Transcript for Session 048

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Transcript:

Hello and welcome to http://chandoo.org podcast. This is session number 48. http://chandoo.org podcast is dedicated to making you awesome in data analysis, charting, dashboard and VBA using Microsoft Excel.

For today's topic I have something very interesting and somewhat puzzling too. Quite a few people ask me how to make animated charts in Excel. So, today, I am going to talk to you about **various techniques for creating animated charts in Excel**, how to set them up, how to animate them, and some of the things that you should keep in mind when you are creating such charts.

Before we jump into the podcast, I just want to share a couple of announcements. You might have noticed a significant gap between the previous episode and this episode. There are not many reasons as such; it is just a very busy and festive time in India in late October-early November. We had a lot of family and relatives visiting us all this while and so I just got busy spending time with all of them eating delicious food and laughing all the way. That's why I couldn't focus time on podcast recording.

The other announcement that I have is that, finally, my book 'Dashboards for Excel' is shipped. It has been out there for a month already but I received a pack of ten books from my publisher about ten days back. They sent them to me just so I could read and maybe gift the books to people who I know. Probably a couple of people from where I live in Vishakhapatnam follow my podcast and blog but not many do. So, I am planning to send two books as gifts to podcast listeners currently living in India. You might be thinking that's unfair because you live in US or Australia or New Zealand. I would love to send these books to you as well but shipping them from here is going to be a bummer and it is pretty costly to ship the book. It is probably by kilogram weight and I don't want to ship that kind of thing all the way from here. But, you can buy the book on Amazon or a local book store whereas the book is not yet available in India and so this is my way of sharing the book with a couple of readers in India. All you have to do is listen to this podcast, drop a comment and please make a note that you are from India in the comment. In case you are not from India, you are still welcome to comment but, unfortunately, I won't be able to send the book to you right now. Maybe when I visit US next time, I will buy a bunch of books and ship them to our listeners there as well in another contest. But, this is strictly open for people living in India. So, if you are one of our podcast listeners currently living in India, here is your chance. Visit

http://chandoo.org/session48/ which is the link for this podcast and leave a comment so that I can pick any two random people from the commenters and get in touch with you and mail the book to you in the next few weeks. That's about the announcements.

Now, let's move into the topic of the day which is **'How to Create Animated Charts in Excel'**. Before we talk about how, let's talk a little bit about the why aspect of this. Why do you want to create an animated chart? The primary reason behind animation is that when you animate something like an object moving it **draws our attention**. Now, naturally, in a Board meeting or a business presentation, things are pretty busy. Everybody is looking at all the numbers and charts and this and that, and it can get a little dull also. This is where a little bit of animation can add a lot of wow factor. When a certain line or bar jumps or moves, it draws some attention and it kind of triggers a lot of thinking and thought process. This is why animation can be used. Now, if we overuse the animation then we become de-sensitive to it. In general, **animation is a way of contrasting your message**. If you have a sentence and you want to emphasize a particular word in it, what would we do? We would apply some sort of effect like bold or italic or underline to that word so that people can look at that and say that it is important. But, what would happen if the entire sentence is bold and there is only one sentence and nothing else? Then it is not contrasted at all by definition because everything looks the same and so we don't really focus on a particular word as such. We just look at everything and treat it as an un-bold sentence. The same thing happens with animation too. If every chart and element is animated then you don't get the desired effects. So, you should be using animation in moderation. That's the mantra here.

Now that we know why animation should be used and how much animation should be used, let's talk about techniques for creating animation in Excel. I am not really sure if you can hear some background noise. If you do, I really apologize. I am running short of time and so I couldn't wait for the background noise to finish before resuming recording. Please bear with me.

Let's talk about **two prominent techniques of creating animation** in Excel. The first one is non-VBA based. This is my favorite. Unfortunately, the non-VBA based solution works only in Excel 2013, 2016 and above. The **non-VBA technique** is fairly straightforward. Starting with Excel 2013, any time a chart's input value changes - let's say that you have a bar chart with a single bar of 100 width and the input value changes to 120 - there will be a smooth animation that takes are bar from 100 to 120. In prior versions of Excel it does not happen. It would be a sudden jump in prior versions. It won't be more of an animation; it would be more of a change of value. Whereas in 2013 you would see the value as if it is going from 100 to 110, from 110 to 115 and then to 120, as if things are slowly changing. These kinds of animation effects have been added in Excel 2013. That, in turn, offers us a way to animate things. Let us say that we are using a slicer to filter some values and a user clicks on the slicer. Whenever the slicer selection changes, the source data will change, and the chart will naturally change and all those changes will appear like smooth animations. This is not perfect and probably not at all desirable in some situations. But, this is the non-VBA method for creating animations. Well, you are not creating

animations here anyway because the animations are there for you by default when you are using Excel 2013.

There is also another technique. It is not useful for charts but when you are using something like conditional formatting to create charts like the in-cell bar graphs that can be made with conditional formatting, we could use formulas that are set to manual mode (not automatic calculation) and iterative calculation. When this is there, the formulas will not run in one go but they will run in iterations. It is a little tricky to explain here in the podcast mode. So, I will link to a particular resource on circular references and how to **create animations using circular references** on the show notes page of this podcast. Head over to http://chandoo.org/session48/ for the show notes page and there you will find a resource that talks about how to create animation effects using conditional formatting and without VBA. Although the non-VBA solutions are the easiest, they are also probably not the most useful. If you have just two minutes to whip up something, you could go with that, but if you want something that is really pretty and impressive and controlled and refined, you've got to use VBA because there is no other solution right now.

Now, let's talk a little bit more about the **VBA based approach** for creating animated charts. The basic approach is just like drawing a cartoon film. Let's say that you are one of the very primitive film technicians back in the 1950's or 1930's or whatever and you need to produce a cartoon film, how do you do it? Let's say there is a cat which is chasing a ball. We would draw the cat and ball in the first frame. In the second frame we would move the cat and ball a little bit. We continue this kind of finer movement and maybe draw 50 cartoons like that. These are called frames in film language. So, we draw 50 frames and, in each frame, both the cat and ball move slightly. In the initial frame, you have the cat and ball and there is some distance between them. In the final frame, the cat is catching the ball. That's what we show. The progression between the cat and ball is shown in gradual steps in those fifty frames. Once all the fifty frames are drawn, we would collect them and run them one after the other in sequence very quickly. When somebody sees only one frame at a time but they are all moving very fast, it creates the illusion that the cat is moving towards the ball. But, in any one frame, neither the cat nor the ball is moving. Everything is static. But, when you combine all of them, and run them as a film, we get that effect. This is not new to most of us. We have seen films and we know how this is done. The same technique is applied when you want to use VBA to create animated charts.

The basic approach is as follows. We identify how many frames we want for the chart to get the animation effect. Let's say that the number of frames is 100. We then set up a small VBA macro that will essentially create the chart 100 times showing the progression of data from one point to another. Let's say the bar has to jump from 100 to 120. So, we draw the bar at 100 and 120 and for the distance of 120 minus 100 which is 20, we will draw 100 charts and in each the bar is moving ever so slightly until you get 120 in the end. You might be thinking - does it mean that we have to create 100 charts and load them and create the VBA? Well, not necessarily. The basic approach is like this. You identify the number of frames and you plot those many charts. It is like this in theory but, when it goes to implementation,

we don't have to draw 100 charts. We could use the same chart but we can change the input data. So, initially, the data will be 100 and the target is 120. Using a For loop from 1 to 100, at each point, we simply add a fraction to 100 so that by the end of 100 steps, we will reach 120. That means that we will have to add 20/100 which is 0.2. So, we will add 0.2 to the 100 value every time and when you do this 100 times, you end up with 120. This is essentially how an animated chart is created. We don't change the chart; we change the input data. Whenever the data changes, the chart naturally has to change. Users don't look at the data. They don't look at the VBA code. They just look at the chart and when the animation is running, it creates the impact that the bar is moving or the line is changing. This is the basic approach when you are using VBA. **The basic ingredients are two things - one is to identify how many times you want to animate and the second is to set up a For loop**. Most animated charts boil down to these two things. Of course, there could be a few other things. For example, if it is a fairly long animation, we could add some bells and whistles like a pause button so that the animation will pause midway. Or, we could add some extra things. Let's say you are plotting the history of a big company like Microsoft or Walmart, the journey is 50 years long and when you are animating everything from 0 to 50, there are lots of milestones and important points along the way and you may want to highlight them and print them as bubbles or pause the story midway so that users can grasp it and then press the button and continue. All of those kinds of things can be added. But the skeleton or bare-bones version is that you have two things. One is a variable that tells us how many times the animation should run. The other is the For loop or While loop that will just jump through all these steps one at a time. This is how the animated chart is created.

Now let's take an **example**. Let's set up an animated chart. Of course this is an audio podcast and so we won't really be creating the animated chart but we are just going through the steps in a methodical way so that you will get a good understanding of how this should be done.

Let us say that you are plotting the sales of a particular product since the product is launched till now. It has been 12 months since the product was introduced in the market and you want to showcase a metric like percentage of market share or total sales or number of customers or whatever. Let's go with total sales. So, I want to know how product A (the particular product that we are interested in) has been performing since the launch. So, there are 12 months and there are maybe 3 or 4 milestones along the way and we want to show the journey. You could create all of this in one chart in a static version but that doesn't really capture the dynamism, the market forces and everything that went along with the 12 months. So, instead of showing everything in one shot, you thought of animating from the 0th day to the 1 year mark. We will plot a line. Let's assume that this line is basically going upwards because we had zero sales when we launched the product and now we have a million sales. So, we want to show the journey from 0 to 1 million and we want to identify some important steps. For example, when we launched, the sales were pretty low like $1,000 or something like that. Then, we launched an extensive print media campaign and the sales jumped up to $20,000. Then, we did a Facebook campaign and the sales went up to $50,000. Then, we started a loyalty program and the sales went up to $2,00,000. Then, the product got mentioned in the daily show or whatever and the sales went up to a $1M. You want to

show this journey. If you plot everything in one go then those key milestones and why the sales are jumping would become really hard to grasp even though they are there.

So, we set up all the data. Let's say that we set up the data at a monthly level so you have 12 rows, each for one month. The corresponding sales for that month will be there in the next column. Whenever there is a critical milestone, we will write the milestone in the third column. So, initially, when we launched, the milestone would be launch. Then, after two months, we will say print media campaign. After four months, we will say Facebook campaign. After six months, we will say loyalty program. After nine months, we will say 'got mentioned in daily show'. This is how the data would look. This is the original data.

Then, we set up a mirror table exactly like this with three columns. But, in that table, we will load only a partial data set. We will not load everything. We will only load up to the first x number of rows. What is the x value? That x will be determined by our animation For loop in the VBA code.

For the time being you would assume that there is a value defined as x. It could be a named range or it could be linked to a cell like B7 or D25 or whatever. We will look into that particular cell. If the cell value is 7 then we will only print the first 7 rows. If the cell value is 4 then we will print only the first 4 rows. If the cell value is 12, we will print all the 12 rows. The mirror table is going to give you only the partial set of data from the top to the first x number of rows. What kind of formula would you use in such a case? You could use your good old INDEX formula to do this. You could also use an IF condition or something like that. If the value is there, we will bring the original value. What should we do if the value should not be brought? Let's say x is 7 and so from 1 to 7 we get the original data. What about 8 to 12? What should that be? Ideally, you can either leave them as blank or, if you want to be more accurate, you can leave them to be NA. NA is a special type of value in Excel. Whenever an Excel cell contains NA and if a chart is dependent on that cell, the chart will immediately understand that it shouldn't do anything for that value because the value is NA. You could also ask why we can't use blank but blanks are technically zeroes and so the lines will go up to the 7th month and then suddenly drop down to 0 and that is not something that you want. We want the line to hang there in the 7th month and wait for the values to go up to the 8th or 9th month. To provide that kind of thing, we usually set up the values as NA. How do you get the value of NA in a cell? It is simple. We use the NA() formula. The approach would look something like this - we look at the x value, if the x value is less than the current month then we will get the value otherwise we will print NA. That's the basic logic that you would use.

Once the mirror table is set up, we create a line chart from the mirror table and set up the necessary labels or whatever. So, the line chart comes up. Right now, if you change the x value to 8 or 4 or 12, the chart gets updated. We want the x value to be changed through the VBA macro. At this point you go to the VBE (Visual Basic Editor) and set up a simple macro that simply updates the x value. Here, we could write a simple For loop:

For i =1 to 12
Range("x") = i

This means that at each step we want the x value to be changed to i. After that line, we write one more line called DoEvents. There is no space; it is just one word. Whenever Visual Basic sees DoEvents, VBA will go back to Excel and see if Excel has to do anything. So, whenever the x value changes, the chart needs to be updated. But, if your VBA macro is running, Excel doesn't have time to update the chart. So, after the For loop changes the x value to the current i value, we say DoEvents. At this point the control is passed back to Excel and Excel sees that the x value has changed and re-draws the chart and then it gives back the control to VBA. VBA again changes the i value and the chart gets re-drawn again. This is the basic thing. Although, technically, this macro will work and it animates the chart, there are two challenges. The first one is that in order to animate the chart, we need to go to Visual Basic and run the macro and that is not very user friendly. So, we'll figure that out. The second problem is that depending on the kind of computer you have, this macro could be super-fast. All we are doing is running a For loop 12 times. On most latest computers like the one I have or the one you are using to listen to this podcast or whatever, it is possible that you won't even notice the animation effect. Everything happens so fast. That's because we are just running the loop 12 times and computers can run a loop thousands of times in a second. So, what do we do? The first thing is that let's address the problem of animating this chart right from Excel and not from VBA. We could set up a small rectangle or rounded rectangle shape in Excel, type the word animate on it and right click on that shape and there will be an option called 'Assign Macro'. We will assign a macro to that button. When you do that, it opens up the box with all your macros and it will contain your Animate Macro there. Just select it. Now, whenever you want to animate, you just need to click on that rounded rectangle box and it will animate. This is how we have set up a **trigger for animation right inside Excel**.

The next problem is how to **control the speed of this macro**. If it is too fast, which is highly likely, we would then have to slow down the macro. One simple approach is that we go to the For loop and we run it unnecessarily more times. If the computer is running too fast, what would we do? We would simply say 'do nothing'. How do we say 'do nothing'? Well, there is no 'do nothing' statement in VBA. So, instead of changing the For loop from 1 to 12, let's change it from 1 to 120, or from 1 to 1200, depending on how fast your computer is. Inside that, we will simply update the x value only once in every 10 occasions or something like that. So, we will update the x value by dividing i by 10 or 100. We are running the loop several more times than needed and most of the time the x value is not changing. It just remains the same. Let's say that the loop is running from 1 to 120. So, from 1 to 12, it will remain like that. And, from 12 to 24, it will change and become 2. From 24 to 36, it will become 3, and so on. We will use this kind of approach to slow down the loop. If the loop is too slow, i.e. the animation effect is a little jarred and not appealing, you could also speed it up by reducing the number of times that the For loop runs. This is the basic approach for animating a chart and that's how you can do it for a line chart.

You can apply animations for line charts, column charts, bar charts, bubble charts and pretty much any kind of chart that you see in Excel. What else can we animate? We can also animate drawing shapes. Let us say that there is a circle or hexagon shape in your workbook and you want to move it from one point to another. You could use similar logic but, instead of changing the data, you would change certain properties of the box like the size of the box, top x and top y of the box, i.e. the x and y coordinates of the box etc. You could use this kind of logic to move shapes or animate pictures or charts. Again, as I said very early in the podcast, you want to do this animation just for a particular type of chart or a particular element in your big report. You don't want to do this for everything because that can create a busy and cluttered feeling in your report. So, **do it in moderation**. Don't go overboard with animations because every animation requires a certain amount of computer and human resources. Computers need to spend time animating it and we need to spend time watching that film to understand what's going on. It's just like watching the Titanic movie. It takes 3 hours to watch the movie and get the story. Or, you could read 3 lines of a newspaper article and get the gist of it. So, it is up to you. If your audience has 3 hours, you go with the movie. If they don't have time and they just need to know what happened to the ship, you tell them what happened. That's the way that you should be thinking of these kinds of things. That's how we can animate.

I have a few resources for you when it comes to animated charts. We frequently publish animated charts at http://chandoo.org. I have created many animated charts. There are a couple of guest authors who have published some beautiful, stunning, animated charts on http://chandoo.org. Please visit http://chandoo.org/session48/ for the show notes page where I am going to share a couple of animated charts and tutorials with you. Check them out, download the workbooks and you will be able to understand how to create animated charts, best practices, and some of the things to keep in mind when you examine the VBA code.

That's about it. I hope you enjoyed this podcast session. A quick reminder - if you are a listener based in India, I am happy to send a copy of my 'Dashboards for Excel' book that I co-authored with Jordan. There are two books that I am giving away. So, I'll pick two random people from the commenters on this podcast. All you have to do is leave a comment on the podcast page. Just go to http://chandoo.org/session48/ and leave a comment on the animated charts podcast and I'll pick two random winners. When you are commenting, please make sure that you mention that you are from India. That's how I will be able to separate you. Even if you are not living in India you are still welcome to comment and leave feedback about the podcast. I would love to hear from you. Unfortunately, I can't ship the books to you right now. But, next time when I get an opportunity when I travel internationally, I will try to buy a couple of books and send them to readers located there as well.

Thank you so much for listening to the podcast. I hope you enjoyed it. I have to rush back to family now and spend the holidays with them. They are not holidays as such but there are lots of festivals and good things going on. That's why I have been away from podcasts for the past two weeks. I hope to make it a little more regular until Christmas time this year. Thank you so much. Have an awesome day. Bye.