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Lecture 10- Key components of a chart and types of plots

Hello everyone, namaskar and welcome to a altogether new discussion which now we are going to have on key components of a chart and types of plots. This section I mentioned in earlier lectures that this I will discuss completely in a separate way. We will have another discussion on maps and other things. So, let us start with this that why graphs. Remember that when we have been discussing about the data you know methodology at that time I mentioned that you know if data we present in form of tables may not be a good thing. So, if a data can be presented in form of graphs or charts or plots it becomes much easier for the reader to understand the things and can interpret or can find some pattern in the data also or some correlation, relationships, relative impact of the data or relations between who is higher, who is lower, who is in middle that kind of thing can come from this graphs or charts. So, a common word is being used here graphs that also includes figures, charts, plots and other thing. So, these are very great and very effective visual communication tools and lot of digital tools nowadays are available to us. So, there is no problem of converting your data into graphs or charts. This can consolidate large amount of data to help identify pattern and relationship.

This is what I was saying pattern and relationship can be easily understood if we do the plotting part. So, whether they are included as part of scientific article, a presentation or poster, scientific graphs always help to communicate the key findings of study or investigation. A picture tells thousand words, remember this. A data table will not create any impact whatsoever. can the data in a table will not bring patterns and relationships among different parameters or variables. But if you use the graphs, charts, plots, you can bring these things and the understanding of the work becomes much easier to the reader. So, this is very-very important. While preparing you know these graphs, charts, few points we should keep in mind. First of all, we can raise a question to our self is it really necessary or needed because just for preparing graphs one should not do it. If not too much data is there, just 2-3 variables are there. They can be presented in form of tables. There is no need of putting a graph. But, if there are lot of data for many years, lot of variables, then it is always good to have a graph or plot. So, some results can be easily summarized in two-three sentences or one-two sentences. So, you can avail that.

Otherwise, if it is too large data categories, variables, measurements, then table be more appropriate. But again, I would say that instead of table, if that data can be presented in form of graphs, charts that would be better. Another thing while drawing or you know creating graphs one should not clutter because the thing the plot which you will create has to be very clear to the audience or to the reader. Audience I am saying because sometime later on we will be also discussing about power point presentations also. So, that is why audience. And the second thing is what types of variables do you have? This is another question which you can raise. So, once you know the types of variables within the data and the results statistical analysis which will give you know a direction to decide the type of graph to use. Because for all kinds of data, all kinds of graphs or plots cannot be used or should not be used. So, very appropriate technique of this plotting has to be used. The third question one is there, what is your message? What do you want to communicate to the readers or audience? So, that thing one should keep in mind.

Graphs should clearly communicate a message. If you have gone for this option then it should clearly communicate the message and I will be showing good examples, bad examples and discussing that part in detail also. Because the data which you are going to include will help to communicate your message in a much better manner and the audience will understand very easily. So, they should not be any misleading in that sense also. Now, while preparing a graph, chart, figure, plot etcetera, one must know what kind of data is going to be handled. For example, you might be having point data, you might be having time series data, you might be having temperature data and so on. Another important thing is to know which graph, chart, figures would be able to so represent for better and convincing understanding. So, once the data like if I give the example of excel which is used extensively then in excel once the data is there you can choose different options and the one which is really good for you know communicating your message or convincing understanding is getting developed then that graph or chart should be developed. This I have said, so no more repetition on this. The best way to display information through graphs, charts and figures, this we know.
So, instead of showing data in tabular form, one should always try to show that data through plots or graphs. There are several such softwares, one I have just named excel, but there are other softwares also which can produce different types of graphs. But do not always try to go for very fancy graphs for a small communication about the outputs or relationships or you know pattern. Do not complicate things. So, if a simple graph or plot can show that pattern or relationships choose that one. When I can show you through a simple bar chart why I should go for a 3D bar chart that may add some confusion in the minds. So, always one can avoid. Now, first thing one should know about when data is represented. Then, we are having here a table which means component and then meaning. So, suppose I am having the data which is in series data, may be time series data and

other data set. So, each set of data points and each set related data points makes up one series. Each series in graph distinguished by colour, pattern or symbol. So, suppose you are having you know rainfall data for many years. So, how do you would like to represent pre-monsoon, post-monsoon that means you are having series of data at least two sets of data. So, that you can sorry water level into pre-monsoon, post-monsoon and rainfall is not in that way good example. Another thing is the categories that what kind of categories in the data is the major divisions of the data. The series data are divided into categories which might be non-numeric and categories represent values of the independent variables. So, one has to understand first the data and then appropriate graphs should be prepared. Now, third is the values. The values of the data that means if I am having say a water level then in a well or in a area or several wells then what is the value and we should provide also unit and other details are there.

Now, what are the typical graphs or what are the key elements of a graph? So, each graph should wear a title though it might be optional but you know once you provide a title that graph or chart becomes completely independent. And if you do not have even in that case particularly in case of a power point presentation and other thing then you need not to have caption. So, you can say you know rainfall pattern or such and such area in the title and that becomes more informative rest of the information can come within the graph. Now, these x-axis value x-axis you know or category x-axis. So, x x y x. So, all these x's should be marked, they should have units and all appropriate or necessary details should be there along the x-axis. This is the common mistake people are putting. They are putting the information as they fed in the excel, but the units are missing. So, if it is a rainfall, it should be in millimeters. If it is a water level in a well, it should be in meter and that kind of. So, the unit has to be there all the time for all both the axis. If it is 3D, all three axis. So, these axis are very very important. Complete information, tick mark, begin, what is the begin value, what is the end value and in between tick mark and the information about the axis. If you are having the series data a set of points data then there are three series in the bar column chart each series represented by bars column.

So, a bar can have multiple colors multiple pattern to show a series that is also possible. So, again you would have to have a series axis one should understand what is in a individual multi storey bar is there. Another important thing never ignore this legend or in case of maps index. So, this is though it is might be optional, but my suggestion always keep legend. But if it is not too many variables are there then one can definitely avoid or in suppose this is bar chart then within that bar you can write different variables and then probably you do not have to put the legend and the title has already come there.

So, like the example which I am giving here very simple this that one by one we will go on the left side and then right side. So, this is the title which we have discussed first and

the title is rainfall by quarter. For every three months you are having rainfall. Now, the value of these axis, see that one should provide the units and this begin and end and all values in between. Same thing here for this axis quarter 1, quarter 2, quarter 3.

So, in this particular case no units are there except this quarter. Then since we are having you know categories, 4 categories are there fine. Then we are providing legend because against individual bar that information is not being written that this is the cosmic, this is galactic and stellar. So, we are providing a legend. Putting a legend is always helpful to the readers, to the audience. You know whenever you are plotting, preparing a chart or graph, the graph itself should be complete by itself. There should not be you know missing things. This is my whole point here. So, once you have plotted something, sit back, relax and look whether the reader would be able to understand everything precisely, nicely or not. and once you are convinced then add in your you know thesis or paper or ppt whatever. So, all these details are there level always access levels are there like here it is a quarter here it is sales in units a number of you know what are the units which have been sold this is just one example. Types of graphs various types are available this list might not be exhaustive either. So, you may have a area graph bar and line graphs like if I open a you know excel then see that area, bar, column, line, pie chart, scatter, 3D area, 3D and this list goes on. But as suggested earlier as mentioned earlier if a simple thing you want to communicate do not complicate your figures make it keep it simple as far as possible. Pie graphs are also possible. I would mention something against pie graph once that discussion comes. Scatter graphs are also there. Three dimensional graphs are there. Scatter graphs are very useful to communicate the relationship between two variables so that people can easily understand very nicely. So, prefer that one if you are having two variables you want to show the comparison or relationship between them.

Stack graphs are also there. So, stack graph you can have like this stack graphs and so on. So, one by one area, bar, column and line graphs these can be used. So, very simple or in same time they are conceptually the same. Same data can be used to plot all these things and they represent basically the values using areas, bars, columns and lines.

I would suggest try to keep things simple. If a data can be represented or set of data or series of data can be represented with line graphs, use that one rather than going for more complicated one. And, the area and line graphs are used to display continuous data, but discontinuous data can also be represented, but sometimes it does not become that much convincing. Whereas, bar graph and column graphs are used to display non-continuous data. The major difference between these two is a bar graph and a column graph is the orientation. the column graphs values are plotted y axis and the categories are plotted in x axis, but some people may go in a reverse way either. But again trying to communicate it is some related with some length then you can change the axis otherwise if you want to

show some changes in terms of height then normal graph plot or bar graph can be done. Stacked graphs or stacked bar graphs of charts are in the graphs stacks are also created like this multi storey bar charts you can say. So, again the legend is there, you know title is there, axis details are there, complete axis details on both x axis and y axis are there and then you know whatever the sales you are trying to show is coming very clearly that in which what item is being sold or what type of printer is being sold in different quarters. Now, this stack graphs each category is represented as one bar or column instead of separate bars. You know within a bar I can compare and among bars I can also compare.

So, it depends on the data. If you are having you know like time series data which has date data like here, then stack bar again are preferred. And, this is the example I am bringing from the corona period. And so, what were the cases in Africa, America, Asia, Europe, Oceania and how things have been changing. So, just notice the you know it started somewhere in January 2020 and then like in India or in Asia this became very big somewhere in the like March 20 had I would say the rehearsal for complete close up of everything and then we had to do that thing for a longer time. Anyway, so this is the good example of a bar graph that things now here the axis have been changed.

So, the categories are here being shown here and the successful nets are being shown here of different words or whatever is there. So, in that way you can also showing relative performance of different things with time or with number and so on. So, as I have said it depends in which axis what you want to keep. The best thing in digital thing if you are using excel you can just change from x axis to y and y to x and can see which one is more convincing to readers. The bad example is here the first point here is that they do not have units at all. So, one is confused and the categories are very long and unnecessary this space is being wasted and also you do not have a pattern fill should be avoided particularly when displaying more than one data series. So, that is also to be avoided. So, it does not have title either, though it is having legend but it is not as good as possible. In digital communications nowadays one should use colours very well without much problem. But if it goes in the printing then sometimes one is compelled to use you know grey or black and white things. So, it depends in where you are going to communicate accordingly. Now, good example of histogram as you can see every detail is there, units are there and axis are marked and the start points are also there, end points are also there. The probably only thing which is missing here is the title, but if a caption is added then that will suffice this problem, but anyway one should always try. Now, with the bad example, I will, we should be adding, ending things with positive notes, but anyway in this one, I am finding a bad example of histogram. So, sorry about that, but we have come to end of this discussion. So, here the problem is, the first problem is that y axis include too many ticks. Unnecessary, so it is not required, so do you know clutter your graphs or charts. Keep it simple when these tricks are not required why to put one.

Second is it is missing the title and the most important one is that when we know that my this my variable is none of these values are having more than 30. So, why I would go up to this? I could have kept the values, number of words between 0 to 30 in this particular example.

Therefore, what would happen if this would have been gone there, this means 30 would have been here, then the difference would be very, very clear about the beak length of these. So, though you have plotted, but you have missed the opportunities to communicate the differences in the beaks of different words. This is the point. So, in civil engineering or in geomatics engineering, there is a subject which is called cartography.

So, cartography is art of map making. But the similar concept we can apply here also. That once you prepare a chart or graph you should see that what you are trying to communicate are you able to communicate or not. Like in this example, no. And therefore, you are missing the point you have put a graph and it is not proving. And the differences between the beak length is not coming as should have been clear.

And therefore, one has to be very careful. Nobody has told you by default the values might be between 0 to 100. But need not to this is as per the software design. So, they have put the value to between 0 to 100. You need not. You can have just up to 50 or 30. and then the differentiation will come. Some people what they do that is one should not do that kind of thing that if they do not want to show too much differences in the you know like beak length of these words then they will have this kind of axis that the entire area is just free of information. But since they do not want to show too much differences between beak length. And sometimes people go in a reverse manner that the there is not much difference in the beak length, but what they will do they will stretch these bars or they will have a such a you know less value difference for the y axis and therefore, these differences would be highlighted no. So, neither way one should do it do the balance approach always try to struck a balance in your charts graphs and once you have plotted, sit back. See by yourself, assess by yourself, am I missing some point, am I able to communicate all the data or the comparison or pattern which I wanted to show. And if not convinced or confused, in that case you can take help of your colleagues, students or friends or whoever it is and then good suggestions might come. So, with this positive note, I end this discussion. Thank you very much. Namaskar.