Functional and Conceptual Design
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Lecture 2
Birth and Growth of a Product

We discussed new product development. What are the major things that you need to keep in mind when you are talking about product design and then we mentioned that function and form are the 2 important aspects of product design. What the product is supposed to do is this function and form is how you provide that function in the product is decided by the form of the product.

Sometimes the function is already known. We know what the product has to do but how do you make that function happen in the product is the challenge and we found that is where the creative design comes into picture; that we try to give a particular shape to the product. A particular way the products function will be happening. So, that is how you design new products.

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Yesterday I asked you a few questions, what was your most & least favourite car or what is the last product you bought for you or someone else and what was the product that fascinated you the most for its innovative design and function. Today's question is, what is that dream product you would like to see in the markets? This actually tells you how good you are as a designer or what is your imagination as a designer. What would you like to see in the

markets? So, what will be that dream product you would like to see in the markets? Anybody?

So, it's already there in the markets. You have to directly go. So, something which you can directly take into your brain, no? So, something which will give you the other information you want you will be able to see it. Any other products you would like to see? Teleportation. Yeah so that you can go to work wherever you like and you will be able to see.

Yeah that is a good product. So, you can have, some of you will be having some dream products in mind. Oh, it would be nice if such a product is available in the market. You do not need to study; everything will go to your brain directly so that you can do whatever you like and then you can get all the information without really reading a book or going through all the notes and slides and other things. Now, that may be a good product.

So, like that you can actually think of many products that will be of interest to you or that would be a dream product which will help you in many ways. So, any product design basically starts with you or the customer. Basically, look at the customer, what actually the customer is looking for?

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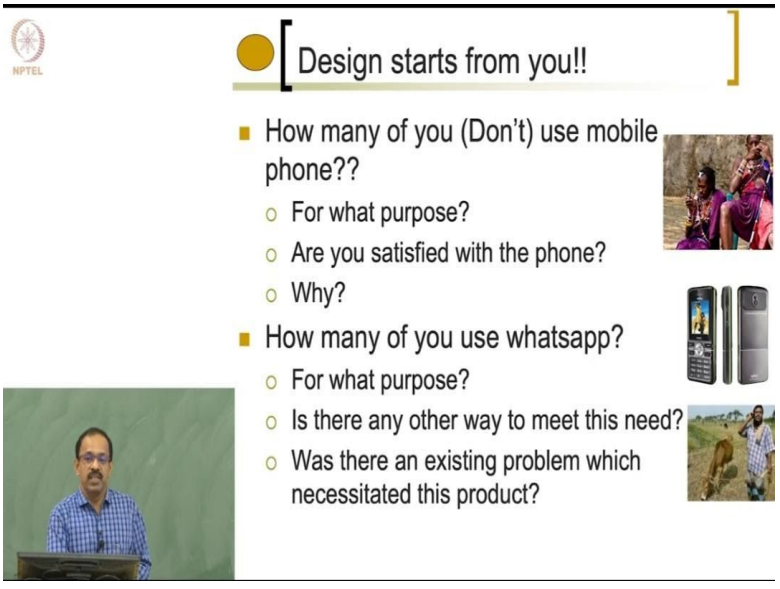

So, the product design starts from the customer or you because we are all customers one way or the other whether you are a designer or you are using a product someone has designed for you. So, every product design starts from the customer. Now, if you look at the current products that you are using as a customer, you will understand what actually went into the

design of the drawings. Basically we will look at what things we normally use. So, if you look at a mobile phone. What is the purpose for which you use a mobile phone? Watching a movie? Listening to music? Okay, so probably for communication, watching movies, many things you use for your work phone. Now, the question is, are you satisfied with your phone. How many of you are satisfied with the phone you have. Okay, you are all satisfied. How many of you are not satisfied with the phone you have? Okay, 1, 2, 3. Some are neutral. They do not have satisfaction or dissatisfaction.

So, why are you not happy with your phone? Yeah, I am talking about the phone. You are saying, some of the softwares you cannot implement in your phone. Yeah, that may be one thing and who else said they do not like the phone. Who was the other person? Yeah. What is the problem with your phone?

Oh you want this to be lighter and probably more capabilities, more memory like that. So, now you can see there is a need for a new phone. Some people are saying that okay I am happy with my phone. Some people are saying I am not happy with my phone. So, those who are saying they are happy with the phone and those who are saying they are not happy with the phone, both are actually contributing to the new developments.

Somebody says I am happy with the phone. They do not know what is going to come in the next generation of phones. Yeah, there may be additional features coming which you do not ask for but somebody will think about the capability, the possibilities of designing a new product with the new capabilities. So, that will come into the market and those who are saying I am not happy with my phone, it says that there is a room for making a better product.

That is the way how design thinking goes. How many of you use WhatsApp? Okay, and when WhatsApp was not there how you were communicating or using this particular function of WhatsApp. Pardon? Text message, but did anyone say that, okay I am not happy with my text message, and I need a WhatsApp? Nobody said that. So, you are happy with your text messaging and you are not knowing what else is possible with this.

But somebody found that, okay now Wi-Fi is available, phone is available, numbers, and communication network is available. There is a possibility to bring them together to create a new product. So, WhatsApp is a product. We are actually looking at, we do not know that it is possible but still somebody found that there is a way to develop a product. Is there any

other way to meet the need now? We are all happy with WhatsApp. Do you think something else can actually replace WhatsApp? What else can be the one which can replace WhatsApp?

Telegram. Not the old Telegram. The new one. So, what is the difference between that and WhatsApp? What is the difference between Telegram and WhatsApp?

Student: Features

Professor: No? Okay, so basically the size limits and other capabilities are better in Telegram. Oh, you get to know the other person whether he has seen the message. So basically, added functionality in the product. So, now these 2 examples basically tell you that whether you are happy with the product or not happy with the products, both lead to new product development.

People were very happy with old smart, I mean, old phones without any smart features. Then somebody brought a smartphone then us, oh that's much better than the previous phone. We threw the normal phone and then moved to the smartphone. So, now we are all saying I am happy with the smartphone capabilities. We do not know what is going to come up in the next future.

People may come up with a better product. So, product design happens because of the customers' requirements and sometimes even if the customer does not know, I mean, the customer is not asking for something new, new products will come up in the market.

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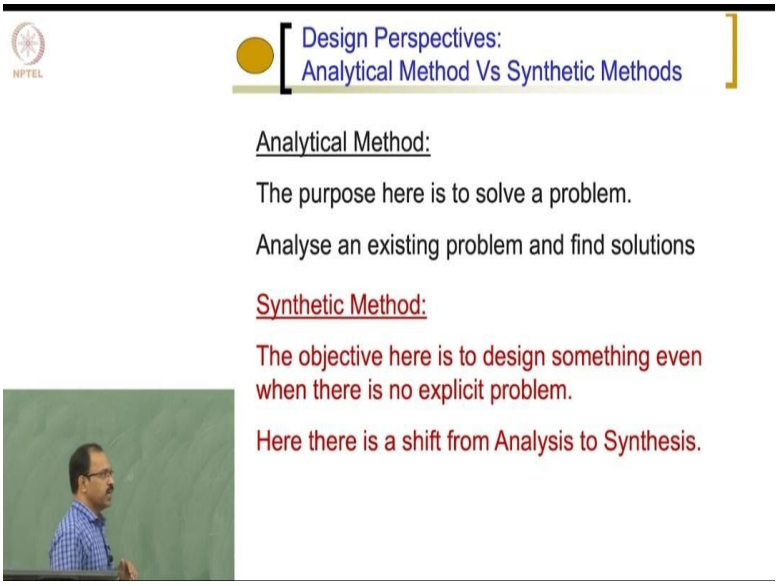

These are the 2 ways in which the product comes into the market and we call this analytical method and synthetic methods. So, the analytic method is basically you have a problem, you want to solve the problem. He says the phone is very heavy, you want to have a lighter phone or the memory is not sufficient or the speed is not sufficient. You have a problem, you try to solve the problem, you analyse an existing problem and find solutions that are basically known as an analytical method of product developments.

So, you analyse the problem, try to solve the problem. Your WhatsApp has got some problems, your mobile phone has got some problems or your laptop has got some problems. They will try to develop a new method and then get the solution. For example, I am not happy with the projector. See, every time I have to come, I have to connect my laptop with an adapter and then connect the projector, the serial connection and then I need to set up my computer to accept that. There are a lot of problems before me.

So, my requirement is that I do not want to have all these issues with me and I come and sit on the computer and maybe press a button. It should be projected onto the screen. I do not care how it happens. That is my requirement. So, I have a problem, I try to solve it and that is an analytical way of designing a new product.

The other one is synthetic methods. You do not have any problem as such. You are happy with what you are having but then you synthesize the product, existing product and then see what can be added to that, what can be modified so that you will get a better product.

You are not finding any problem per se as such but you feel that there is a way to improve it. Either the improvement could be because of some technology changes, communication change or there is a change in the display. So now you have, at present what we have is all widget displays. So, someone has just developed a flexible display. Now, I feel that there is a potential opportunity for me to change my font with the flexible display. That is basically a synthetic method of product development. The objective here is to design something even when there is no explicit problem.

So, nobody has found a problem as such but we feel that there is a potential opportunity to develop a new product. So, you synthesize the existing things and then see what is available in different domains, different technologies, how do we use that one in order to develop a

new product. So, that is basically known as a synthesis method or synthetic method of designing products. Got it?

So, now can you tell me an example for synthetic products? Pardon? Smartphone. Okay, anything else? Anything else? Any other product we can say is a synthetic product? Tablets, okay. Car, okay. Smart TV, okay. So now, whenever you say this, you just analyze what was the reason for this product to come into markets.

If you look at every product, you are using hundreds of products and you take any product, you will see the birth of that product, how it actually started, how it went on to grow into different stages and sometimes how did and also some products will actually have a natural death.

There are many products which will go to a natural death. If you look at your old TVs, many of you have seen that tube TV, nowadays, you do not see it big one, big boxes with a picture tube. What happened to that? Dead. No more of such products are available now. Nobody uses that and what actually came are your LEDs, LCDs and all those things, flat TVs are there. So, any product you look at or you can try to analyze, you will see a growth of the products and then a death of the product. Sometimes death, sometimes it is still going on.

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Let us take a few examples to see how a product is born, how it grows and how it dies. So, we look at the case study of one of these products and then see how it happens in the markings, the birth and growths or sometimes the deaths of a new product. We take 1 or 2

examples to see how this happens in the markets or what actually leads to the birth of a product and the growth or death of a product and you will be able to analyze these with every product.

Any product you use, you will see such a growth whether you take your pen, your specs or phone any product you see, and you will be able to analyze the product from its start and the end of the products. Let us take a simple example here and then see how the product grows or how a product is born and then how it is grown.

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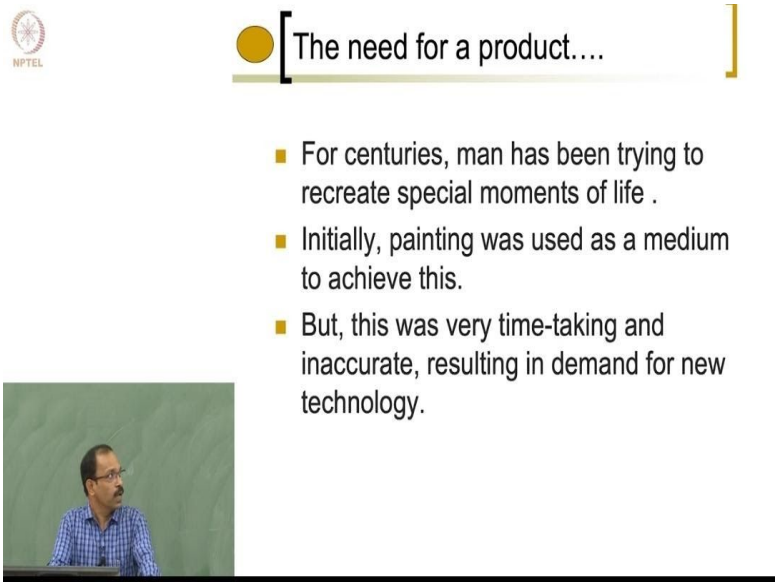

As I told you the need for a product is felt by somebody. Either I said synthetic method or analytical methods both ways. Someone will see there is a need for a product. For centuries man has been trying to recreate special moments of life. Agree? For centuries people have been doing this. Have a very special moment, I want this moment to be protected for a long time. How was it done long ago?

Long ago, very long-ago paintings or stone carvings, people used to carve on the stone and then later on it went to paintings. If you go to museums and all, you will see a lot of old paintings. So, there was a need to preserve the precious moments or the history of precious moments and people have been painting, have been using painting as a medium to achieve this and there were a lot of issues with painting. For painting as it will take a long time and people will have to be there for a long time for the painter to capture all the details and there

was an issue of the painting getting spoiled because of either weather conditions or because of various reasons.

Therefore, somebody thought, how do we actually change this? What is the way in which we can actually create new products coming into the markets. What would be the products? Can you guess? Camera. So that was, I mean, nobody knew that camera was going to come but everyone knew that there is a need for something different. Painting is not the best way to recreate the moments or precious moments. They wanted to get a new method or a new product which can actually capture this.

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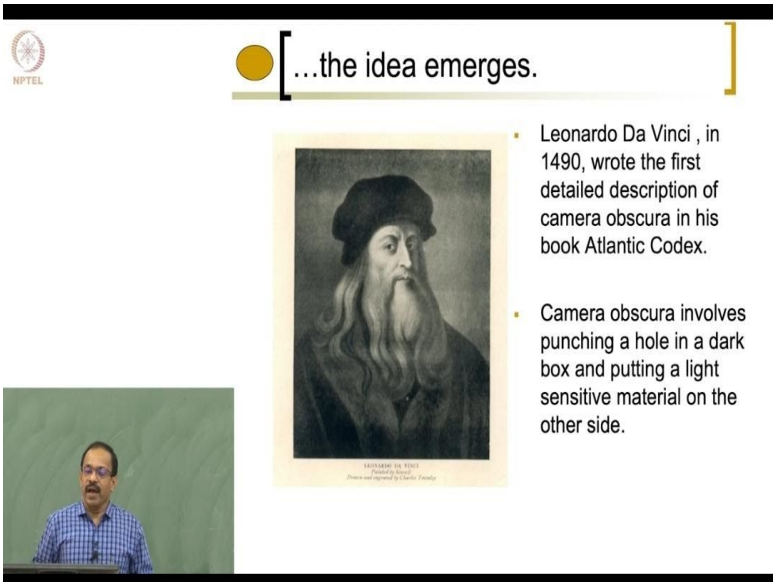

Idea emerges. So, some intelligent, or creative innovative guy will come up with an idea. That idea may be very crude and not feasible but somebody came up with an idea. Okay, so Da Vinci in 1490 wrote the first detailed description of camera obscura in his book Atlantic Codex. So, that was the probably first recorded description of replacing a painter or a paint. I mean a picture. So, painting actually would be replaced by this and this camera obscura involves punching a hole in the dark box and putting a light-sensitive material on the other side.

The material science and the technologies were actually progressing and there was someone who actually developed some material which can actually change its colour, shape one colour or something when subjected to lights. So, this actually, this technological development led to someone converting that technology into a product.

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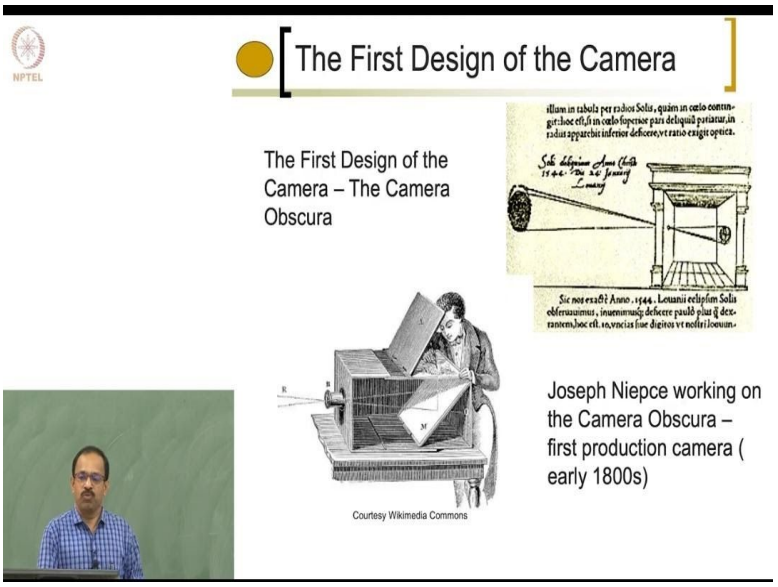

That was when this camera obscura was actually proposed where you can put light through a hole and that change the sensitive materials or the light-sensitive material will change the image on the, so that was the first thought process on developing a camera. Then the first design of the camera, the camera obscura was like this. This was the first design. Yes, so the proposal was done by someone and then this person Joseph Niepce working on the camera obscura. So, he was the one who actually tried to bring this into the product domain.

I mean that the other one was more of a theory or an imagination but then this person in the 1800s, he tried to give this a shape. We wanted to have that image captured and how do you provide that was basically based on the function and the form of the product. The function was more or less clear, but what form to be given was not known and this person tried to develop it. Joseph Niepce working on the camera obscura. He created the first one which can actually be used for creating images and the first ever photograph.

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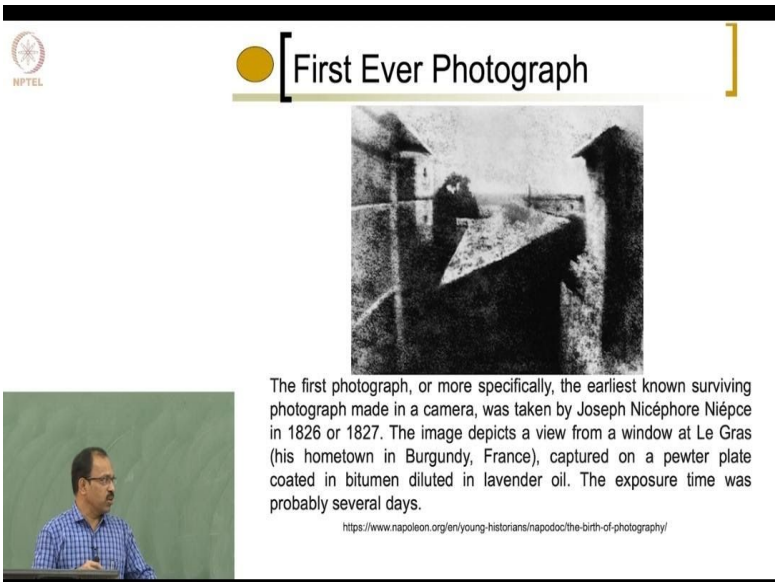

I am skipping a few things and then we are going through the history of the camera. The earliest known surviving photograph made in the camera was taken by Joseph, the same person, in 1826 or 1827. So, the image depicts a view from a window at Le Gras, his hometown in France captured on a coated in bitumen diluted in lavender oil. So, that was the chemical he used in order to get that image through the exposure. That was the first photograph and then once it comes then there will be a lot of development taking place. People will start working on it and then try to develop.

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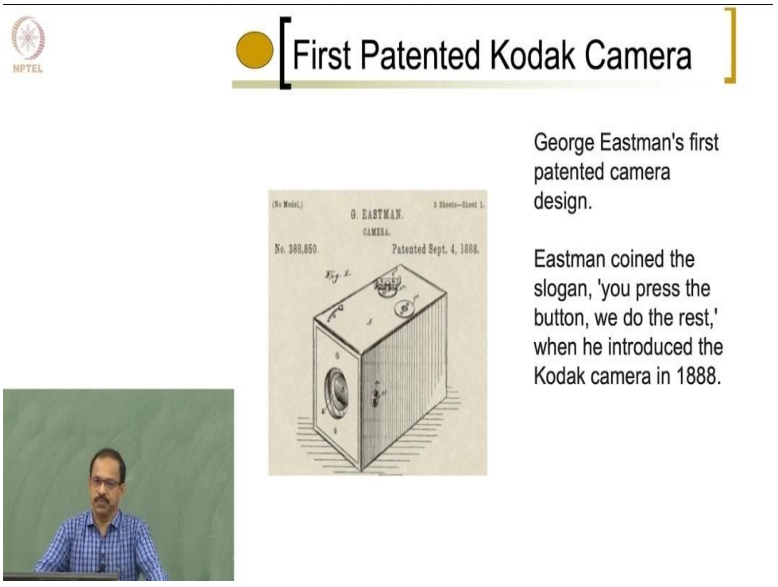

The first patented Kodak camera was brought in 1888. So, in 1888 Eastman coined the slogan, you press the button, we do the rest. So, that was the first camera in 1888 and from there onwards we had a lot of developments.

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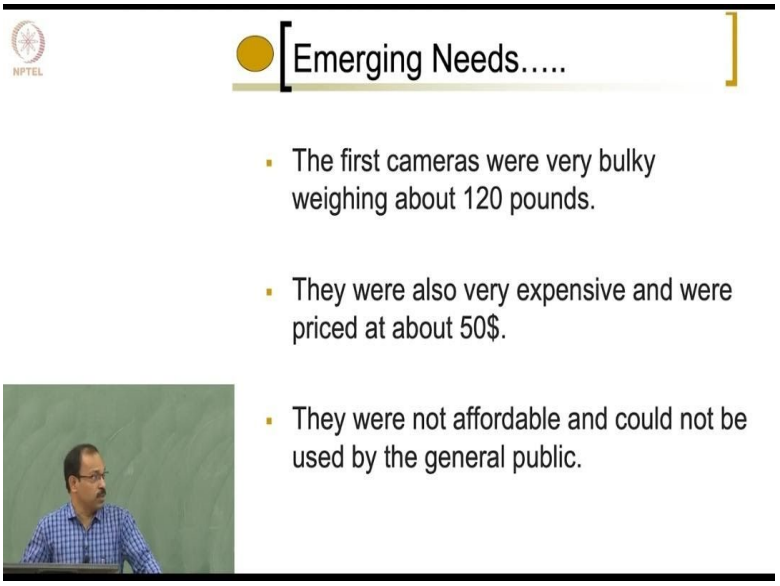

The first cameras were very bulky weighing about 120 pounds. They were also very expensive and were priced at 50 dollars. So, you can imagine 100 years ago, 50 dollars was a huge amount and that was very heavy, huge, and costly and they were not affordable and could not be used by the general public. So, the public could not use this. So, now there is a need for modifying it. So, there is a need to identify, the problems have been identified. So, you need to do an analytical method of design.

We need to analyse the problem and then see how do we redesign the product or how do we make the product more and more user-friendly and more and more useful by the public and that is where you get new designs coming up.

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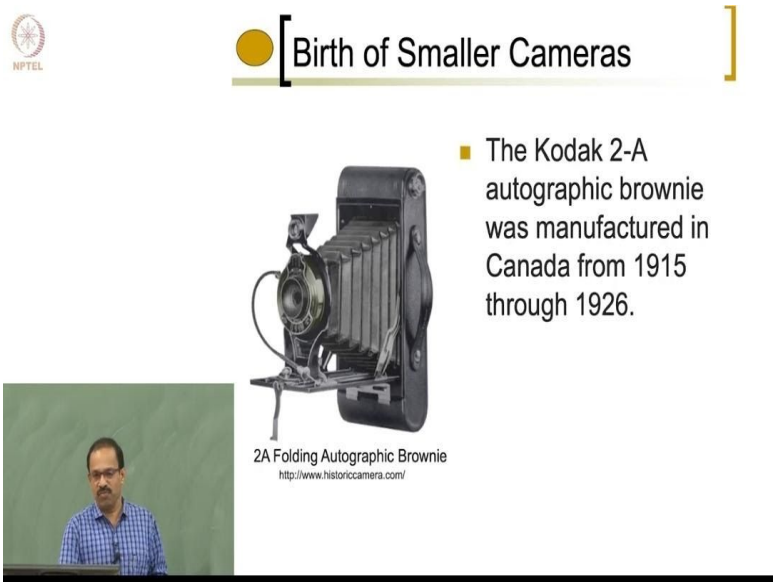

Then we started getting a lot more products. The Kodak 2-A Dewey, an autographic brownie, was manufactured in Canada 1915 through 26. So that was after the Kodak camera, you got this, the previous one, you bought this product 2-A which was 1915 to 26 this was being manufactured and again, there are lot of issues with this and most of them are black and white cameras and they are huge, costly and that are working on the development. So, parallelly there will be a lot of technological development taking place. People will be working on the technology aspects, getting better and better material, better and better the films and then looking at how you improve the image generated. So, that is the way how it goes.

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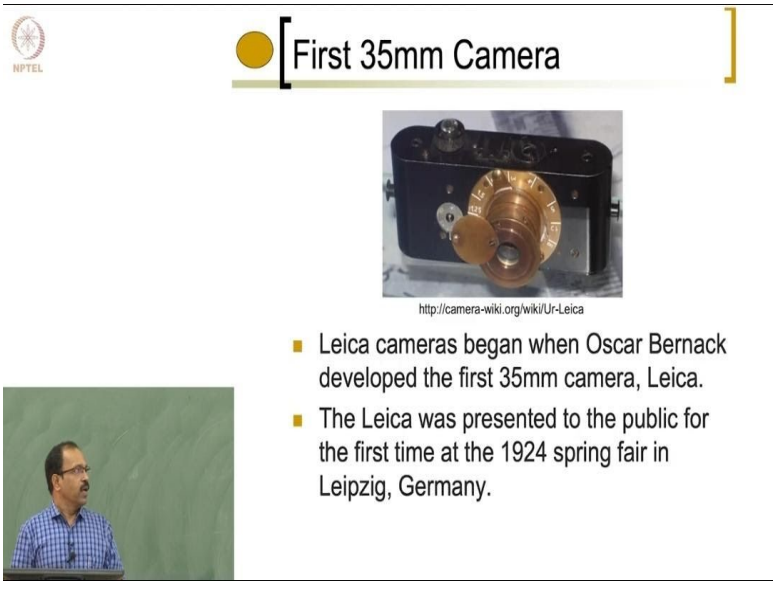

And the first 35mm camera, Leica brought the first 35 mm camera and in 1924 you got this camera in Germany.

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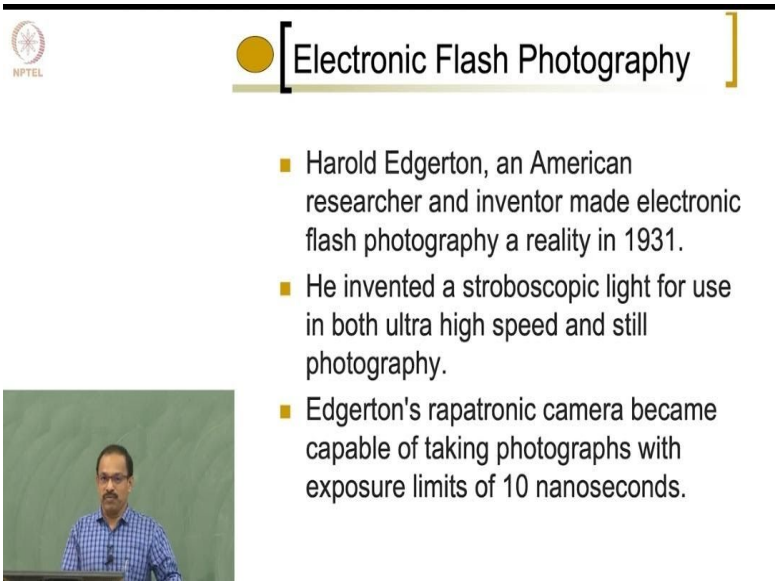

Again, electronic flash photography was introduced. Flash photography was introduced in 1931 we had the flash photography and then a stroboscopic light for use in both ultra-high-speed and still photography was invented. Somebody found that the images are not bright enough. So, they started putting flashlights in the photos.

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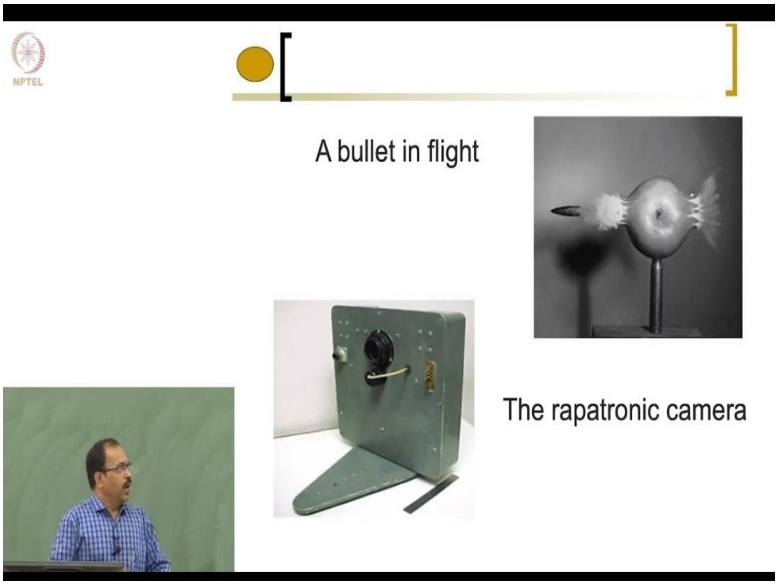

And then we got a lot of the high-speed cameras, something which can actually record very fast movements, and can actually record the bullet movement. So, that was again about the speed of the camera. How do we actually capture high speed events?

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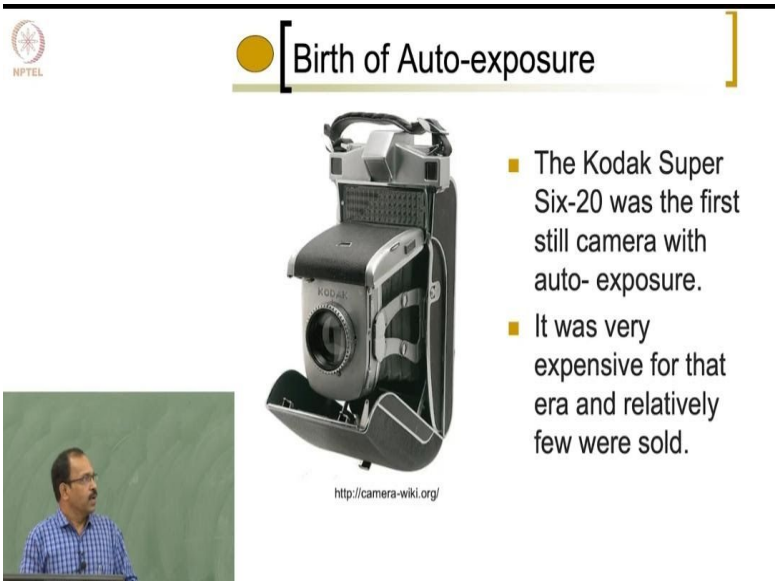

Then we got auto-exposure that was auto-focus. Earlier it was used to be focused by manually, manually focusing and then we got auto-focus coming into markets. Again, this Kodak Super Six-20 was the first still camera with auto exposure.

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Then we got these self developing cameras. So now we again are coming back. That is, you click and you get the photo. That is a self-developing camera. So, in 1947, Edwin Land

demonstrated that instant film at the optical society of America meeting in New York, and he marketed the Polaroid-95, the first commercially successful self developing cameras. So, Polaroid was the first commercial camera, which can actually do the self developing images.

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And then the first photo of Earth was taken in 1966 again using cameras.

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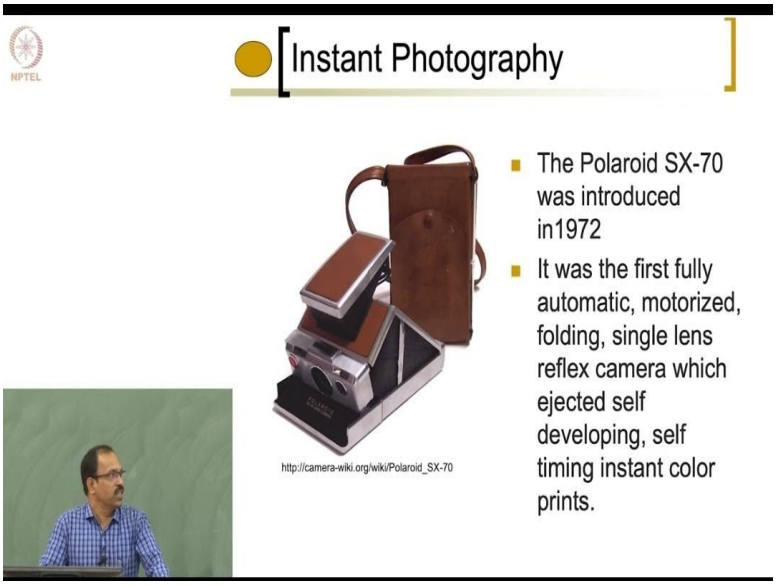

Then we have this instant photography, Polaroid second generation of photography.

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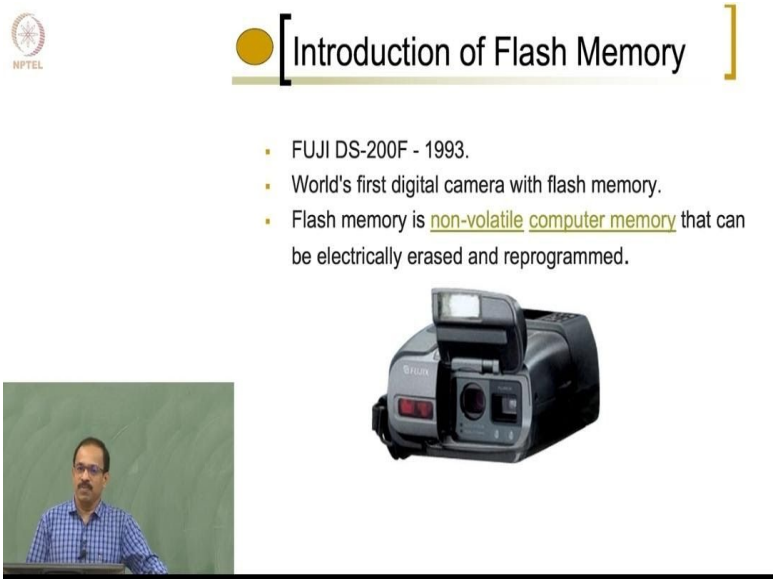

You have this flash memory coming up because the memory was an issue with the camera. So, digital photography and flash memory was introduced. Non-volatile computer memory that can be electronically erased and programmed that was introduced into the camera so you can actually now have large memory size capable in the camera.

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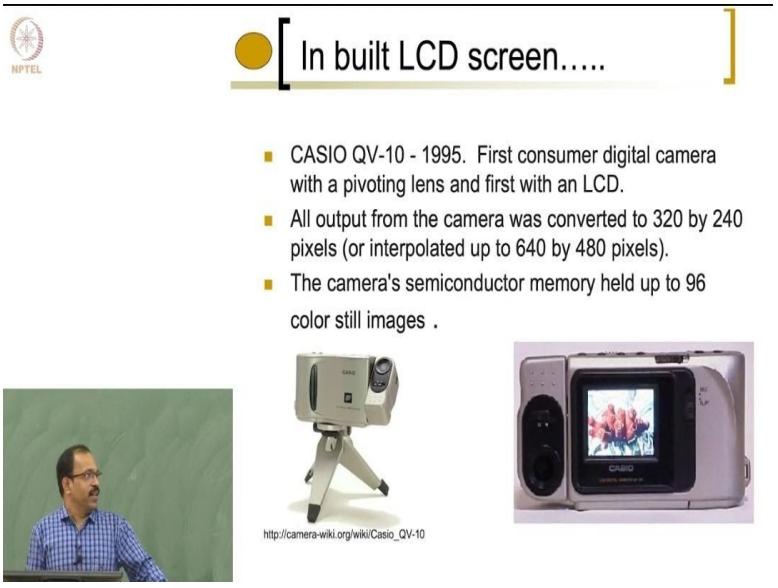

And then inbuilt LCD screens. That was the recent addition we got in 1995 because the development of LCD technology enabled having a display in the camera itself. That is the LCD technology coming into the camera.

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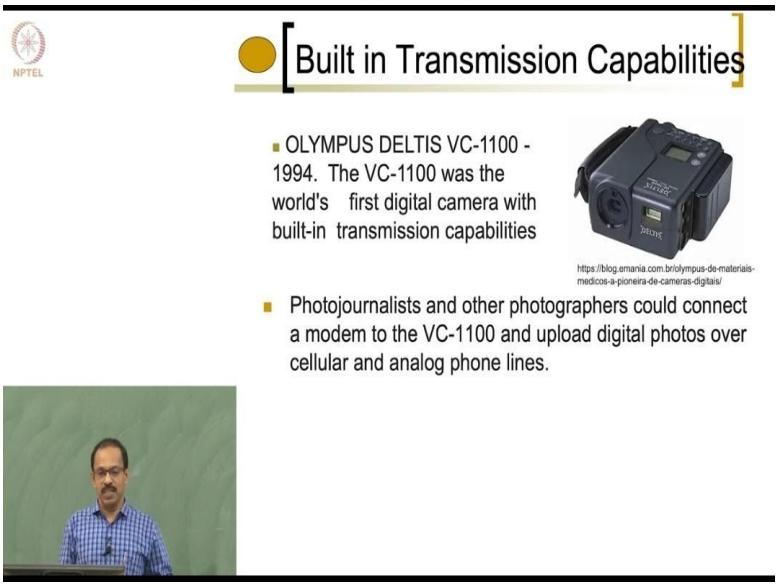

Then you have this transmission capabilities. So, you take the picture and can be automatically transmitted to the air destination. That is you have communication capabilities, integrative camera so you are having additional features of communicating the photo to a destination.

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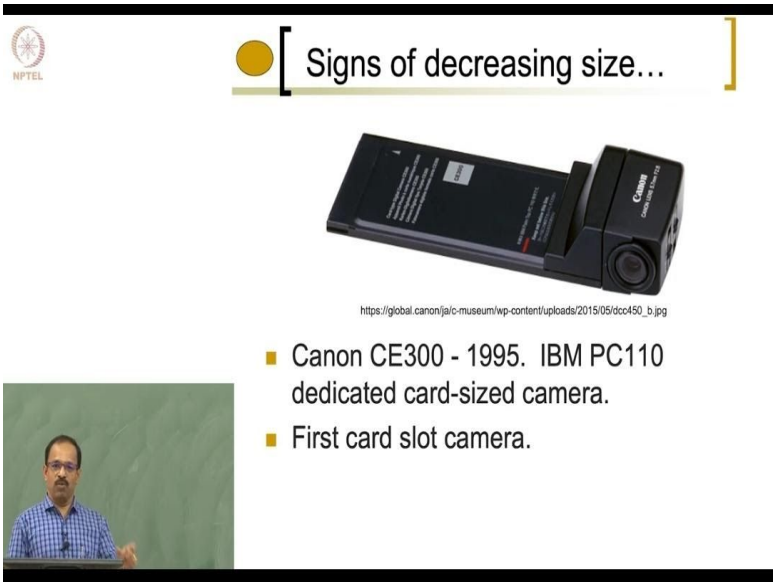

And the camera size started coming down. We have very small size cameras, very high capability, and high image quality and keep on reducing the size of the camera as well as the quality of the cameras not going. So, if you look at, as the technology progressed, some of the old cameras went into their deaths and new cameras came up in the market. So, every time a

new technology comes up, a new product comes and the old sometimes survives and sometimes will not survive and it has a natural death in the markets.

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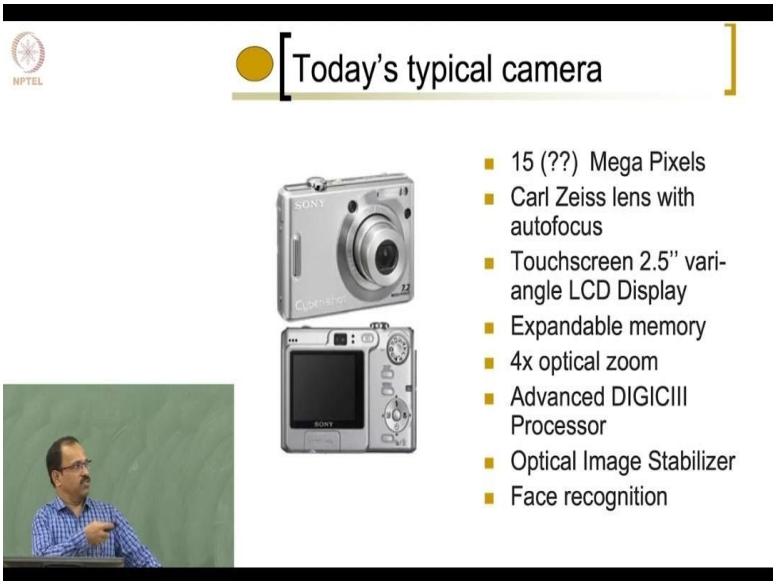

Now, today's typical cameras. These are very old now. 15 is not the current, you can have large megapixels and you can have a touch screen, you can now optical zoom and you can now advanced processors, you can do a lot of image processing in the camera itself. You can do a lot of vibration, I mean, shake control or acceleration control, a lot of things are available in the camera which improves the quality of the images.

If you look at this birth and growth of the product, you can see at every stage there was a product which was providing a function but then someone was either not happy with the products or somebody felt that this can be improved. Though they are happy, they felt that as a technology is changing, there is a potential for increasing the capability of the product.

So, these 2, the synthetic method and analytical method sometimes work together in order to get better and better products in the markets. Any product you take you will see this kind of birth and growth of a product.

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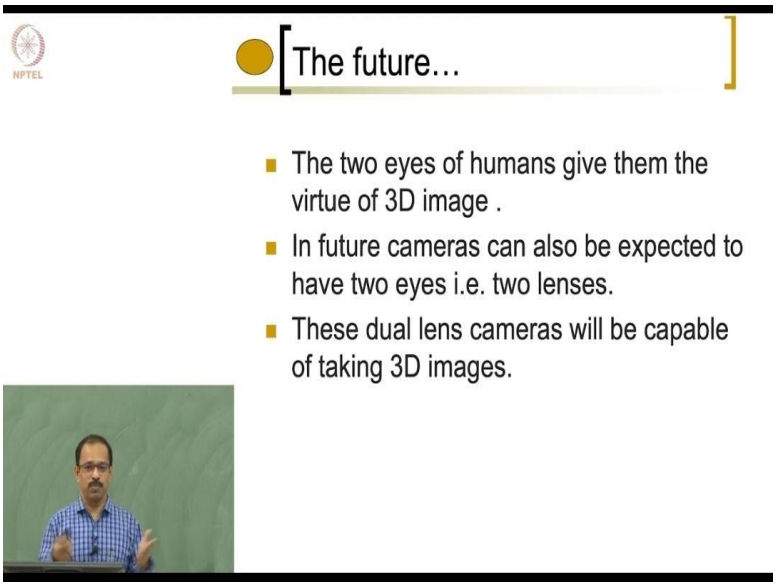

The future of the camera basically probably will be looking for, there are stereographic cameras already, now probably a 3D vision camera. It is already there in the market for industrial applications. So, in the near future, you may be getting a 3D camera just as a consumer product and maybe other features also may be coming with 2 lenses and 2 eyes and using it for various applications like humans and then probably interpreting many things from the images.

So, these things will keep on improving. As the technology improves, we will be getting better and better products in the market and as the new products come in the market many old products will go into their natural deaths. Whenever you see a product, now this is what you need to look for. What actually led to its invention or the development of the product and how these products grew over years and then reached the current state of the products? If you take any such product, you will see this kind of a natural growth of the products. Just to give you another example, we will not go into the details.

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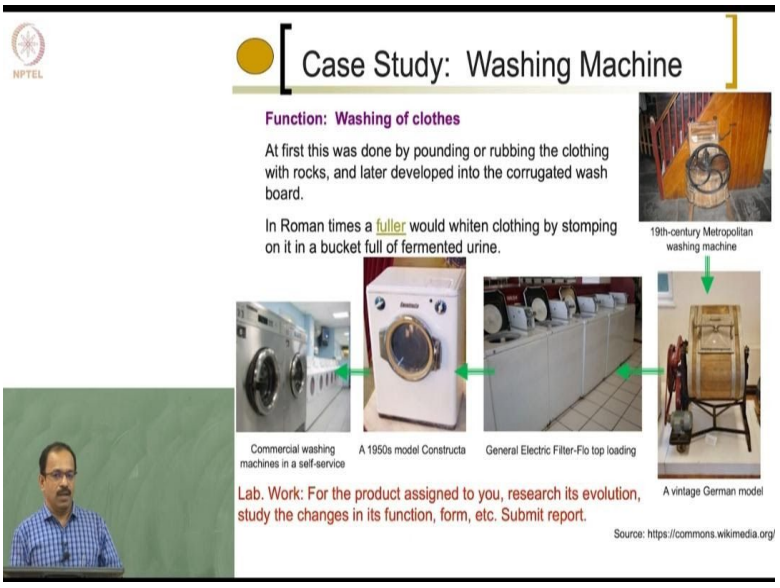

Basically, you will see a washing machine. How was washing done earlier? Manually we will put it in water and then use some stone and then we clean it up, the clothes and then it was somewhere in the Roman times, this was something called a fuller which will whiten clothing by stomping on it in a bucket full of fermented urine. So, that is the way people were cleaning their clothes and then we got something like this in the 19th century.

We got a product like this which can actually be used for cleaning clothes and then slowly change its shape, its feature change and then we got the electrical washing machines and you got industrial washing machines and now the washing machines are very highly sophisticated You can actually have washing, you can have drying, you can have ironing also. Ironing is possible? Yes or no?

Would you like to have an ironing in the washing machine? Pressing. Okay, so probably the next generation of washing machine, now at present what you use at home, most of the washing machines are only washing and drying. Drying means it will not do the complete drying. Most of the washing machines available in the market will do rinsing basically.

They do not do yet real drying but there are washing machines which can do drying operations. Now, what is the next stage that you are looking for? Ironing and after that? Pardon. Folding. Okay. Then? Keeping inside the cupboards and then? Yeah, then after taking a bath you decide which dress you want; it will automatically come and then you will be able to wear it. Is it possible?

Pardon. Then we do not call it a washing machine. Something else will be part of the washing machine. So, there is no limit for your imagination. Okay, and then and that is this imagination is what actually leads to new products. There are already machines, which can actually do ironing. Okay, you can actually feed the clothes, it will do ironing and then it will fold it and it will give it to you also.

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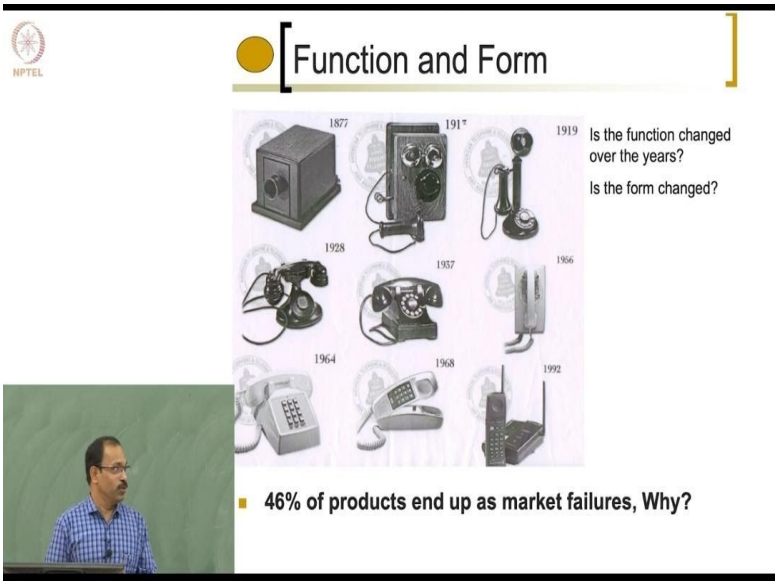

So, what you need to look at is how each product comes into the market and what the next stage of growth is going to happen. So, your first exercise in the lab, when you go to the lab you will be given a product, you will be doing some exercise with the product but you will be asked to search for its history. What is the history of that product, whether it is an iron box or it is a washing machine or it is some other products? You need to look at what was the history of that product, how indeed time it started, what was its earliest form and what is the current form and what was the change in its function.

Are there any function changes in the product or there was an additional function or the function remains same only the form of the products change. So, this is what you need to look for in any products you see in the future. As designers, one good understanding is basically how the things, how products evolve over a period of time. The evolution of a product for a period of time has a lot to learn. You have a lot to learn from evolution.

You need to look at how the product is changing in the market and what drives the product to change its shape, colour, size or whatever it is. What was the driving factor which led to

change in the product architecture of the product shape? This is what we need to look for in the products. So, let me close this by just telling you about a few things on the products or every time you please check whether the function changed or the form changed and if there is a change in the function and form, what actually led that to that change in functions.

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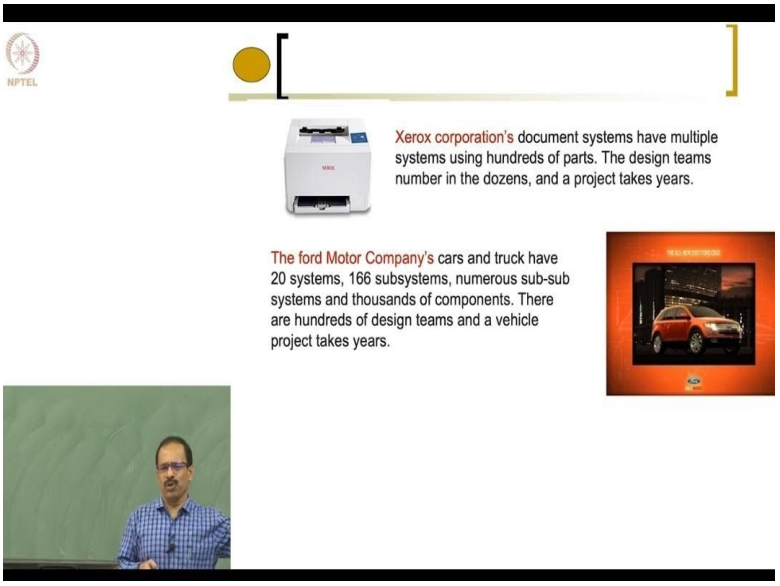

So, I will just tell you. So, this is basically for your information. Basically, there are a lot of design theories coming up in the market.

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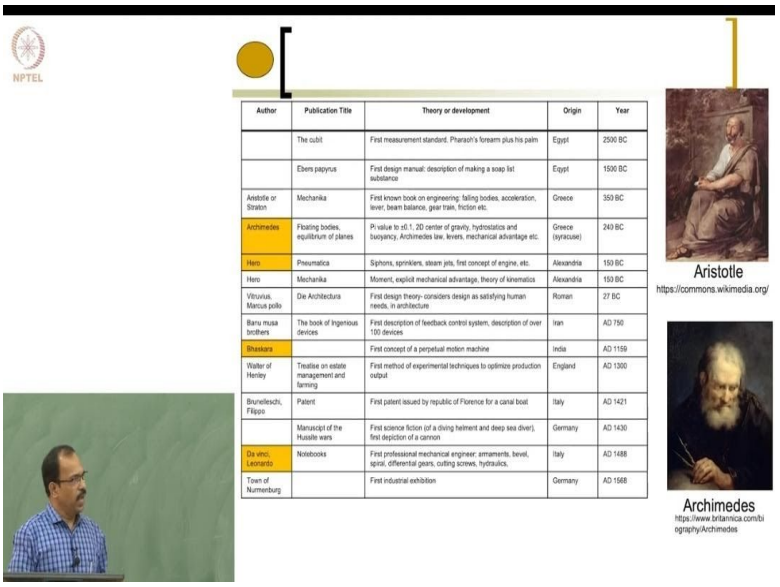

Author	Publication Title	Theory or development	Origin	Year
	The cubit	First measurement standard. Pharaoh's forearm plus his palm	Egypt	2500 BC
	Ebers papyrus	First design manual: description of making a soap list substance	Egypt	1500 BC
Aristotle or Straton	Mechanika	First known book on engineering: falling bodies, acceleration, lever, beam balance, gear train, friction etc.	Greece	350 BC
Archimedes	Floating bodies, equilibrium of planes	Pi value to ±0.1, 2D center of gravity, hydrostatics and buoyancy, Archimedes law, levers, mechanical advantage etc.	Greece (syracuse)	240 BC
Hero	Pneumatica	Siphons, sprinklers, steam jets, first concept of engine, etc.	Alexandria	150 BC
Hero	Mechanika	Moment, exploit mechanical advantage, theory of kinematics	Alexandria	150 BC
Vitruvius, Marcus pollo	Die Architectura	First design theory- considers design as satisfying human needs, in architecture	Roman	27 BC
Banu musa brothers	The book of Ingenious devices	First description of feedback control system, description of over 100 devices	Iran	AD 750
Bhaskara		First concept of a perpetual motion machine	India	AD 1159
Walter of Henley	Treatise on estate management and farming	First method of experimental techniques to optimize production output	England	AD 1300
Brunelleschi, Filippo	Patent	First patent issued by republic of Florence for a canal boat	Italy	AD 1421
	Manuscript of the Hussite wars	First science fiction (of a diving helment and deep sea diver), first depiction of a cannon	Germany	AD 1430
Da vinci, Leonardo	Notebooks	First professional mechanical engineer: armaments, bevel, spiral, differential gears, cutting screws, hydraulics,	Italy	AD 1488
Town of Nurmenburg		First industrial exhibition	Germany	AD 1568

As you look at the history of the product development and you will see that people like Archimedes, Hero, Bhaskara, Da Vinci, these are the people who actually developed design

theories or came up with better designs and new designs into the market. So, probably they did not make the product per se but they probably gave the idea or they developed some of the technologies to develop the product. So, these are the people who actually contributed well into the history of product design.

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And one main observation is that the design theory is not yet a mature field. New developments are constantly being undertaken. So, if you plot the design theory development, you can see that the design theory got a large jump during this period and now still keeps on increasing. So, your new products coming up, new technologies coming up. So, the design theory is still not mature.

There are a lot of things happening in the market and in the technological, the research and development and it is up to us, up to the designers to come up with better products, new products, which can actually change the market or which can actually make a revolution in the markets.

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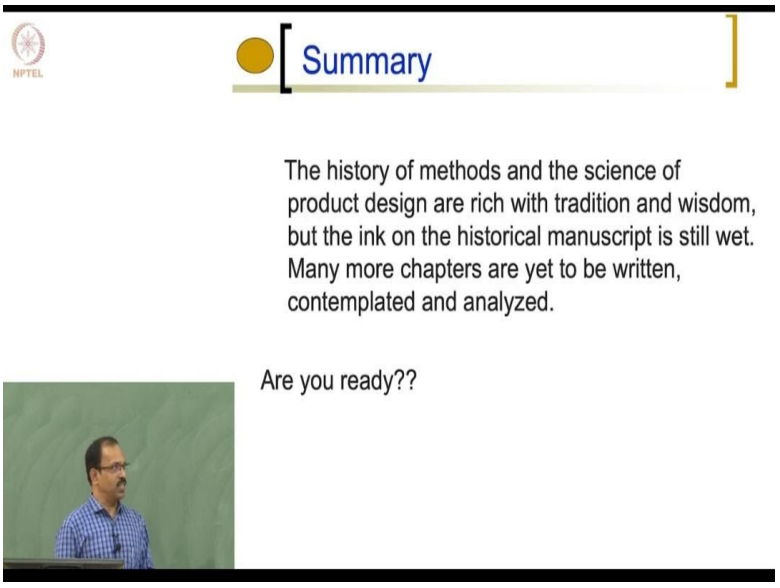

So, to summarize the history of methods and the science of product design are rich with tradition and wisdom. So, you can see a lot of rich wisdom will be there in the historical development of the product and the ink on the historical manuscripts is still wet. Many more chapters are yet to be written, contemplated and analyzed. The big question is, are you ready to take up the challenge. Are you ready? Are you ready to develop new products? Okay.

So, then from next class onwards we will see how to develop new products. Of course, we will not jump into product development. We will slowly start with step-by-step procedures and then see how we can contribute in the development of new products? Okay.