TPO 19 Script

Section 1

Conversation

Listen to a conversation between a student and the professor.

Student
Hi, professor Handerson. That was a really interesting lecture in class today.

Professor
Thanks, Tom. Yeah, animals' use of deception, ways they play tricks on other animals, that's a fascinating area. One we are really just starting to understand.

Student
Yeah, you know, selective adaptations over time are one thing. Oh, like, non-poisonous butterflies, that have come to look like poisonous ones. But the idea that animals of the same species intentionally deceive each other, I have never heard that before.

Professor
Right, like, there are male frogs who lower their voices and end up sounding bigger than they really are.

Student
So they do that to keep other frogs from invading their territory ?

Professor
Right, bigger frogs have deeper voices, so if a smaller frog can imitate that deep voice. Well ...

Student
Yeah, I can see how that might do the trick. But, anyway, what I wanted to ask was, when you started talking about game theory. Well, I know a little bit about it, but I am not clear about its use in biology.

Professor
Yeah, it is fairly new to biology. Basically, it uses math to predict what an individual would do under certain circumstances. But for example, a buisness sells, oh computer, say, and they want to

sell their computers to a big university. But there is another company bidding too. So, what should they do?

Student

Well, try to offer the lowest price so they can compete, but still make money.

Professor

Right, they are competing, like a game, like the frogs. There are risks with pricing too high, the other company might get the sale, there is also the number and types of computers to consider. Each company has to find a balance between the cost and benefits. Well, game theory creates mathematical models that analyze different conditions like this to predict outcomes.

Student

Ok, I get that. But how does it apply to animals ?

Professor

Well, you know, if you are interested in this topic, it would be perfect for your term paper.

Student

The literature review ?

Professor

Yeah, find three journal articles about this or another topic that interests you and discuss them. If there is a confict in the conclusions or something, that would be important to discuss.

Student

Well, from what I have looked at dealing with game theory, I can't say I understand much of the statistics end.

Professor

Well, I can point you to some that presents fairly basic studies, that don't assume much background knowledge. You'll just need to answer a few specific questions: What was the researchers' hypothesis? What did they want to find out? And how did they conduct their research? An then the conclusions they came to. Learning to interpret these statistics will come later.

Lecture 1-Linguistics(Proto-Indo-European)

Narrator

Listen to part of a lecture in a linguistics class.

Professor

All right, so far we have been looking at some of the core areas of linguistics, like syntax, phonology, semantics, and these are things that we can study by looking at one language at a time, how sounds, and words, and sentences work in a given language. But the branch of historical linguistics, involves the comparison of several different languages, or the comparison of different stages of a single language.

Now, if you are comparing different languages, and you notice that they have a lot in common. Maybe they have similar sounds and words that correspond to one another that have the same meaning and that sound similar.

Let's use a real-world example. In the 18th century, scholars who have studied the ancient languages, Sanskrit, Latin and Greek, noticed that these three languages had many similarities. And there might be several reasons why languages such as these had so much in common. Maybe it happened by chance, maybe one language was heavily influenced by borrowed words from the other. Or maybe, maybe the languages developed from the same source language long ago, that is, maybe they are genetically related, that was what happened with Sanskrit, Latin and Greek. These languages had so many similarities that it was concluded that they must have all come from the same source. And talk about important discoveries in linguistics, this was certainly one of them.

The scholars referred to that source language as Proto-Indo-European. Proto-Indo-European is a reconstructed language. Meaning, it is what linguists concluded a parent language of Sanskrit, Latin and Greek would have to be like. And Proto-Indo-European branched out into other languages, which evolved into others, so in the end, many languages spoken all over the world today can trace their ancestry back to one language, Proto-Indo-European, which was spoken several thousand years ago.

Now, one way of representing the evolution of languages, showing the way languages are related to each other, is with the family tree model. Like a family tree that you might use to trace back through generations of ancestors, only it's showing a family of geneticall related languages instead of people. A tree model for a language family starts with one language, which we call a mother language, for example, Proto-Indo-European. The mother language, is the line on the top of this diagram, over time, it branches off into new daughter languages, which branch into daughter languages of their own, and languages that have the same source, the same mother, are called sisters, they share a lot of characteristics, and this went on until we are looking at a big upside down tree languages like this. It is incomplete of course, just to give you an idea. So that's the family tree model, basically.

Now, the tree model is a convenient way of representing the development of a language family and of showing how closely related two of more languages are. But it is obviously very simplified,

having a whole language represented by just one branch on a tree doesn't really do justice to all the variations within that language. You know, Spanish that spoken in Spain isn't exactly the same as Spanish that is spoken in Mexico, for example.

Another issue is that languages evolve very gradually, but the tree model makes it look like they evolve over night, like there was a distinct moment in time when a mother language clearly broke off into daughter languages. But it seems to me it probably wasn't quite like that.

Lecture 2-Astronomy(Radio Astronomy & Optical Astronomy)

Narrator Listen to part of a lecture in an astronomy class.

Professor
So how many of you have seen the Milky Way, the Milky Galaxy in the sky? You, you have?

Student
Yeah, I was camping, and there was no moon that night, it was super dark.

Professor Anybody else? Not too many. Isn't that strange that the Milky Way is the galaxy that the planet earth is in, and most of us have never seen it? Now, what's the problem here?

Student
Light pollution, right? From street lights and stuff ...

Professor
Yes, Especially unshielded street light, you know, ones that aren't pointed downward. Now, here's an irony, the buiding we are in now, the astronomy building not far from our observatory, has unshielded lights.

Student
So the problem is pretty widespread.

Professor
It is basically beyond control, as far as expecting to view the night sky anywhere near city, I mean. I have lived around here my whole life. And I have never seen the Milky Way within city limits, and I probably never will. There is a price for progress, eh?

But let's think beyond light pullution, that's only one kind of a technological advance that has interfered with astronomical research.

Can anyone think of another? No?

Ok, let's look at it this way, we don't only gain information by looking at the stars, for the past 70 years or so, we have also used radio astronomy1, which lets us study radio waves from the sky.

Student
How can you observe radio waves? I mean, tell anything about the stars from that.

Professor
Well, in optical astronomy, using a telescope and observing the stars that way, we rely on visible light waves. What we are seeing from earth is actually electromagnetic radiation that's coming from stars. And just one part of it is visible light. But there are problems with that.

When photons and light waves hit objects in our atmosphere, water droplets, oxygen and nitrogen molecules, dust particles and so on. These objects are illuminated, they are lit up, and those things are also being lit by all our street lights, by the moon, all these ambient light. And on top of that, when that visible radiation bounces off those molecules, it scatters in all directions. And well, light from stars, even nearby in our own galaxy, doesn't stand a chance against that. Basically the light bouncing off all these objects close to earth is brighter than what's coming from the stars.

Now, radiowaves are electromagnetic radiation that we can't see. Nearly all astronomical objects in space emit radio waves, whether nearby stars, objects in far away galaxies, they all give off radio waves. And unlike visible light waves, these radio waves can get through the various gases and dusts in space, and through our own earth's atmosphere comparatively easily.

Student
Ok, then we might as well give up on optical astronomy and go with radio astronomy.

Professor
Well, the thing is, with the radio astronomy, you can't just set up a telescope in you backyard and observe stars. One problem is that radio waves from these far away objects, even though they can get through, are extremely faint. So we need to use radio telescopes, specially designed to receive these waves and then, well, we can use computers to create pictures based on the information we receive.

Student
That sounds cool. So, how do they do that?

Professor
Well, it is kind of like the same way a satellite dish3 receives its signal, if you are familiar with that. But radio telescopes are sometimes grouped together, is the same effect as having one big telescope to increase radio wave gathering power. And they use electronics, quite sophisticated.

Yeah, it is neat how they do it, but for now why don't we just stick with what we can learn from it. Some very important discoveries have been made by this technology, especially you consider that some objects in space give off radio waves but don't emit any light. We have trouble discovering those sorts of bodies, much less studying them using just optical telescopes.

Student
Well, If the radio waves are so good at getting throught the universe, what's the problem?

Professor
Well, answer this. How come people have to turn off their cell phones and all our electronic devices when an airplane is about to take off?

Student
The phones interfere with the radio communication at the airport, right?

Student
Oh, so our radio waves here on earth interfere with the waves from space?

Professor
Yes, signal from radios, cell phones, TV stations, remote controls, you name it. All these things cause interference. We don't think about that as often as we think about light pollution. But all those electrical gauges pollute the skies, just in a differen way.

Section2

Conversation 2
Narrator Listen to a conversation between a student and the director of the student cafeteria.

Student
Hi, I... I am sorry to interrupt, could I ask you a few questions?

Director Sure, but if it is about you meal plan, you'll need to go to Room 45, just down the hall.

Student
Eh, no, I am OK with my meal plan. I am actually here about the food in the student cafeteria.

Director
Oh, we do feed a lot of students, so we can't always honor individual requests. I am sure you understand.

Student
Of course. It is just that I am a little concerned, I mean, a lot of us are, that a lot of the food you serve isn't really that healthy. Like there are so many deep-fried foods.

Director
As a matter of fact, we recently changed the type of oil we use in our fryer. It is the healthiest available. And would you believe that at least ten students have already complaint that their french fries and fried chicken don't taste as good since we switched?

Student
Oh, I try not to eat too many fried foods anyway. I am just aware that, eh...You see, I used to work in a natural food store. They had all these literature4 advising people to eat fresh organic growing food. Working there really open my eyes.

Director
Did you come to the organic food festival we had to celebrate Earth Day?

Student
Oh, sorry, I must have missed that.

Director
We served only certified organic food, most of which was from local farms. It is not something we can afford to do on a daily basis, and there aren't too many organic farms around here. But sometime the produce we offer is organically grown. It depends on the season and the prices of course.

Student
That's good to know. I like the fact that organic farms don't use chemical pesticides or anything that can pollute the soil or the water.

Director
I do too. But let me ask you this. Is it better to buy locally grown produce that is not certified as organic or is it better to get organically grown fruits and vegetables that must be trucked in from California, three thousand mile away. What about fossil fuels burned by the trucks' engine. Plus the expense of shipping food across long distances. And nutritionally speaking, an apple is an apple however it is grown.

Student
I see your point. It is not so clear-cut.

Director
Why don't you visit our cafeteria's website? We list all our food suppliers. You know, where we buy the food that we serve. And the site also suggests ways to make your overall diet a healthy one. You can also find some charts listing fat and calorie content for different types of seafood, meat and the other major food groups.

Student
I didn't realize you thought about all these things so carefully, I just noticed the high-calorie food in the cafeteria.

Director
Well, we have to give choices so everyone is satisfied. But if you wish to pursue this further, I suggest that you talk to my boss.

Student
That's OK, seems like you are doing what you can.

Lecture 3-Marine Biology(Plant Life in Salt Marshes)

Narrator Listen to part of a lecture in a marine biology class.

Professor

Ok, today we are going to continue our discussion of plant life in coastal salt marshes5 of North America. Salt marshes are among the least inviting environments for plants. The water is salty, there is little shade and the ocean tide comes in and out, constantly flooding the marsh, so the variety of plants found in salt marshes is limited, but there is a plant genus that thrives there, the Spartina.

In fact, the Spartina genus is the dominant plant found in salt marshes. You can find one type of the Spartina, Saltmarsh Cordgrass, growing in low marsh areas. In higher marsh areas, you are likely to find a Spartina commonly called Salt-meadow Hay. So how is the Spartina able to survive in an envrionment that would kill most plants? well, it is because salt marsh grasses have found ways to adapt to the conditions there.

First of all, they are able to withstand highly saline conditions. One really interesting adaptation is the ability to reverse the process of osmosis6. Typically, the process of osmosis works... Well, when water moves through the wall of a plant cell, it will move from the side containing water with the lowest amount of salt into the side containing the highest amount of salt. so imagine what would happen if a typical plant suddenly found itself in salt water, the water contained in the plant

cells, that is water with very little salt would be drawn out toward the seawater, water with a lot of salt. So you can see the fresh water contained in the plant will be removed and the plant will quickly lose all its water and dehydrate. But what about the Spartinas, well, they allow a certain amount of salt to enter their cells, bringing the salt content of the water within the plant, to a slightly higher concentration than that of the surrounding seawater. So instead of fresh water moving out of the plant cells, salt from the seawater enters, reverse osmosis, and this actually strengthens the cells.

Another adaptation to the salty environment is the ability to excrete excess salt back to the environment. That's why you might see a Spartina shimmering in the sunlight. What's reflecting the light is not salt from seawater that has evaporated, although that's a good guess. But it is actually the salt that came from within the plant. Pretty cool, eh? You can really impress your friends and family with that little ? the next time you are in a salt marsh.

But coping with salt is not the only challenge for plants in the salt marsh. Soil there is dense and very low in oxygen, so Spartinas have air tubes, air enters through tiny openings on the leaves, the tubes provide direct pipe line for oxygen, carrying it down the leaves through the stems and into the roots, where it is needed. If you pull up a Spartina, you might even notice some reddish mud on some of the roots, this is caused by oxygen reacting with iron sulfide in the soil, and it produces iron oxide or rust.

Now, although the Spartinas have adapted several chemical and physical mechanisms that allow them to thrive in salt water and to feed oxygen to their roots. There is yet another aspect of the harsh environment that they have to adapt to, the force of tides and occasional violent storms. Wind and water are constantly crashing into these plants. So as you might have guessed, they have developed a means of solidly anchoring themselves into the soil. How? They have tough sort of underground stems called rhizome, rhizomes from one plant grow through the muddy soil and interlock with those of other nearby plants, the plants form a kind of colony, a community that will thrive and perish together. Because alone as single plants, they cannot survive. Of course the plants in these colonies also need tough resilient stems above the soil, stems that can bent a lot but not break as water constantly crashes into them.

So in addtion to the interlocking underground rhizomes, they have yet another adaptation, and it is ... well, we are back to reverse osmosis again, by adjusting the osmotic pressure so that the cells are always fully inflated, the plant is able to withstand great pressure befor snapping, so Spartinas may look like simple marsh grass, but they are really a wonder of chemistry, physics and structural engineering that allows them to survive and even thrive in an evironment in which most plants will wilt7 and die within hours.

Lecture 4-Art History(Cecilia Beaux)

Narrator Listen to part of a discussion in an art history class.

Professor

All right, let's continue our discussion of portrait artists(portraitist) and portraiture. Who remembers any of the important points we made last time? Sandra?

Student
Well, artists have done portraits of people for centuries, of famous people and regular people, and most portraits convey the artists' personal vision, like their feelings and insights about a person.

Professor
Great, that's a crucial point, and I'd like to explore that a little today. A great example of that, that vision in portraiture, is Cecilia Beaux. Cecilia Beaux was born in 1854, and after learning to paint and studying with several important artists of the time, Beaux became known as one of the best portrait painters in the United States. She was very successful. She even had portraits of the wife and children of Theodore Roosevelt, while he was president. Some did not get much more prestige than that.

Now, those portraits also reflect the kind of subjects that Beaux tended to use, which were mostly women and children. For example, in her first major work, her subjects were ..., the painting featured her sister and her nephew. Yes, Mark? Student Yeah, it just seems interesting. I was wondering if that was unusual to have a portrait artist who is a woman become so well-known and successful in the 19th century.

Professor
Great question. Yeah, she really stood out back in the 1800s. And today, she is still considered one of the greatest portrait painters of her time, male or female. In fact, she was the first full-time female instructor at the Pennsylvania Academy of the Fine Arts, and she was a full member of the National Academy of Design. These are pretty important institutions, so, yeah, she definitely made headway for women artists.

Ok, so let's look at one of her portraits now, this painting is called The Dreamer. It is one of my favorites. And I think it is especially characteristic of Beaux's work. So what you see here is a portrait of a close friend of Cecilia Beaux.

So tell me what's the first thing that draws you to this painting? What catches your eye first.

Student

Well, for me, it is her face and hands, I think they are really expressive, and also, they make the woman seem very comtemplative, seems like she is thinking pretty seriously about something.

Student
Yeah, her eyes kind of draw you in. But what strikes me is the contrasting colors, the white dress and the dark background. It kind of reminds me of that painting we discussed a few weeks ago, by ...eh... John Singer Sargent. I think it was called MadameX?

Professor
I agree, good point. Yes, Beaux had high regard for Sargent's work. And this is something, a technique you will find in both of their work.

Ok, but the painting is called The Dreamer. What do you see is dreamlike about it?

Student
Well, the background behind the woman is pretty vague. Like, maybe there is no real context, like no definite surroundings, expecially compared to the woman herself, since she is so clear and well-defined.

Professor
Yes, the unclear background definitely contributes to that dreaminess. It is meant to show a sense of isolation I think. With the woman is deep in a daydream and not really aware of anything else. This painting shows how insightful Cecilia Beaux was as a portrait artist. Besides her excellent technical skills, like her use of brush strokes and color to make an impression, both respectives come through. Her portraits reveal her own interpretation of her subject's state of mind. This is what it is all about, not just likenesses.

Now, the undefined background also shows how Cecilia Beaux was influenced by the French Impressionists, who believed, like Beaux, in a personal rather than conventional approach to their subject matter. Beaux used some impressionist techniques and share much of their phylosophy, but her style, it was all her own.