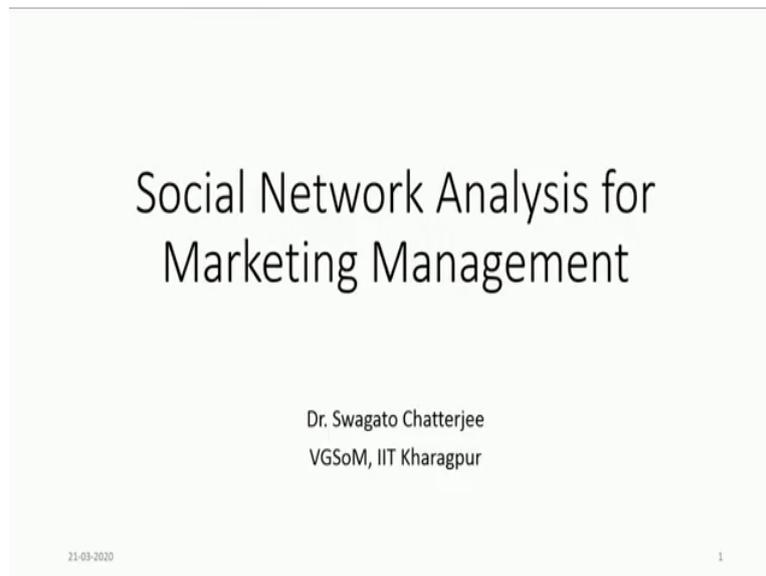


Marketing Analytics
Professor Doctor Swagato Chatterjee
Vinod Gupta School of Management
Indian Institute of Technology, Kharagpur
Social Network Analysis and Excel Dashboards
Lecture 61

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Hello everybody. Welcome to Marketing Analytics course, this is Doctor Swagato Chatterjee from VGSOM IIT Kharagpur who is taking this course. We are in week 12 and in this week we will discuss Social Network Analysis for Marketing Management.

So we, again as I discussed in the last video that we have come a long path, we have understood what customers want, what customer asks for, what is the demand, how pricing can be done and in the retail context how recommendation engines can be created, how RFM analysis can be done, how customer lifetime value can be calculated, and in the last 2 weeks thoroughly we discussed about text mining as a technique and its applications.

In this particular class we will be using social network analysis. This is not exactly social media marketing. There is a difference between that, so social network analysis for marketing management. So the first thing that you should not, when you start this particular week, the last week, you should not keep in mind that I am going to talk about anything like how to give advertisements on Facebook or how to give.

It is not social media or, digital marketing that it is not related to that. I am not teaching that in this part of these sessions. What we are more concerned about that is that how the connections between the people that are there, how that can help in various kinds of business decision making.

For example how I am connected for my professional purposes some people, I am connected with, let us say some professors in India, some people from the industry, a few guys from, some students I am connected with and then in the personal front I am connected with some other people, it is my family member, it is my friends of my friends, and let us say some other acquaintances, my neighbors and etc.

So every person has certain kind of social connection, I have connection, you might have social connection. Some of those connections can be common between us. Some of the connections can be very specific to my network or very specific to your network. So there can be, and some connections we have very strong relationship with them.

For example my relationship with my wife or my relationship with my kid or my family members are very strong. On the other hand my relationship with one of my students, let us say, would be any class in my course might not be that much strong. So the strength of relationship also varies. And then there are relationships which are bidirectional or unidirectional.

For example let us say there are relationships which are unidirectional. For example I give something to, always to somebody, so let us say there is a banking manager who is a bank's teller, and whenever I go to him, I go to bank I actually go to that guy so that any kind of transaction and etc happens. So I, for me, the direction or the strength of the relationship with me and with the bank is always through that particular person.

Now, but you have to imagine that, that particular person who is bank's teller I am not his only customer. There can be another 100 such people who prefers him and who is basically the single point connection with the bank for these 100 customers. So for these, all these 100 customers, bank means this person. But this person does not think that customer means this customer. He might think customer means all these customers.

So my strength of relationship with that person and his strength of relationship with me might be different. My strength of relationship with that person will be very strong. His strength of

relationship with me might be very weak or non-existent. He might not even know me. He smiles to everybody.

I go to him, he smiles, probably he smiles to everybody. He gives good service to everybody. So he might not know me by face, or might not know me by my name and etc, but I know him by his name, by his face and etc. It happens quite few times.

In the first few days in my college let us say a new batch has come up and I teach, in Kharagpur I teach these people, let us say around 60 guys and then I meet them in the market in the evening. There is a small campus, it is a campus, not small, it is pretty big campus.

So in this campus there is a market called Tech Market so we go to the market and often times there are some people who say Sir, Hi and I am all, means I am at loss. So I do not even know his or her face and I try to remember that who is this person?

So his connection towards me is strong and my connection towards him or her is very weak, because there are other 60 students and they are all new, there are new guys coming in the campus, they are at let us say 10 subjects that is given in the first semester. So 10 subjects they remember 10 professors and by chance I teach 2 of those subjects so basically out of 9, there is one professor.

And whose connectivity with the batch is twice than the other professor because other professor takes one, one course in the first semester, I take 2 courses. So basically the connection with me for these guys will be very strong. They will know my face and etc but I do not know them because there are 60 students in the class. So there can be unidirectional or there can be different kind of relationship strengths between two persons also depending on the direction of the relationship.

A's relationship with B and B's relationship with A might have different kind of weightages, so all of these nuances, all of these small-small details comes into the picture when we try to discuss about social network analysis. So I will go ahead.

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Social Network Analysis: A Background

- Term Coined by J.A. Barnes in 1954
- Sociometrics
- Harvard School
- The Manchester School

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So social network analysis, the term was coined by J. A. Barnes in 1954. It was quite old concept that is coming up in the business of sociology or even computer science this is there for quite some time.

And it is majorly used in sociometrics and it was first used by Harvard's School of Business and Harvard's school of Sociometrics and etc and later the other schools like The Manchester School has also adopted this particular analysis technique. So this is nothing new, this is pretty old in terms of the usage. But in the context of marketing this is coming up to be new.

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Common Uses

- Diffusion of Ideas and Diseases
- Social Influence
- Social Support
- Overt and Covert Organizational Structure
- Marketing and Management
- Social Movements

21-03-2020

What are the common uses? The common uses are in diffusion of ideas and diseases. So we are in a very difficult situation right now. We are going through something called Corona virus and we have to understand that this thing whatever I am going to talk is also related to something called diseases.

So diseases also, often times spread this term, the connectivity of the people. For example you would know that I have probably seen these videos, lots of videos are coming up, so there is 1 person, from 1 person there would be 3 persons who gets and from each of them will again give another 3 persons, and after some time this becomes a huge number.

Now the question is that if there is these 3 persons, let us say this is his family member, this is his friend and this is his colleague, okay. So who has the highest chance of getting this disease from the first infected person? Probably that person will have a higher chances of getting this disease who will also have the, probably the chances of, who is more connected with this person, means whose relationship strength is more.

So probably not his colleague, but most probably his family member will be most connected and that is why you will see that often times people, whoever is the family member of that particular guy who is, who has Corona virus gets isolated. So, or often times kept in a quarantine facility also. And may be his friends also, he is connected to his friends, so that is how the any kind of, I would say epidemics and etc spreads.

Now you have to also understand that if the social network is very cohesive in nature, very, let us say there is one social network where there is one person. He has 3 connections, okay,

this is the connection, this is a connection, this is a connection. This guy has 2, again 4 connections, this guy has 5 connections, this guy has 7 connections.

So that kind of an, these connections are also connected with the original person and these 2 connections are related to each other, this connection and this connection is related to each other, people are cohesive. They all talk with each other versus another network, this guy is connected with 3 persons and they are connected with 3 persons just like that. But these 3 persons do not know each other.

Now tell me that where are the chances of spreading will be higher? It is more or less a common sense that here it will be higher because they are more connected. This guy, this person can get infected by this person, this person, this person, this person, there are 5 persons who can infect him. And each of these persons are also connected with multiple other people. So this network structure, how the network is structured can impact the diffusion of ideas or diseases.

Similarly let us say who has the highest chance of getting infected in this thing? Let us say this guy gets infected because he is in the peripheral side. So do you think that a person whose, who is the first person who gets infected of Corona virus in any country?

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Common Uses

- Diffusion of Ideas and Diseases
- Social Influence
- Social Support
- Overt and Covert Organizational Structure
- Marketing and Management
- Social Movements

21-03-2020

The first person who gets infected with Corona virus is somebody who is staying abroad, because it is coming from abroad in most of the cases. The guy who gets affected for the first time is somebody who is staying abroad but then the person who is, after the first person gets

affected, the person who has the highest chance of getting affected is the person who meets these kind of people most.

Probably the doctor, or the nurses because all the persons who gets affected from the peripheral regions which is like the abroad people will come back, get bad, get worse in their health condition and etc and will come to hospital. So the hospital guy is directly connected with all of these persons, all of these patients and he has the highest chance of getting infected after the peripheral type.

So he might not be the first person, the doctors and etc, he or she might not be the first person to get affected but they might be the most important, most vulnerable persons when the actual epidemic starts, so similar things can be applied in the context of marketing also.

Now think about how this kind of things can be used in marketing. Let us say government now is trying to say that Stay Home Stay Safe kind of a news government is trying to pass. So government wants this news to be passed to as many people and you think that I will believe a message from government or anybody or even multiple people tells me, right?

So I, so it is not often, a person, it is not only the reaching that person is matters, often times multiple exposure of this particular information in front of a person is important and that is why government is trying through mobile, radio, TV, print media, local health workers, this, that, government is trying in whatever way possible.

So we have to understand that a message only goes within my mind when 2-3 impressions happens. More impression happens means what kind of message I would want? I probably want such a network where there are lots of connections between each other. The network is cohesive such that if I can inject the information within that, lots of people will actually follow that thing because people will come to know from multiple sources.

On the other hand you have to also understand this that a cohesive networks are often, it has been seen that the cohesive network, the network which only talks with each other, certain, sometimes some religious people, certain religions who try to stop other kinds of people, there can be certain people who do not allow other kind of people, they think that whatever I believe is the utmost thing.

Or there can be, let us say, even anybody who follows a very ideology very strongly they believe that whatever I think, I believe, whatever I have in my life, that is the utmost thing.

So in these kind of networks, groups of people who have similar kind of belief system, it can be religious belief, it can be political ideology, it can be anything, when the belief system is very strong and they only talk with each other and do not talk with others, penetrating those particular network becomes very difficult.

So if a network is very like this, very or everybody is connected with everybody then getting into is very difficult. But once you get into it, it will spread very easily. So that is something that we have to, this kind, now how that will apply in a real life situation?

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The slide is titled "Common Uses" and lists six items: "Diffusion of Ideas and Diseases", "Social Influence", "Social Support", "Overt and Covert Organizational Structure", "Marketing and Management", and "Social Movements". A red bracket on the left groups the first three items, and a red bracket on the right groups the last three. The "Social Support" item is circled in red. A small red checkmark is next to "Social Influence". In the bottom right corner, there is a small video inset of a man with glasses and a blue background. The date "21-03-2020" is visible in the bottom left corner of the slide.

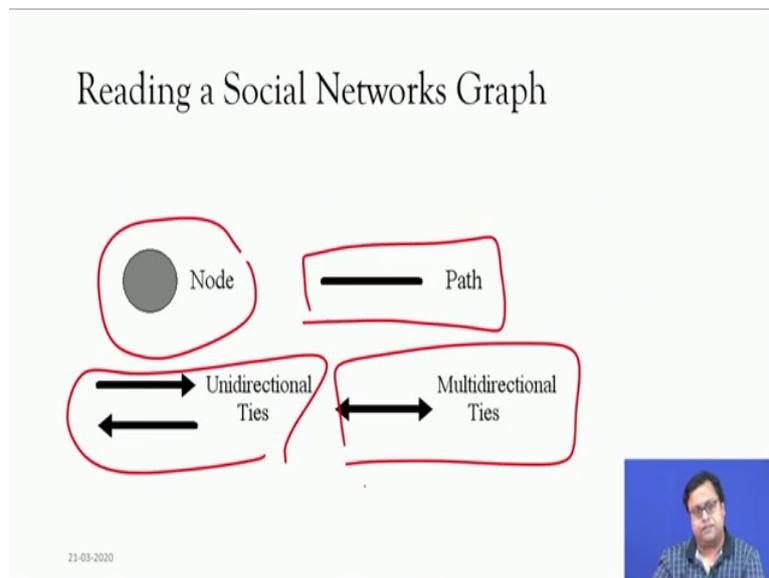
- Diffusion of Ideas and Diseases
- Social Influence ✓
- Social Support
- Overt and Covert Organizational Structure
- Marketing and Management
- Social Movements

21-03-2020

If I am having this kind of a problem I should know that whether I will be using what kind of network I am facing, what kind of problems I will face in penetrating that network and etc, that kind of information I should have.

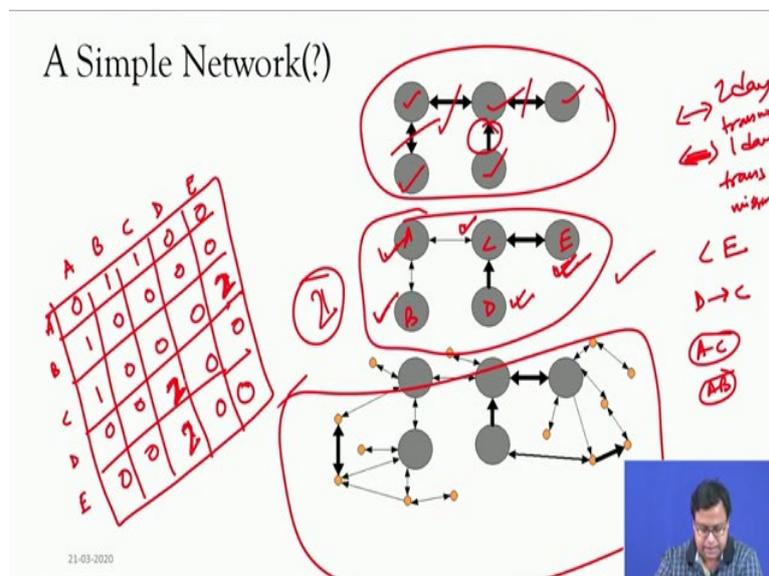
So diffusion of diseases as I told and then comes probably social influence, how to influence people, social support system, how to make sure that the support reaches the right persons, overt and covert organizational structure, marketing management, social movement so it has use in many-many places this particular thing, this social network analysis has its usage.

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Now in any social network analysis we have basically some node. Node are basically the connections, the points, in this case the human beings and the path, path means connections. And path can be unidirectional ties where either A to B or B to A or can be multidirectional ties. So these are the basic, I would say aspects or without these things a network cannot be built.

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Now a simple network looks like this. Let us say there are 1, 2, 3, 4, 5 nodes and all of these things, unidirectional, this is multidirectional, this is only unidirectional. So this is basically one simple thing. Now we can also bring in lot of more information.

So one thing is direction. We can also make these particular links that they have, the paths, the path width can be changed. And path width can be a measurement of how strong or how weak the relationship is. So I can say here that if I name them A, B, C, D and E then I can say that C and E are most connected because they are multidirectional connections, then probably D to C that connection is there but C to D that connection is not there. A C and A B, these are loose connections.

So if I have to now pass a message to these people whom will I put? Now see if I give it to C, this guy gets affected in the very first day but these two guys get affected in the second day and third day, fair enough? But if I give it to the, D does not get affected because there is no this direction. On the other hand if I give it to let us say if I give it to D, then this guy affects in first day, this guy gets affected in second day, and this guy is affected in, let us say third day and then in fifth day.

So I am saying the fat one is 1 day transmission, this is 2 day transmission. So we can find out that in which kind of thing, whom should I put the, who gets infected, that will impact the whole network quickly. These are also networks, so these are some examples of networks that has been given.

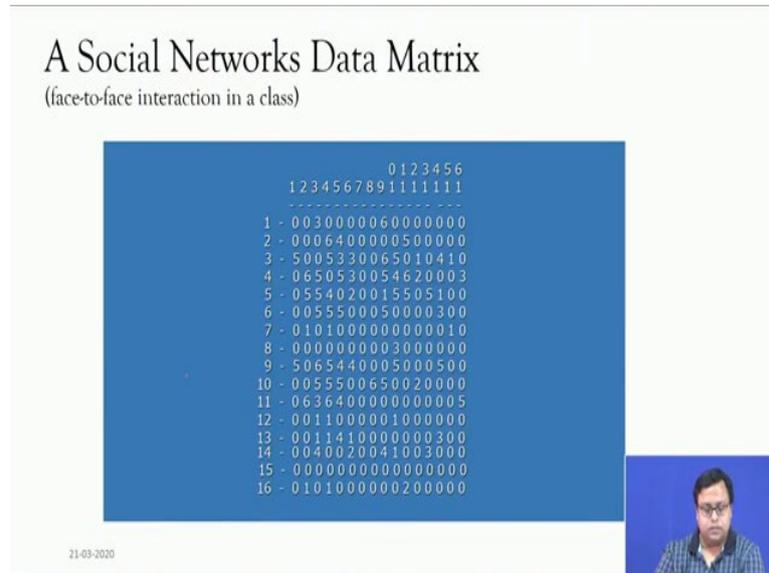
Now if we try to put this particular network, let us say I am trying to put this particular network, network number 2 in a graphical way. What can I do? I can say A, B, C, D, E and there will be again A, B, C, D, E fair enough? Now tell me whether A is connected with B? Yes. Whether A is connected with C? Yes. Whether A is connected with D and E? No.

Now whether B is connected? B is only connected with, sorry this is wrong, B is only connected with A. So that diagonal elements will be 0, I am just writing it down. B is only connected with A and not connected with any other guy. On the other hand C is connected with A and E both, C is connected with A and E and not connected with D. D is connected with C and nobody else, and E is connected with only C again and nobody else, basically nobody else.

So this is the matrix that I have created which actually talks about this picture. So either this matrix or that picture is enough to tell me the structure. Now I can say instead of 1 0 1 0, I can say that all the fat ones are double as the, not fat ones, thin ones, the path I am saying, so then C and E this connection is fat. So C and E this is 2, and E and C is also 2 and then D to C is also 2.

So now if I write this then I know that okay, what is the path strength also. So this kind of a matrix is what we create to make sure that whether there is a network or not. We call it basically a connection matrix.

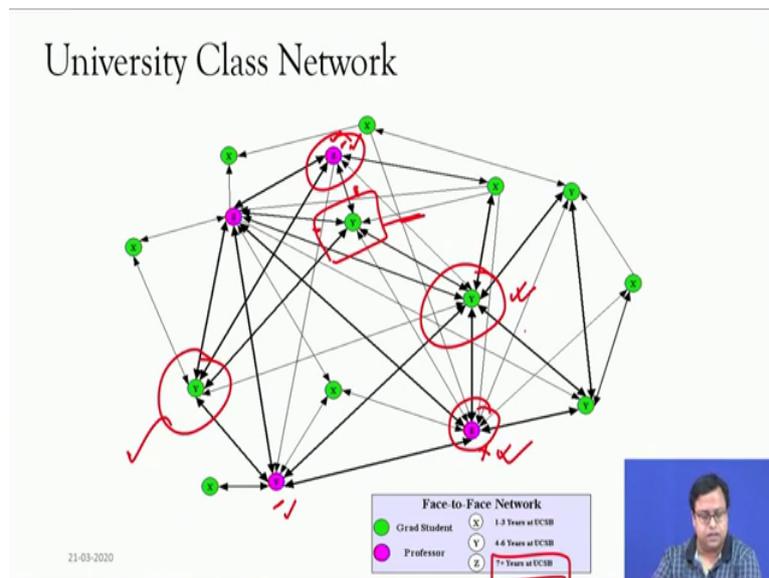
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Now a social network data matrix looks like this. See there are basically 16 people here in this particular one and each row is 16 numbers and this 3, 6, 5, 1, 2, 1 any non-negative, non-zero number or non-zero or non-negative, basically a positive number is talking about that whether a relationship exists or not, and the higher the value of that particular relationship, the higher will be the strength.

So this kind of network will be given to you. You can make this kind of pictures out of that and then make sense out of it, whether it is giving any kind of insight or not. So social network analysis as a starting point that is why is often a observational study and then there are certain other things that comes into the picture also. We will not, we will see that how much we can cover about that.

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For example there is university class network that has been created. So the green ones are graduate students, the pink ones are professors. You will see that professors are more, it is a unidirectional relationship, sometimes it is bidirectional relationship. And XYZ is 1 to 3 years in the university, 4 to 6 years and Z is 7 plus years in the university.

Now in this network we have to find out that who are the people who are most connected, who has more centrality, centrality means they have most connections, more central positions in the network and what is the cohesiveness of this particular network, so there are various measures of that. I will not go into these details but this kind of a picture telling me that not all professors practically talk with each other.

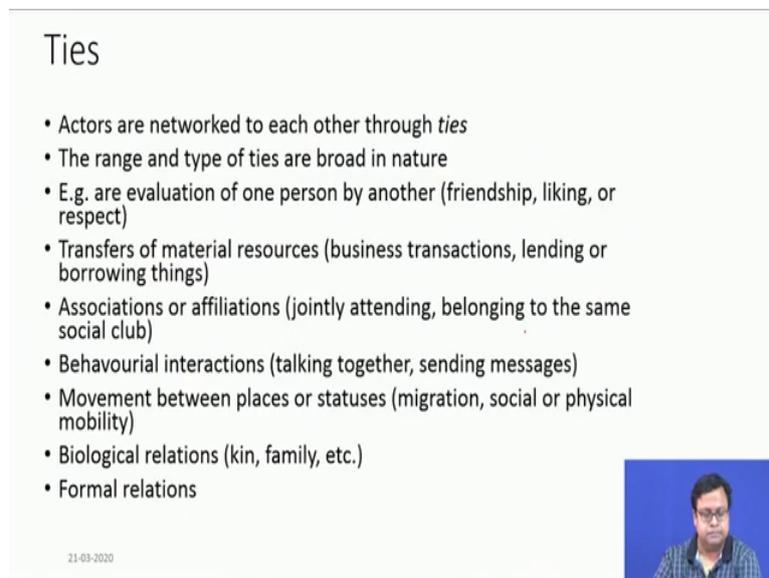
For example you will see that Y does not, this professor Y does not talk with professor Z. This person does not talk with professor Z. Professor Z has a connection with, this professor has a connection with this professor but this professor has a connection with this professor but the opposite is not true.

On the other hand you can also find out that this professor has no connection with this professor. So that means that not all professors talk with each other. On the other hand if you just check the which professor is most popular you will know that this professor is most popular and this professor is actually least popular professor. Though he is here for more than 7 years he is not so popular and this professor is the most popular, also he is there for 7 plus years.

Out of the students who are the most popular students? Popular student is this person obviously, and this person. I could have told this person also but see the connection strengths are not so much so, while connection strength here is much higher. So connection strength here is much higher and this is, not only connection strength is higher, the number of connections is also higher.

So this gives me an idea that the optimal number for Y is 4 to 6 years so as age increases in the network your popularity increases obviously but not always because there are certain professors which, who are of high age but still are not so popular. So that kind of an insight we have to bring in when we talk about this.

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The slide is titled "Ties" and contains a bulleted list of examples of ties between actors. The list includes: Actors are networked to each other through ties; The range and type of ties are broad in nature; E.g. are evaluation of one person by another (friendship, liking, or respect); Transfers of material resources (business transactions, lending or borrowing things); Associations or affiliations (jointly attending, belonging to the same social club); Behavioural interactions (talking together, sending messages); Movement between places or statuses (migration, social or physical mobility); Biological relations (kin, family, etc.); and Formal relations. In the bottom right corner, there is a small video inset showing a man with glasses and a blue background. At the bottom left of the slide, the date "21-03-2020" is visible.

Then there is something called ties. So path or tie is the same thing. Actors are networked to each other through ties. The range in type of ties are broad in nature. Example are evaluation of person by another, it can be friendship, it can be liking, it can be respect, who respects whom, so whatever way you try to define a network.

Transfer of material sources, it can be business transactions, who pays whom, who is the employer, who is the employee, who is teaching whom, that kind of, lending, borrowing, it can be association of affiliations also, so who is affiliated to which guy, jointly attending, belonging to the same social club, it can be behavioral interaction also like talking to each other or sending message.

It can be movement between places or statuses, biological relationships, formal relationships so there are various ways you can define a tie. When I say that there is a connection between one person and another person that connection, the definition of this connections can be many thing, it can be your social connection, personal connection, professional connection, it can be payment, it can be a message being sent, it can be a gift being given, it can be anything. So you have to decide that what you define as ties.

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The slide is titled "Dyads" and contains the following text:

- Tie connects two actors but the tie is the property of the pair and not to any single individual
- Some analysis take a pair of individuals and their connections (also known as a *dyad*) as the unit of analysis
- One can observe the possibilities of tie, undirected or directed (which will bring in reciprocity)

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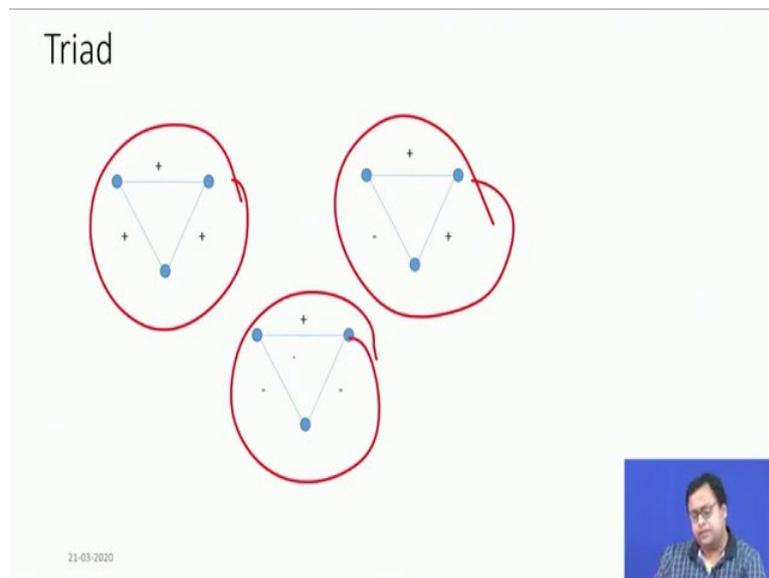
- A circle containing the text "relationship - 2 persons - 1 connection".
- A diagram showing two nodes (circles) connected by a line, representing a dyad.
- A bracket around the third bullet point.

The date "21-03-2020" is visible in the bottom left corner of the slide. A small video inset of the presenter is in the bottom right corner.

Now there is something called dyads. Tie connects two actors but the tie is the property of the pair and not to any single individual. Some analysis take a pair of individuals and their connections as a unit of analysis. So if I take this, this and this, a relationship basically, a relationship. Any relationship has two persons and one connection. These three things together create a relationship. So that is called a dyad.

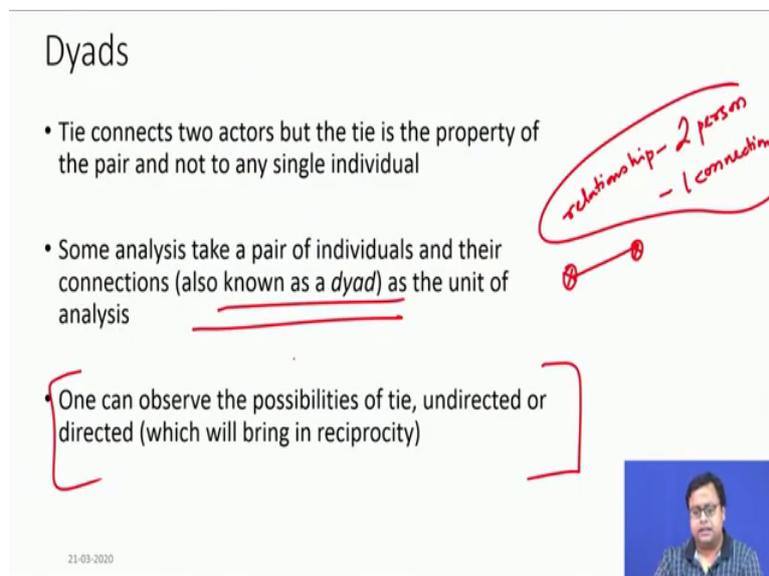
Different kind of dyads are, sometimes dyads are also an important aspect of analyzing. One can observe the possibilities of ties undirected or directed which will bring in reciprocity so that kind of things when comes up then the dyad is there.

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Triad, the same thing but now there are 3 persons. So when there are 2 persons only 1 connection are there. When there are 3 nodes then there will be 3 connections. Now this connections, triad can be all positive or 2 positive, 1 negative or 1 positive 2 negative that kind of triads are possible. So there are different kinds of triads possible. Now how will I define this? Where it will be applicable?

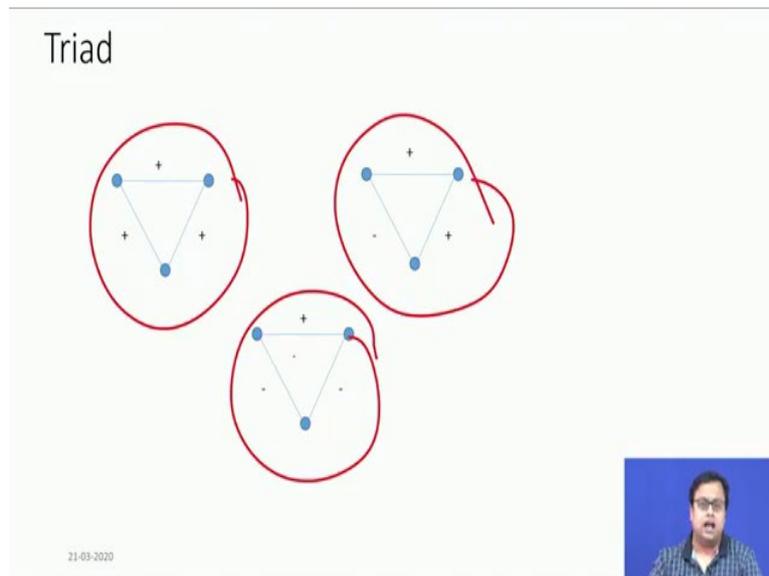
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For example dyad, if I try to find out that how the dyads in a family relationship, let us say you are there, your kid is there, your wife is there, the family members are there. How the strength, the dyad strength, let us say the dyad strength whether that will have, or the number of dyads at least whether that will have a positive impact on consumption or not.

So we used to say at one point of time that a family who eats together stays together. So stays together is that means the number of dyads are high in a network. So if the number of dyads are high in a network whether that family has higher chances of consumption because this stays together that means they celebrates their being togetherness and one way of celebrating is having food together so they may have higher amount of consumption. So we have to check that. That kind of hypothesis can be checked with dyad as a concept.

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Triad has similar kind of applications. Let us say triad, the more is the number of triad and if the relationships are sometimes positive and negative both side the more is the chances of conflict. So if I want to see that whether are conflicts available, in a social network how many conflicts are happening, that can be predicted by the number of triads that, that particular network have. So these are hypothesis which can be checked using the network structure.

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Centrality

- One of the earliest ideas that the social network analysts pursued is that of centrality of individuals and organizations in their social networks
- The origins of this is the concept of a *star* – the person who is most popular or who is at the centre

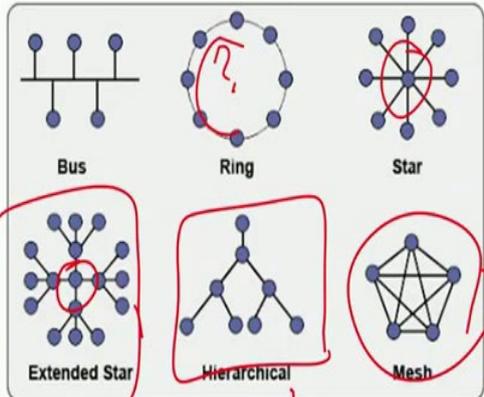


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Then there is something called centrality. As I was telling that how central one person is, how he is more close towards the middle point, so one of the earliest ideas that the social network analysts pursued is that of centrality of individuals and organizations in the social network. The origins of this is the concept of a star, that person who is most popular will be always in the center. So that kind of a thing can also be measured.

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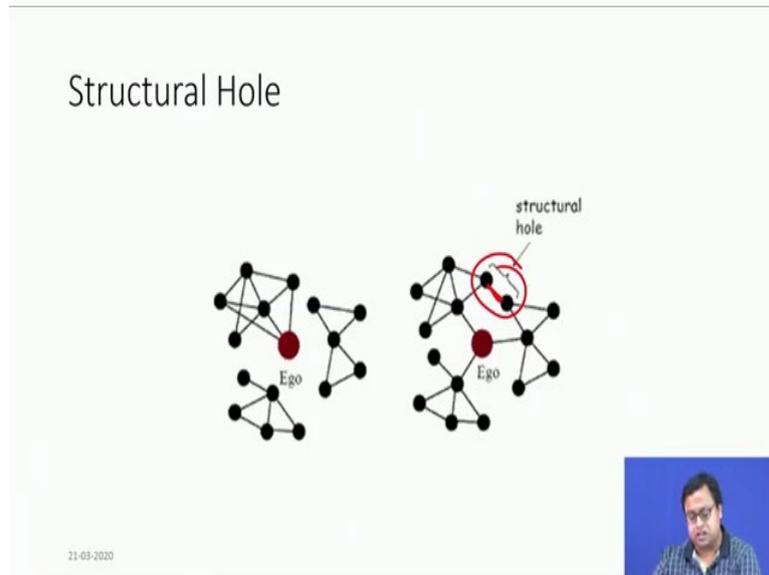
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There are various types of social networks. For example this guy is central, there is no centrality here, this guy is also central, so we can find out that what is the centrality depending on the network structure and there are various possible network structures that you can see. This is a classic network structure.

For example this is organization network structure in a very bureaucratic organization you can see this kind of a structure. This is open organization structure probably and this is probably a structure of a multinational company. So that kind of things you can be able to see.

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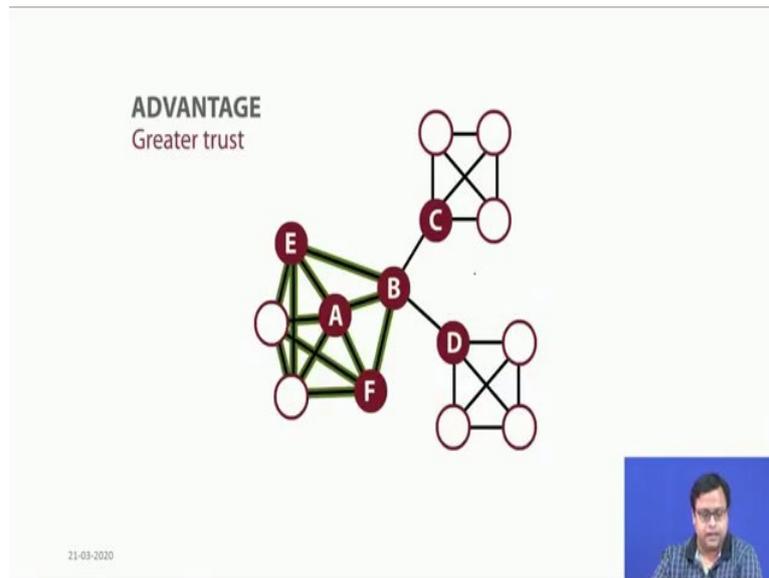


And then comes structural hole. The structural hole is basically that, if the hole which is actually saying that there are two sets of networks which are not connected with each other because of these 2 nodes are not connected. If these 2 nodes are connected then this network and this network will get connected. So that is called, absence of that kind of network is called structural hole.

Structural hole actually reduces the number of information passing. It reduces the chances of information passing. It is like the barrier that is abruptly being created between 2 networks. So that is something that even this, if you see these quarantine facilities or this lockdown that are happening because of Corona virus, in the network of people they are trying to create this kind of structural holes.

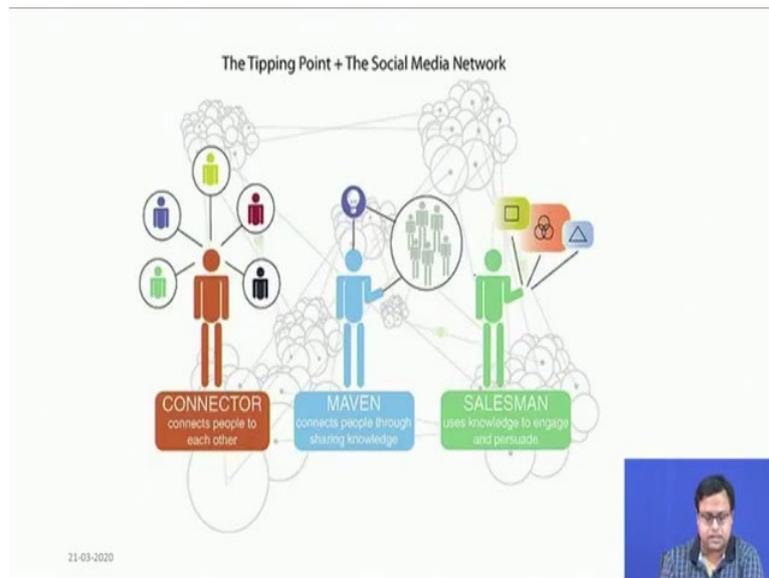
If I stop you from going to a office today then there will be, let us say 20 people in the office who is the office network. If you are infected and go to office then this office network will be also infected. I am creating a structural hole between you, your personal network and your office network and your office network gets saved from the getting the infection. So that kind of structural hole concepts are also there.

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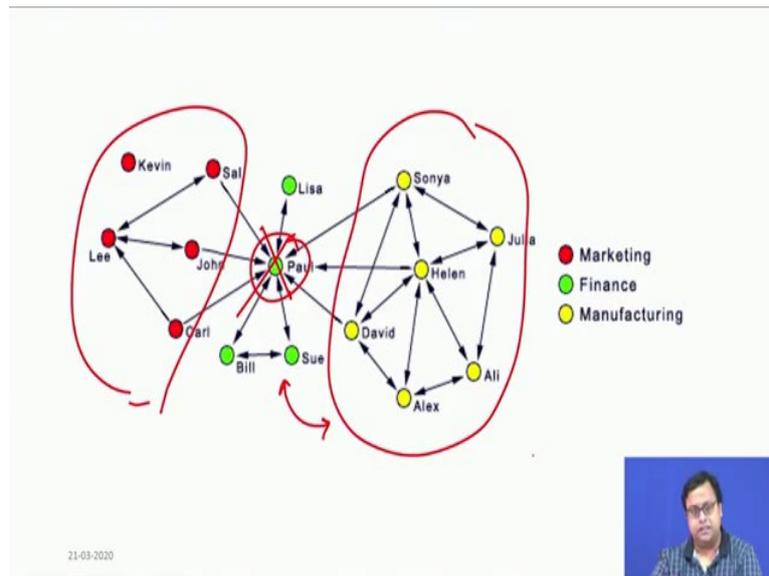
Advantages are greater trust between the more structural holes are there, the more cohesive these guys are. So the trust will be higher.

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And there can be so many different kind of people , in the network. There can be connectors, there can be mavens, there can be salespersons and we have to identify who these persons are.

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For example, this is an example of organizational culture kind of a thing and they are saying that these are the, red ones are let us say the, red ones are the marketing, the yellow ones are the manufacturing and the green ones are finance. And probably Paul is the person who connects everybody.

The marketing guy talks with each other. The marketing guy does not talk with finance guy, manufacturing guy. Manufacturing guy connects with finance because they have to connect with finance and these guys talk with also, so by chance if this person is not there, these 2 networks will be absolutely different from each other. So basically Paul acts as a structural hole.

So we will stop here for this particular video and I will give you a case study in the next video to discuss that how these particular concepts can be applied in a real life situation. Thank you very much.