Enclosure Design of Electronics Equipment

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Lecture – 04
Design as applied to small electronics products and projects

Good morning, let me continue with something which is a continuation of what I had spoken in the last 2 lectures plus something by itself which is anybody can start and start working towards making concepts for your ideas in your mind over the years we have gone into a nice level of abstraction when you want to say something you can talk in terms of known physical quantities for example, if you talk about a distance saying it is. So, many miles you can get a estimate of how many how long it will take how much effort it will take and so on when you talk about a mile and then probably the highest abstraction level is made by mathematicians where they do not use known physical quantities anymore instead they represent physical quantities by numbers.

So, things like A B C and so on saying if you add A and B it will happen to something and then next level is we are all familiar with the well known thing like the Pythagoras theorem where we can add areas and then we can come into net result of it and so on. It seems to make a lot of sense in several human efforts directly hence you are to cut out a cloth for a shirt like this by taking various measurements and laying them out on a flat sheet you can always go and ask for a cloth which is probably what I call a meter wide and length maybe say one and half meters and then using that the concepts of 1 by 1 and half meters its possible for us to lay out a cloth cut it and then make a garment out of it, but you will notice if you just directly talk about an area saying I want a one and half square meter cloth it can be anything because the second level you need to specify what are the 2 sides of such a thing which you want; however, in real life we are very visual people and our own world is dependent on the various inputs which you get from the sensory input one of them is visual input saying the moment you look at it you can understand things this is where even things like optical illusions play a little on the things which will make a formation.

Next level is probably touch a tactile feedback. So, going touch it you have a slightly better idea of what it is something related to all this is probably sounds which things

make if somebody were to ask you is this made of metal or is it made of ceramic you take a cup and probably you click the cup; take the cup and you make a click then you can make your tires this is probably neither metal nor ceramic meaning it is not a bone China, probably it is made from a molded plastic then after that when you tilt it in see you see various lines and all that from there you make an idea oh it is probably made from some a different type of plastic different type of thing and what you call various types of materials.

Now, I come back to one of the very important things which is the importance of sketching something which is very related to our human understanding of the world is; however, sketch things and how we make things which keep going forward.

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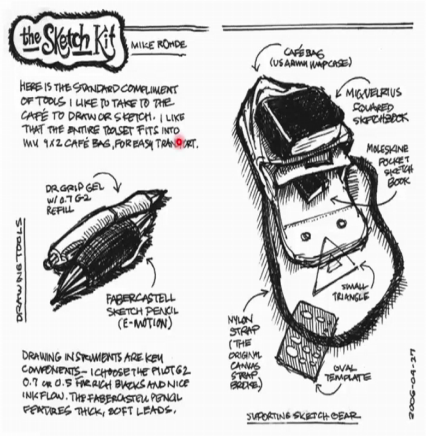

So, I would like to point out that I would like to acknowledge the source from which I have taken this it is from Goshen dot Edu and then concepts if it is possible if it is still being maintained there you can take a look at it if not the things that are presented here are relatively common. So, you can make this thing out of it. So, this Mike Ronde talks about the simple way of converting any of your ideas into what you call put expressing them on paper is a first step of converting them into a product.

So, he says we have the sketch kit here the standard complement of tools to draw a sketch and he says you see I like to take them to draw a sketch you seen we get back to one of the important academic activities drinking coffee and that is how this cafe comes

about other than just about wasting time in the coffee thing it means that you do not take a break all the time you are busy sketching and then you calls you it a cafe bag and then here you have a sketchbook and then you have a pocket sketchbook and then you have various sketching things and then you have templates and then there is a strap to carried most important is we have a gel pen here then with the refill and then a sketch pencil here drawing instruments are key components I chose the pilot G 2.7 and then all some with a Faber Castle thick soft leads.

So, if you do not have it do not worry about it the brand is not important the importance is that you need a pen which is not very sharp, but then it does give distinct lines with a clean edge that is where that point seven either ink or pencil or something comes the other is a pencil which say typically we use 2B and 3B pencils and sketching thing is if you press a little harder you can get it darker and then you can probably shade corners of it and then you can even chisel point it.

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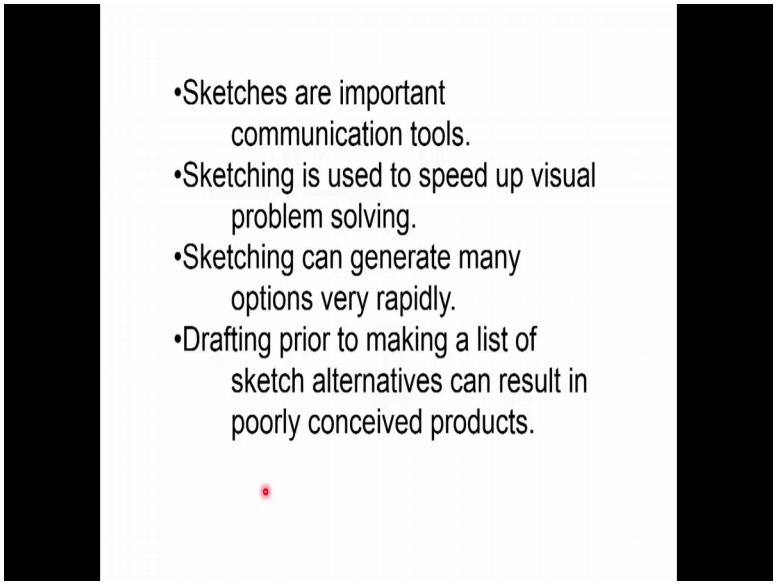

So, that you can get better things the next slide talks about why sketches are important one is there important communication tools this is how you can explain somebody how things are I will put the pointer here and take it out most important is it will speed up visual speak up problem many options very rapidly drafting prior to making a list of sketch alternatives can result in poorly conceived product.

Now, you remember you know what is talking about is drafting; drafting means a semi formal engineering drawing because engineering drawings are already abstracted you have a 3; we are drawing saying you have a plan you have a elevation and we have a side view and then you have the what you call American system of a 3 view of drawing and then you also have the European projections and then you have an isometric view then you have pictorial view all this comes into drafting because in general drafting is to scale, but when you were to explain to a friend of yours how to look at a feature on the street what will you do one of the first levels is probably show them a map saying we have a map here then map is again a little bit of an abstraction because it takes a bird's eye view of the what you call as the features that are visible outside, but you travel along a road you travel along a path looking forward and you are looking for visual cues where to take the next decision.

So, next question is you will explain to him saying at this point you will find this big some building or you will find billboard or you will find a physical feature saying at that point you need to know to take the next station saying you take it turn left or from there count 3 turns and you do not take the turn right and. So, on and if you are lucky and if they are birds you will reach that place in due course you will see that we understand this things very well and then there is never any confusion, this is where the sketches are very very important us communication tools you need to communicate while a very routine thing like reaching your place or contacting you is easy imagine something which is in your mind it has to.

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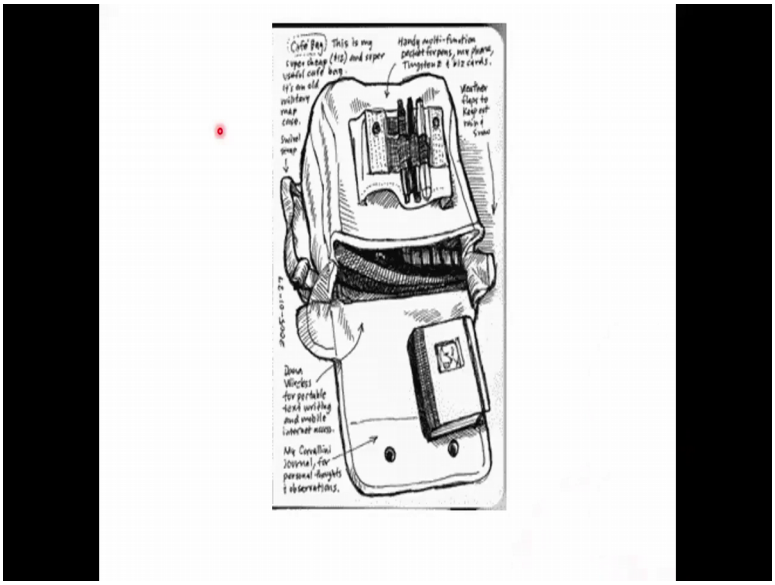

Now get manufactured you see here a little more this thing about what are all the various tools I will not spend too much time on this then I know you have this, this and so on like that so many of them.

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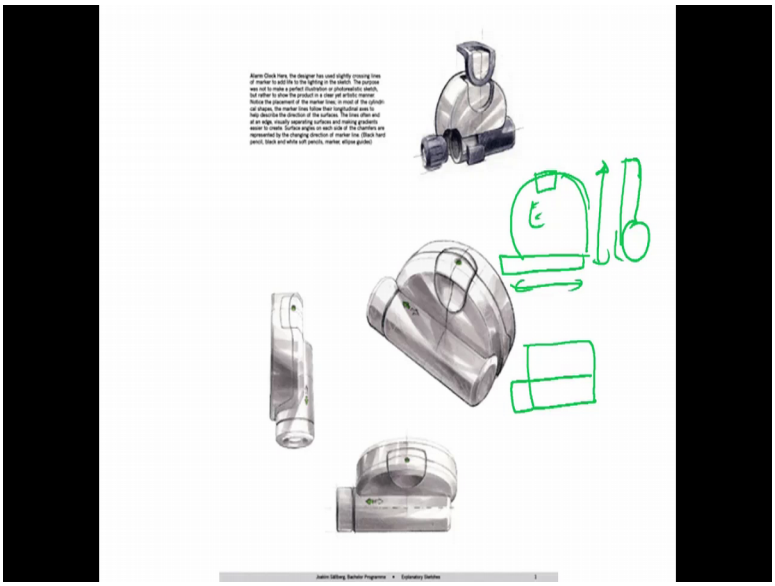

Now, we come back to very very important thing of sketching will you believe these are not generated by a computer these are all done by hand somebody has spent a lot of time they have started with looking at it you know very well it is probably a circular what you call device it is not a what do you call it is not a oblong or as I told you in the previous

class know it is not an oblates ferrite or it is not a I mean other things like that. So, if you look here one of the first things you will notice is if it were to be an engineering drawing we will end up with a 3 view of drawing.

So, something here will explain saying there are something here like this and then there is something here and then you see it is not a very explanatory thing and then this we call it a front to you I do not know or elevation and then we write another view here saying we have a part of it here and there is something else here like this I have a feeling this is more useful in trying to decide who is qualified to be a draftsman you really cannot make out anything out of this engineering representation of it, but what it does have does do is we can directly give dimensions here we can give a dimension which is shared by these 2 we can give a dimension they shared by this and we can also highlight feature saying this is transparent and this is so on and so on and various types of thing here it is probably some alarm device which is I cannot say.

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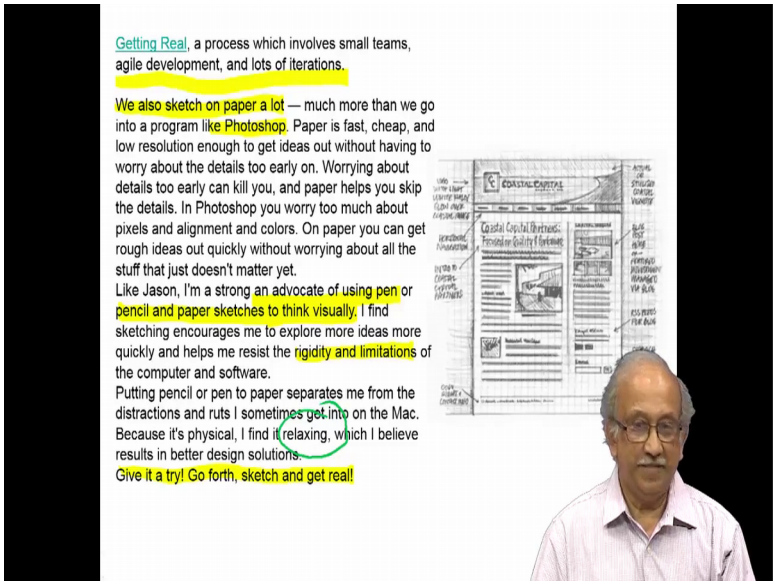

Now, I will go on to the next slide as we go on most important here seems to be agile development and lots of iterations try to sketch on paper a lot very important is a wide Photoshop shocking isn't it, but if you see carefully Photoshop is fair playing around on photos not meant for your sketching. So, it is it. So, many other luckily right now I am working on a graphic a computer it is easy for me to sketch and all that it is not quite the same as taking a paper and taking wherever you want and sketching it.

So, everywhere they talk about an advocate of using pen or pencil and papers sketches to think visually it comes naturally you just need to practice it and then if you were to sit in a class like I did I had a lot of education what I picked up or what I start some of it is useful some of it became useful much later on, but when we lose contact with the lecturer what do we do we sit in do oodles of doodles keep on practicing one of the easiest thing to practice is our signature second thing is how to sketch the features which we see around.

In the end, there is no rigidity and limitation of the computer software give it a try go forth sketch real and what I was talking to a little while about it is relaxing.

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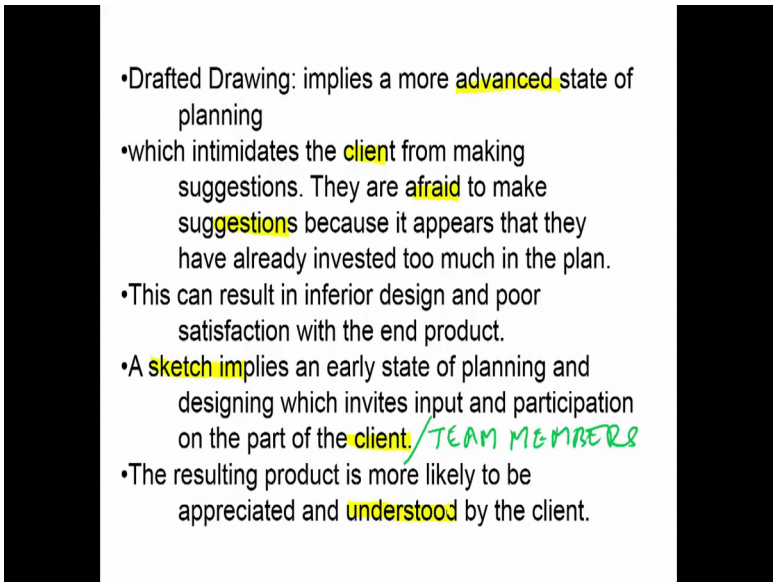

This what we have been doing in schools colleges sometimes in now meetings everywhere you see here a full fledge drafted drawing implies a more advanced state of planning because already things like actual sizes relative portion have all been frozen you have seen this already clients are afraid to suggest because it appears that they have already invested too much in the plan.

So, we all know about it in the case of let us say you get ready for a photo shoot. So, you know who stands where and all that know supposing you give them a formal plan saying like you are in an elementary school all of you stand at an arm's length and you maintain this and all that it becomes a or something you need to avoid; however, a sketch on the contrary implies the at least state of planning and designing which invites input and

participation on the part of the client and the word client here I will substitute it with other team members of, but yes this is the only way you can communicate with somebody if we just randomly real offered things related to weight and materials and fabrication process we have a little problem, but when we are working together resulting product is likely to be appreciated and understood better if you communicate in the terms of sketches.

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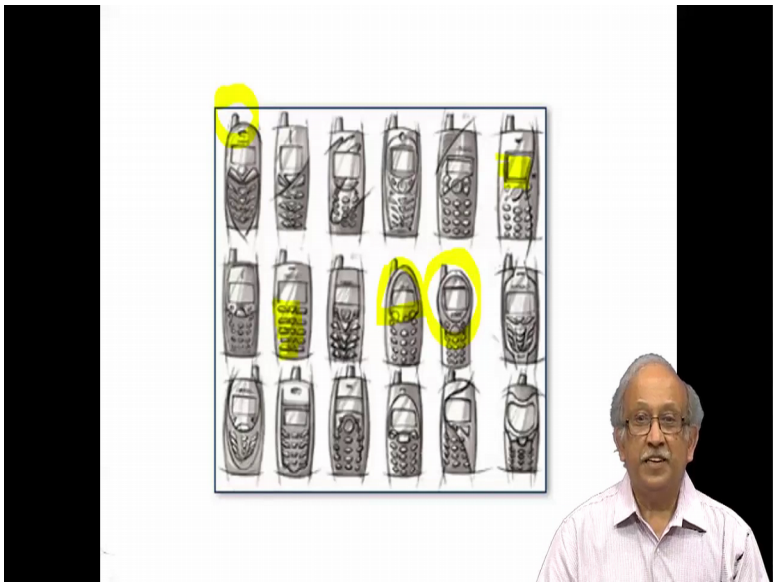

This I think earlier I have shown to you this is taken from a Siemens phone see how many variants have been worked out and a very basic theme very basic theme is here we have a display then we have set of keys how do you know make the keys and then in the case of the old phones we always had.

This antenna which has to be stuck out now do we shall just stick to a simple cube type of device are you make it something a little more like this are you make the important thing feature a little bigger these are concepts; obviously, know there is a population stereotype and we most people they respected to hold the phone on the left hand then the packet the thing from be using the right finger it is also left also is possible.

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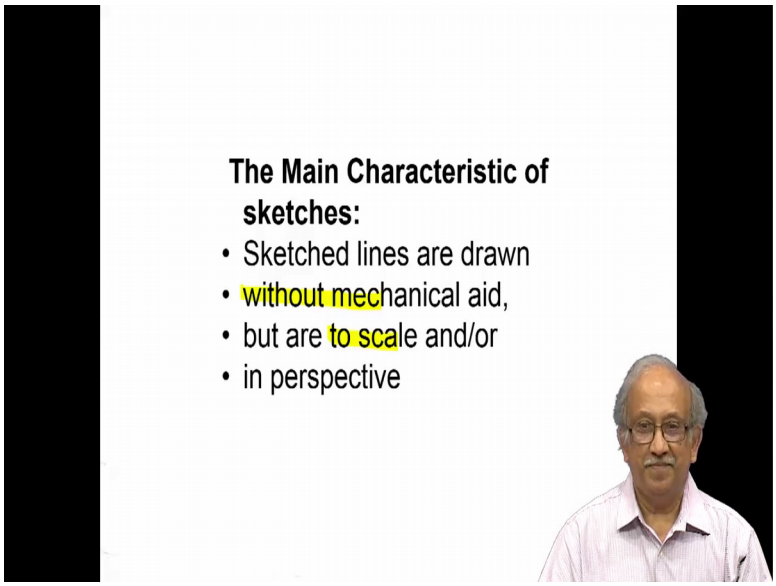

Now, luckily with the new things you can even reconfigure the things sketch lines are by definition or drawn without mechanical aid, but relative to each other are to scale and by definition always in perspective most important is that this perspective since to help us a lot seen this beautiful what to tell.

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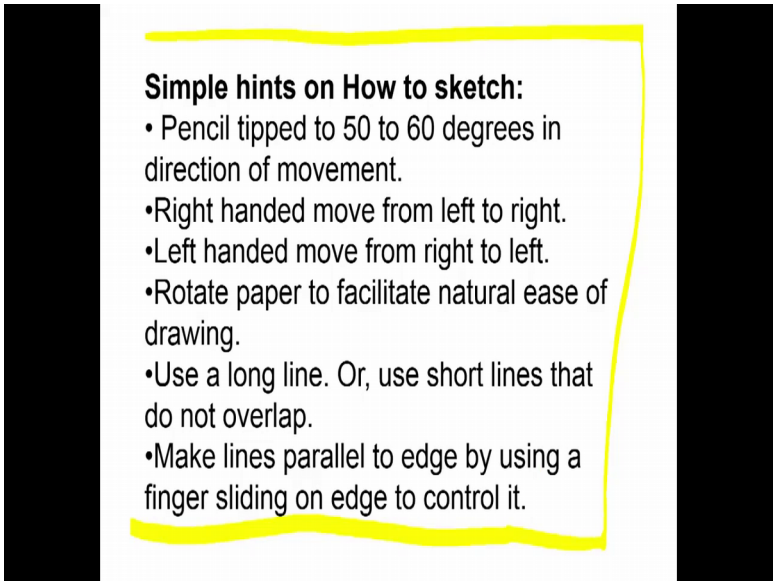

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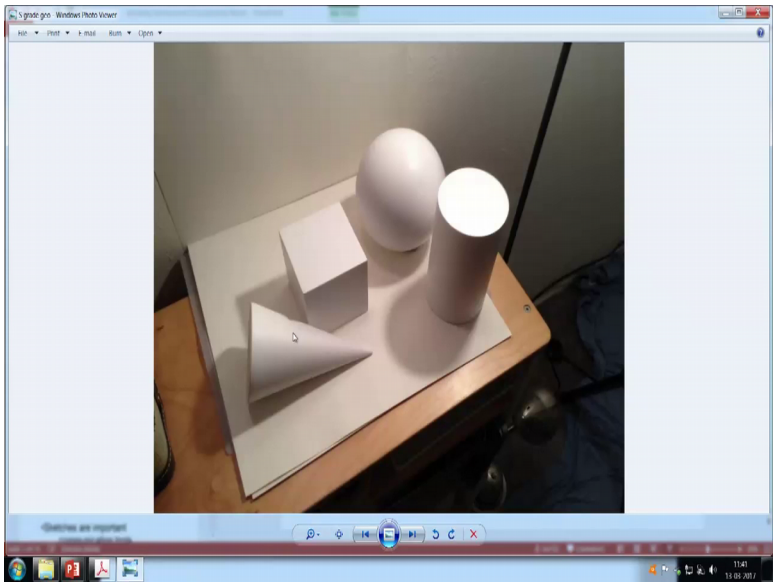

A study on a table or still life picture as kids would have love to write a picture of a house or flowers or anything we have all been taught there is; obviously, very simple way of writing something what we do we go here and then we try to draw essentially what is called a gabled house what a gabled house does is next to come in when I come back to it I will tell you this very simple way of it, but in real life if you see carefully here even geometric solids like this they seem to have beautiful things here you see is a beautiful edge here you seen this there is a beautiful edge here though it is a simple rectangular slide we have an edge here which shows that we can identify it and there are various grades of shades which are there including there is something which is catching the highlight here and then there is something which is catching the shadow here.

Now, sometimes you have a you would have seen in various art magazines and all known there are outside what you call landscapes and all which are done on the pavement meaning the roads it looks like there is a big hole and people are little cautious about it only thing there is the difference between 2 D and 3 Ds 2 D is flat from one point you will be able to appreciate the thing. So, if you see here any markings on a big court typically in India we all play cricket and then where is other things you see the promoters names being written from the main camera it appears in proportion the proportion of the promoters name appears in promotion, but actually if you go very close to the thing you cannot even read it because there is what is called a foreshortening because of the angle depending keeping these things in new a lot of times its very easy for us to strike to, but

you call sketch things and make them look presentable left handed see things are given here saying right handed move from left to right left handed move from right to left rotate paper to facilitate natural ease of drawing.

Next time you walk it watch a an artist he does not like we expect know he does not go about what you call writing something directly on the top or anything instead use your pen like this or to makes things on the nicely very conveniently he is able to draw things without any problem make lines parallel to edge by using a fingers sliding on edge of this thing to control I will just show you this have a look at it see here if you want to draw something you just need to hold it and then if you drawn like this very very easy for you to continue with your this things I will draw it here.

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So, that it is easier for me this people have been doing for a very long time and you too would have had as if you are somebody was curious and is taking these classes I am very sure that people are very you like all these things a lot coming to the next slide slowly we are getting into a little more details about drawing you seen here.

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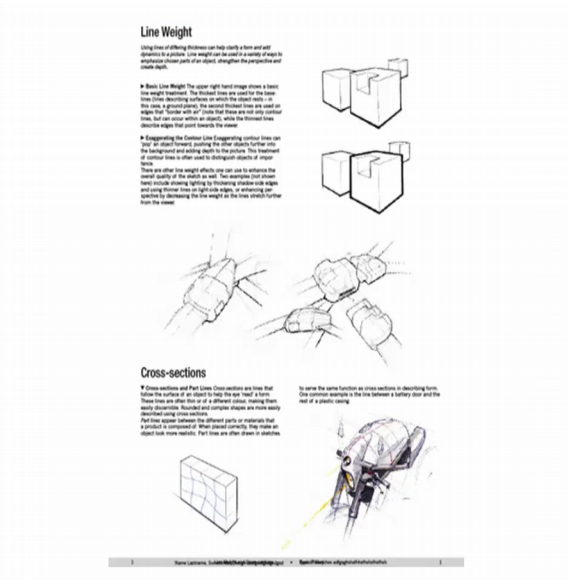

So, we have a perspective and what is called line weight depending on the outline; outline generally if you draw it a little thicker the object will come out of the page. So, that it looks easier and then parts can be removed and by addition and subtraction of the solids you should be able to make various features and you see here very important thing here at the bottom there is a grid line which is painted over that it looks as you its a brick corresponds and you know some there is a depression that is made in it, but in reality its a flat surface, but the visual cues presented here make sure that it looks as if there is a depression.

Now, if you come to more and more advanced features you have the picture here of a motorbike front.

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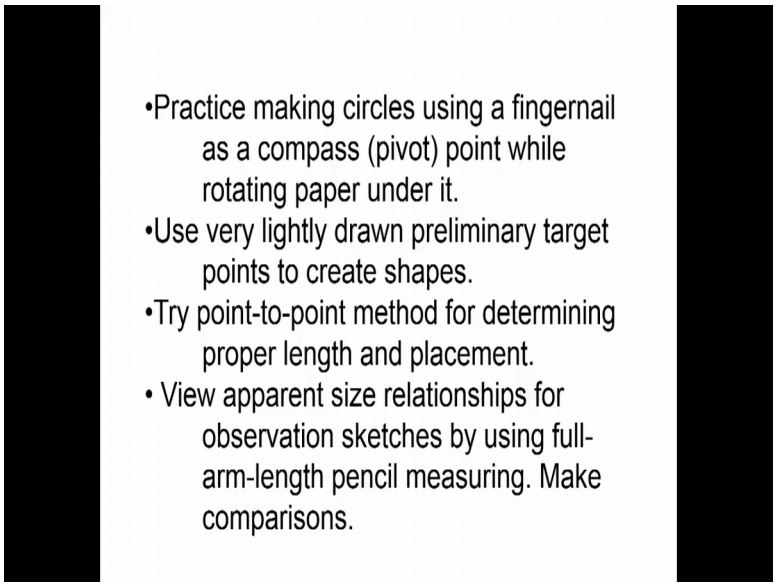

So, we have a seat here and then we have the tank and then we have the various type of controls there. So, it is possible for us to practice all these things circles using a fingernail as a compass very lightly drawn preliminary target points to create shapes point to point method a determining proper length apparent size relationship observation by using full arm length pencil marking.

So, you see here if you see art is often they hold their thing like this here know then measure saying you see this Eiffel tower is about. So, long or a this is short and then using those things they try to make a proper preliminary sketch to make things quite easy next slide will probably show you what is drawn inside a book see inside the book this person has kept on making circles and then after that their various things to make these things look nice.

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So, it is a matter of practice you are seen here there is a beautiful something know there is a rectangular vertical object around it to circles have been drawn and then they just keep on practicing this.

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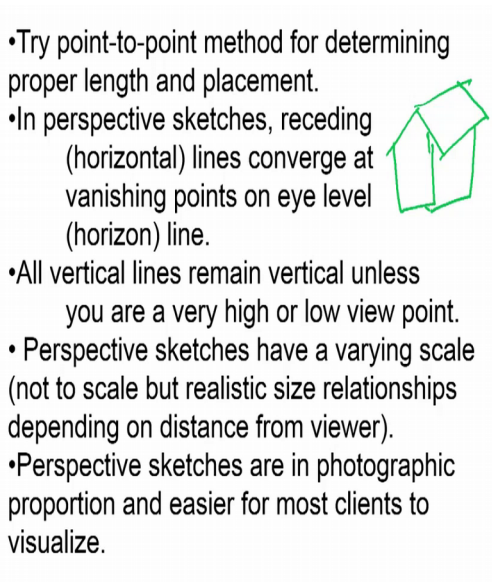

It makes it look very very easy in perspective sketches receding horizontal lines converge at vanishing points at eye level vertical lines remain vertical unless you are a very high or low view point. So, these next pictures you remember I was talking to about

how you have been asked as a child to make a house what did we do you started with a gabled roof.

So, we have a gabled roof there though very rarely we have slopes all the time we have flats instead and in the front we probably have already entrance to it make it 3 dimensional; obviously, these best way would be to add you see already it looks a little like a 3 dimensional object. So, children have been taught on simple methods how to make these things sometimes there sometimes there not one of the easiest way they keep tell them is saying you start drawing any shape in the front and then try to imitate the same shape a little at the back and now join the lines and then you already have very beautiful 3 D object which appears.

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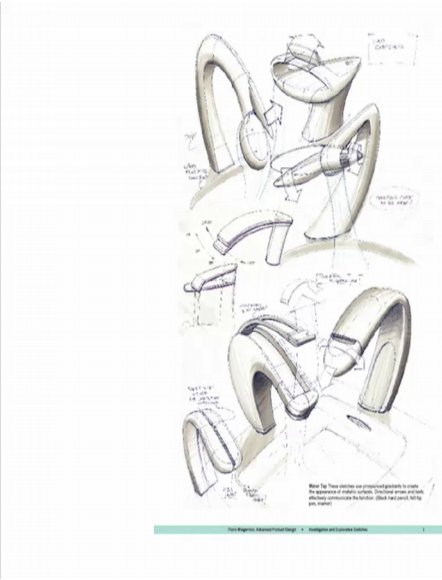

But you will notice one of the first thing you will notice is vertical lines have to be vertical and there is always a vanishing point which makes sure that your objects are in proportion.

Now, see here we have a I do not know I think it is a faucet people call it a faucet or I think a tap. So, you say people have been these are basically you can all be reduced to set of geometrical parts and then something added to there it is it sketching and related to the sketching is the line weight.

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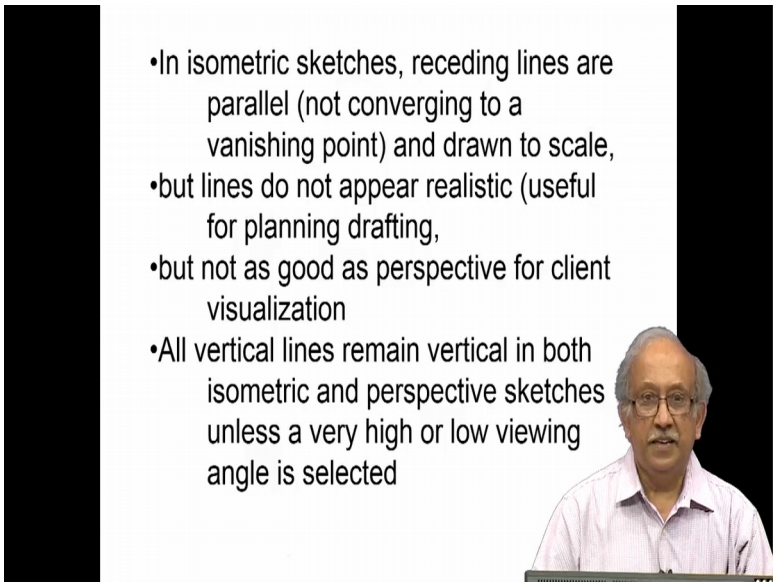

And the little bit of shading the moment you keep adding this line weight and shading things look more and more useful here you see here what started and top as a very simple goggles suddenly as goes down it looks more and more natural more and more real I will go back.

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However in isometric sketches receding lines are parallel not converging to a vanishing point they are always drawn to scale it looks a little irritating, but useful is that its somebody can take a compass a compass is nothing, but you have to sharp points and

then you have a scale. So, it takes something from here and put it on the scale and automatically you know what it is a height can be scaled width can be scaled same it is a length can be scaled by definition isometric is all the 3 axes are equally represented in the object foreshortened by their some relation point eight seven minutes on like that the problem is well it makes a lot of sense for the person who is doing the drafting that is making an engineering the workshop sketch not very useful to visualize products with it all vertical remains vertical in both isometric and perspective unless a view angle are selected.

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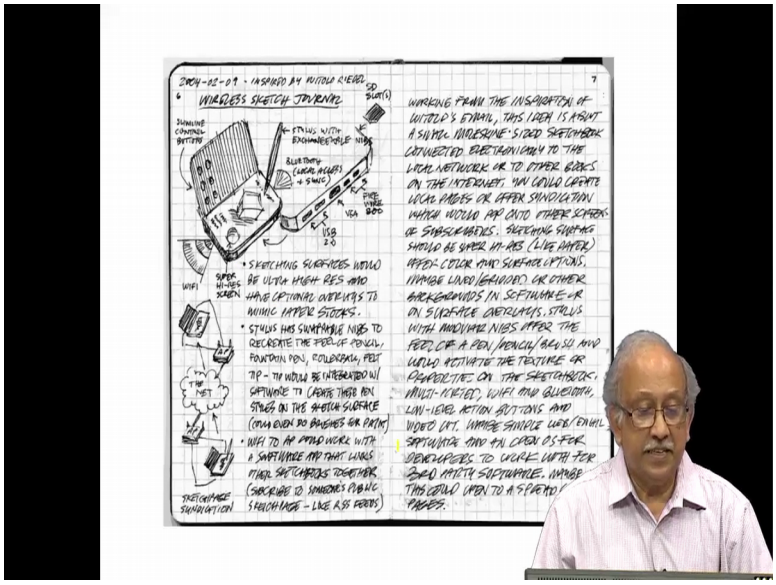

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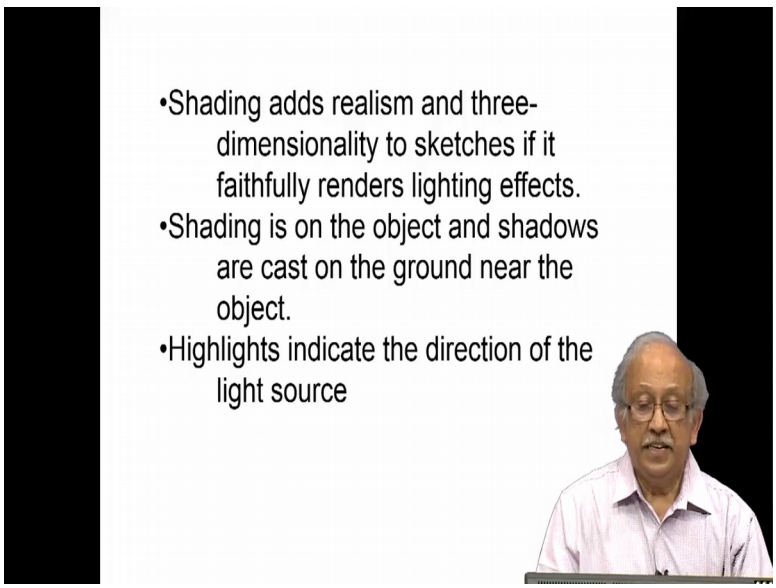

Now, here if you see very very carefully see lot of stuff has been made here sketching surfaces would be ultra high resolution and so on and so on know you can keep on trying to make things as you like shading adds realism and 3 dimensionality shading is on the object and shadows are cast on the ground highlights indicate the direction of the light source 3 important things this if you remember I showed you that sphere there is something which is catching the highlight and reflecting it back to you the moment it appears like a spot you know probably the surface is a spherical surface it becomes a line it is either actually a line or a joint of 2 edges anytime you have a joint of 2 edges it will catch the highlight.

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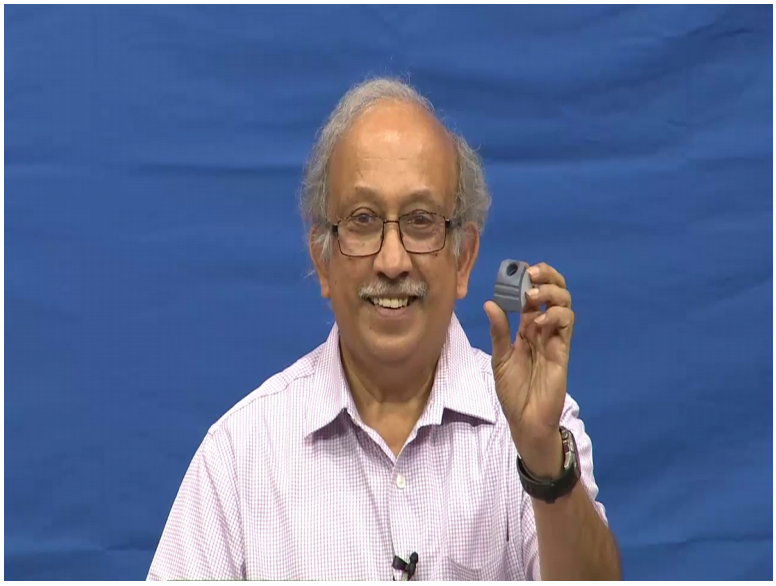

And then it will make you even if you take a very what you call peculiarly objects like this in reality though it looks dark you have here these highlights which is what which will give you an appearance of what the product is which is very very critical.

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Now, coming back to my slide presentation I have shown you this; the call goggles again we are all impressed by this you see this beautiful cars sometimes they do them. So, well we have a doubt whether it is a real car or it is a actually a mock up it looks good how else can you convey to your team staff team members that your vehicle looks like this.

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Now, I will show you some very very very interesting object you have seen this know it is one of those old espresso coffee things it place around a little on various things which we would like to have the starting point is at the bottom now seen this; this is a standard

percolator and nothing different about it now it is a standard percolator and the standard percolator you keep it on a you have seen this stovetop I think some parts of the word it is called a cooker. So, it can be conductive or it can be gas what we have and. So, on and then the top portion of it looks a little like the water fountain or somewhere you can collect water.