might have kind of focused more on.

Right. Have you worked something with, you know, applicable to high school students or non biologists or non scientists? So I can't say that I have a very personal project where I might have sort of walked around that idea, but then I've had the opportunity of working with other people or looking at other people's work where design sensibilities or art sensibilities have been sort of used to also have conversations around science. In some of the work that I've done, for example, what we did was we used drawing or crafting as a way to look at something. So at the, you know, especially when I've done work, we think about science as this process of either asking questions, asking good questions. I don't know if we can really answer what good question means. But, you know, asking good questions that come from certain sense of observation and looking for certain kinds of patterns.

The next thing we think about is that if you were to ask a question, how do you go about figuring it out? And then there is the actual figuring it out. And I think what ends up happening within the work that's done with younger students is that a lot of it is about information communication. And I think that's the idea that I personally would like to break. And I've seen a lot of other people try and break it. And one of the great ways is this idea of engagement, where the joy of making or the joy of doing something becomes part of either self-driven discovery or information communication as the goal may be.

So things that require students to make things, to fail at things and then discover what's actually working for them, like those kinds of kits and those kind of tools. I'm a big fan of those kinds of work. And it's also collaborative. I mean, can there be group projects where they're building something together? Yeah. So one can also think about that, that those can be either personal activities or communal activities.

And it depends on how one again designs it and what's the intent. If it's something that needs to happen across time, one might need to imagine it as more as a personal activity, because you may not be able to get the same cohort together unless it's happening in like an education environment where by design they come together. But if it's something that's

a one time event, whether it's a one week long or two day long or one hour long, but if something allows a cohort to come together, then you think of those one time activities that people can do together to build something or to create something. I like this idea of persistence in the practice of science. So I often do think about what can be something that one does repeatedly across time and then builds upon it.

And in fact, this first of my project that I just mentioned, been thinking about how do we make it accessible for a larger community? Can we encourage collaboration across space and time? Can the questions of one person inspire another person to make certain kinds of observations? So I mean I don't know whether digital media technology, it's possible to maybe think across space and time because you can create databases and you can build communities that talk to each other. But I think at least at the younger level, it's great to also develop that sensibility of perseverance and persistence and ability to work with failures. And yeah, those kinds of projects are similar for any field, actually.

That's probably also true. Yeah. We need to build those characters. Yeah. Yeah. For any kind of pursuit, I suppose.

Yeah, that's true. I want to shift gears now. And so we have, together with you, we have written this online book called I Think Biology. And we are using a lot of chapters from that book to teach this course. And you have beautifully created the banner image for the I Think Biology course. And can you tell us a little bit about the thought process which went behind creating that banner? And also, when we think about textbooks, it's usually these, you know, static images, which we say that, okay, it's okay, this is the scientist or, you know, there'll be a black and white picture of a mugshot of a scientist, unfortunately.

And or it could be, you know, this is how a lab looks. So like a few conical flasks or something else, pipettes. So that's a typical imagination of a lab. But in the book, we have tried to move away from that and include art, include illustration in a very dynamic, in very, you know, it also talks to students to kind of enhance their learning abilities.

So can you explain some of those? Sure. Yeah. So first, I'll thank you for inviting me to be a part of the book. It was a great joy to work with you all. And I'm really pleased with the, you know, the work that we've been able to create. Talking about the banner image in particular, you know, the book name is I Think Biology, and I think comes from Darwin's diary where, and I love that piece also, because, you know, he starts with a sentence and ends with an image.

And then for me, as a science illustrator, it's a great example to show that how thinking or communication sometimes happens in images, rather than in words. So that's a great

starting point for me anyways, to start talking about images and science. And that tree is very interesting, because in that small tree, it talks about descent, it talks about diversity, talks about extinction, all of that together. And again, that sentence, I think, and that drawing of a tree, so that I think places an eye, a scientist, a naturalist, a student, who is thinking, who's looking at this world and wants to understand it. So that's how the human element in that picture came to be.

And for me, you know, hands to me are the tools by which humans look at the world, like that is what allows you to hold something in isolation and say, this is what I'm looking at right now, or to manipulate it, which is what a biologist does often. And so then hands, so somewhere in this idea of looking and manipulating with hand and then making certain connections in your head, that's how I hand and brain also became part of that image that I imagined. So, so I think that thinking is through hand, brain and eye access. And I think all knowledge generation really relies on this access. And so that's how that human came into the picture.

So I mean, I don't know if people have noticed it, but the Darwin's tree is actually, you know, an Easter egg in that image. So go look for it. And then as an illustrator, the idea of processes happening in space and time is kind of very interesting to me. And when I was looking through the material that's been discussed in the book, the idea of scale came through to me that we're thinking about things that are happening at multiple scales. So what I had to do essentially was just, you know, curate the sense of elements that are curated set of elements that are working across a scale from molecules to ecosystems.

And how can I bring all of that in that same image? So that's what I tried to do. And then we went through multiple rounds of, you know, corrections and feedback systems, as you perhaps remember, to finally create the image that's now on the book. Yeah. To answer your second question about working with images that are beyond a certain kind of typology that you brought up, that's quite interesting to me. And as somebody who thinks about images and science and illustrations, it's very relevant in that sense as well.

What I like that the I think biology book has been able to do is, because it's a multi-author book, so there is also already a sense of taste that comes from everybody who has been involved in making of the book. And that allows for a certain kind of subjectivity in the way you would want to show things. Already bring, you know, becomes a part of the book or the images that one curates then for the book. And I mean, even when I was thinking about how do I want to draw the illustrations that I was making for the book, I wanted to keep it in a style that felt like that a student should feel like that if they wanted to draw it, they can do it as well. So I wanted the drawing to have a certain sense of approachability, if that makes any sense.

I don't know the students should tell me whether I have been successful or not, but at least that was the intent sort of behind making the illustrations in the way that I've done. Like very broad strokes, few colors in a composition. And there are certain drawings which are a little more integrated than others. But I remember the certain drawings that we did for a particular cell biology chapter where the idea was also that the student will participate and add elements to the drawing or complete the drawing in a way. So that kind of interactivity with the image is a great way to learn.

And from what I've seen, even in my interactions with scientists, like I often collaborate with scientists to create images that are sort of explanatory of their work. Scientists will have their own way of thinking about their process because they think about it daily. They're deeply rooted in that problem. And when they interact with me, because I have to think about how we will look on the paper, that's the sensibility that I'm bringing. Sometimes I'll ask them a question, that will just like stuff them because then now they have to think about something that they haven't thought about.

And I think inviting the student to participate in the drawing does really just the same, except now they're coming from a student perspective instead of coming from a scientist perspective. That's actually really nice that you said that, because as scientists, we kind of assume that, OK, this knowledge is given and we make things unnecessarily complicated sometimes not knowing who the audience is. So putting things in a more accessible way is, I think, really important. I mean, whether it's student or scientist or anybody, for that matter. It also probably illustration helps to kind of tease apart that and take things in a step by step manner.

Also, what happens is that like we I mean, a lot of science and a lot of education is very textual in nature. And there's really not much that we can perhaps do about it or maybe we can, I don't know. But what happens with illustrations or inviting students to draw is that people who don't necessarily prefer textual learning also get an opportunity to participate in that learning and make connections for themselves that words alone aren't allowing them to do. And in biology, again, because it's again this idea of processes and networks and space and time. So putting that in paper, just trying to map how it's working in this space or how working in this time, that kind of mapping also just allows you to build connections and also to ask questions.

So I think summarizing in pictorial way or illustrations allows you to you know access things that perhaps words alone don't allow. I mean, just again, going back to Darwin's I think and that sentence ending in a tree. I don't think he had the words to describe that tree and had to use an image. So, you know, by including participatory illustrations, we

certainly allow students to access that as well. Yeah, that's really interesting because that's very different from, you know, when you talk to high school students or like, you know, who have just finished, you know, class 12 and who are fresh undergrad students, when I asked them to draw something, they're all a little scared.

Oh, do we have to draw? And, you know, it has to be very accurate and exact like replica? This freehand drawing of what you see something and you just draw it, that kind of is almost disappearing and we want to bring it back into the classroom. So there is a notion that, OK, you know, you have to draw a microscope, meaning like it has to be exact. So in textbooks, I know that you have previously worked in with in creating digital art for in other various platforms. So do you feel that that accuracy, that level of accuracy is retained or is it stressed? So I really like the question because one has to question that where is the student learning from? So when that student brings that fear of having to replicate a microscope or a certain cell, you will realize that often what they are wanting to replicate is what they've seen in the textbook. Like if you ask them to draw a cell, they're drawing the cell that they have seen in the textbook and not the one that I've seen through the microscope.

That's true. That is true. Yeah. So again, we are asking them to reproduce a presentation that we have created rather than based on their own observation. And because those representations or presentations are, you know, sort of mass produced and everywhere you see them sometimes even erroneously created or incompletely created, they have become a similar icon. I particularly think about the cell a lot because a lot of my previous work was around the cell. Even with the, you know, bachelor's students who were doing science degrees who have read through cellular biology textbooks who have been through now various microscopy exercises, if I don't give them any stimuli or input, and just ask them to remember a cell, the cell they remember is that circle within a circle, which I call the sunny side up, which is the nucleus and the cell membrane boundary. So I do believe that there is merit in this idea of bringing back observation sketching to the classroom, which automatically takes the, you know, pressure of perfectness away.

Rather, you are talking about what you are seeing. And what's interesting about what you drawing, what you are seeing is not only that you train your hand to draw what you see, I mean, it does require a certain sensibility of skill, but also what you see and what I see might just have subtle differences. You know, I might be attracted to let's say the color patterns in the wing, and you might be attracted to what's there on the eye, if you're looking at an insect. And so then if you bring that as a collective class experience, now you have created an insect, you know, you can create a composite image that brings together everyone's observations and everyone interests together.

Okay. And one more learning opportunity to do that. Yeah. Yeah, that's nice. Yeah, it's interesting, because these are some of the things which we think regularly in the classroom setting also, and you know how to incorporate these things. Yeah. So I had one more question that we see that there are several students who are really interested in who are very good at drawing, and also using digital techniques to illustrate different things.

But it often remains as a hobby. And it would be great to convert hobby into a profession, which you have successfully done that. So can you tell us a little bit about what are the opportunities in India for students who are, who like drawing, and who also like science, and how they can combine the two things together. The real situation is that we don't have science illustration programs in India. There are a few, you know, across the world, and some of them really good. So the, if one wanted to just learn within India, I imagine two possibilities.

One is that you learn by, you know, self practice, which is possible to do, which is what I did. The other is to pursue an illustration or a graphic design degree, which though may not be oriented towards science, but if you are somebody who comes from, let's say, bachelors in science training, or some other kind of scientific training, or even just like love or appreciation for science, you might be someone who may be able to bridge these two together on your own. The other, perhaps also a possibility to think about is that India actually has a lot of great natural history illustrators around, some of them even in Bangalore. I can think of Neeru Parao, I can think of Sangeeta Kadur, Abhishekha Krishnagopal, and there are others throughout the country as well. And if you're able to show your interest and dedication, you might be able to reach out to them and request for some training opportunities, however short, even if that's possible for them, of course.

And once you're able to train and build a portfolio of your work, you put that online, you put that wherever you can, and just tell people that you're looking for work. And you may land up big work already, or you may land up with small gigs, but I think at the moment, proper sort of contractual or permanent job opportunities for people who do science illustration are very limited. Only a few science media centers in some elite institutions have those kinds of positions. And the other possibility, or the way one could think about job opportunities is education industry.

There is a whole lot of education technology industry that's coming up. And there are a few media houses that often work with the scientific community. So those kinds of media houses also would hire or need people like people who have both understanding of science and illustration or science and graphic design. The other fourth possibility that I personally pursue is this idea of freelancing, where you look for collaborators like Azim Premji of the biology department, or other kinds of collaborators, different institutes, and

you work with them to build a body of work to create meaningful work. And yeah, at the moment, these are the possibilities I imagine.

No, it's definitely better than when probably we were studying. Yeah, it's definitely better. And because science communication as a field is also sort of growing and blooming in India right now. So one can really imagine that in not so very far future, in very near future, there will be more opportunities for both science communicators and science illustrators within that bracket. Yeah, museums haven't kind of, you know, haven't taken illustration in a big way in India, whereas I see like a lot of opportunities in the West.

Yeah, I mean, I think that's only because there are not enough museums in India. And I know that there are museums that are coming up in different parts, and I've had the opportunity to engage with a few. So I would say that what happens there is that the production is a very high paced environment. And often, people who are from art and design schools are employed in production. So, but if you are somebody who did professional illustration courses after having done a scientific training, then that would also be a good place for you to actually look at look at people who do production for museum projects. Because museums themselves don't hire artists or, you know, they usually give that work to an agency who will make everything from models to whatever mechanics and whatever installations that have to be created, along with the illustration and design work.

So thinking about those media houses that then work, either in science communication or production for museums, then become the places that you need to eye out, keep an eye out for. Yeah, it's great to know.

Yeah. Thanks, Ipsa. Yeah, thanks a lot for being with us today. And it's, it's really nice talking to you. I mean, I whenever I read a text or a book, illustration is what catches my eye. And then I go for that book.

So it was really, really nice talking to you and learning from you. Thank you. Thank you. I enjoyed this opportunity as well. Thank you.