Interaction Design
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Lecture – 05
Interaction Paradigm

Hello. We are running into week 2 of this course on interaction design and it had 2 different sessions. In the last session, we had seen and tried to understand what do we mean by interaction model. And in this session, our primary emphasis would be to understand interaction paradigm. But before we do that, let us do a quick review of what we had learnt in the last session.

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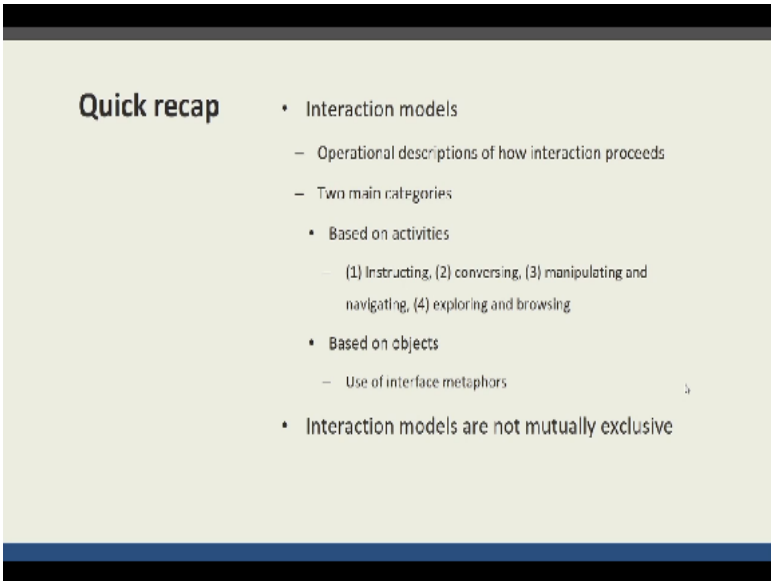

On your screen if you see with the heading of interaction model, we have understood that interaction models are operational descriptions of how interaction proceeds with different user groups having different goals and preferences. And it had got 2 main categories and we had understood that these 2 categories were interaction models based on activities and interaction models based on objects.

Within the category of interaction models which were based on activities, there were 4 of these types. The first set of interaction models was based on activities around instructing. The second set of interaction model was based on activities around conversing. The third set of interaction models was based on activities around manipulation and navigating through the interface. And

while the fourth set of interaction model was based on activities around exploring and browsing.

To know more details of these activities, I encourage you to view back the session 1 in week 2. And then within the next category which are primarily based on objects, we had seen and understood the relevance of interface metaphors. There was a short discussion on what do we mean by metaphors and how do we use them in case of interaction design. And then we have concluded and summarized our understanding in the last session by saying that interaction models are not mutually exclusive.

So there are often cases when 2 or more interaction models get utilized in interaction design. Today, we have to understand one more aspect of interaction model before we move on to interaction paradigm. And this aspect of interaction model is about how do we evaluate them? So there are 3 dimensions across which we can evaluate any given interaction model.

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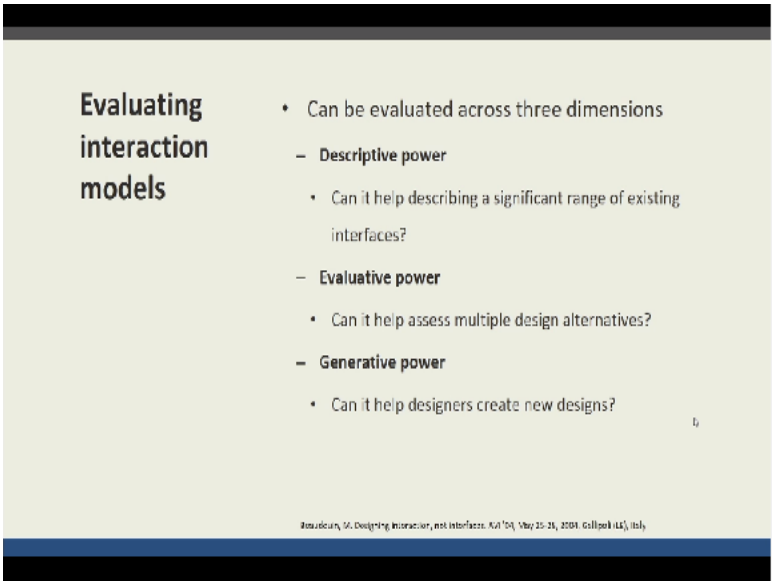

The first one is the descriptive power and the essential question that we ask is that can it help describing a significant range of existing interfaces? So if you remember the example of direct manipulation which was an interaction model, focussed around the activities of manipulation and navigating through the interface. If you remember that interaction model, what we mean by the power of description is that that particular interaction model should be able to describe all different interactions which are being thought as part of that model.

Can it help or can the interaction model, given interaction model, can it help describing a significant range of interactions or existing interfaces? And then comes the evaluative power. So thinking about the same interaction model, direct manipulation by Ben Schneiderman, we should be asking a question like the one shown on the screen which is, can it help assess multiple design alternatives?

So if you are considering an interaction model or a set of them, any given set of interactions or different interfaces, if they, if you think about them, you should be able to assess those different interfaces within that interaction model. So that is what we mean by evaluative power. And we are asking a question, can it help assess multiple design alternatives. And then third one is the generative power.

So any given interaction model or a set of them, if as an interaction designer you are using those in your design, then that interaction model should be open enough, should have the scope for you to think about new interactions within that interactive model and that helps designers being creative and innovative with their interface design. So any given interaction model should be in a position to help designers create new designs.

And that is what we mean by generative power. So the question that we are asking once again is, can it help designers create new designs? So this is very important slide. Any given interaction model, if you were to evaluate it, there are 3 dimensions. Descriptive power, can it help describing a significant range of existing interfaces? Evaluated power, can it help assess multiple design alternative? And generative power, can it help designers create new designs.

And here onwards, we are moving into the topic of interaction paradigm. This is important because now we are going to a little more abstract understanding of interactions and if you look at interaction paradigm, try to define them or try to understand them, this is what we come across.

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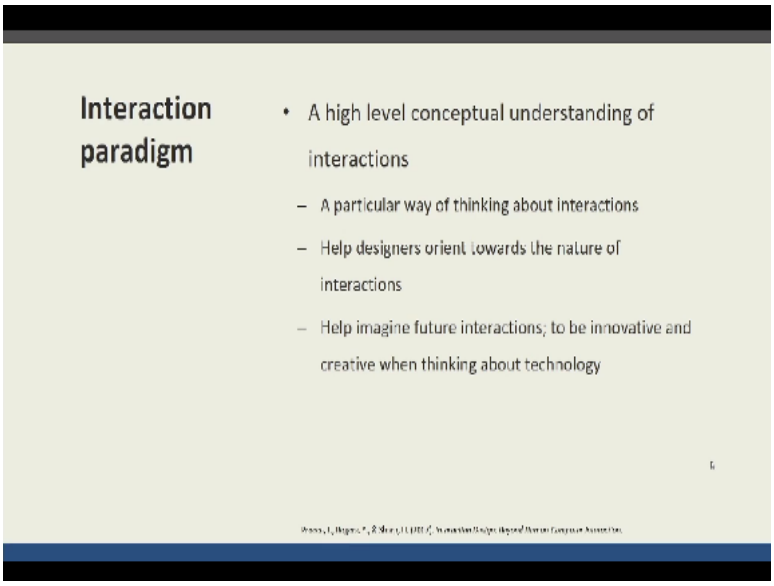

So these are interaction paradigm basically or higher level conceptual understanding of interactions. So these are the very high level understanding of interaction. How the interaction is proceeding and not really the operational description because if you remember operational descriptions were the interaction model. These are further higher level, more abstract understanding of interactions.

So these are actually particular way of thinking about interfaces and interactions. A particular thought of how do we imagine a set of interactions or a set of situations where the interaction proceeds and these are meant to help designers orient towards the nature of interactions. So here not just thinking about how do we do this? You have to think about what is the nature of this interaction and we will understand this through several examples in different slides to come.

But at this point of time, let us keep these few points in mind. They may look like a bit more abstract points. But I would encourage you to keep them somewhere in your notebook and help understand them through the use of further examples. So a particular way of thinking about interactions is interaction paradigm and it help designers orient towards the nature of interaction. It also helps lot of researchers and designers to imagine future interactions, to be innovative and creative when thinking about technology.

So we will understand these 3 or 4 different points through different examples of interaction

paradigm. The first example that we are considering is a very interesting example because not only it is much talked about, it is also much much more relevant and we are now going to talk about ubiquitous computing or popularly known an ubicomp as an interaction paradigm.

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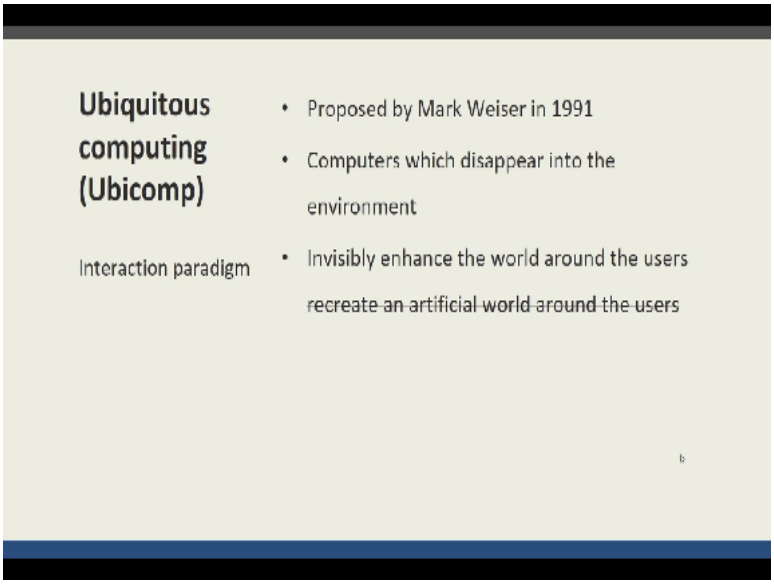

So it was proposed by Mark Weiser in the year 1991 and he imagined a set of interactions or an interaction space where computer disappear into the environment, where the technology becomes invisible, that is what he mean by disappearing and invisibly when they become invisible, when the technology becomes invisible, even in that sense it is helping users and hence their world. So it is helping users enhance their capabilities and the understanding of the world next to them, of the world surrounding them.

So computers which disappear into the environment and when they do that, they should enhance the world around the users and he did not mean that when they enhance the world around the user, that is not really to say that they need to recreate the world or recreate an artificial world, that is not what he meant. He meant that the existing world of the users or the world or the environment around them, that should get enhanced with the presence of technology that disappears into the environment. It is also known as third paradigm.

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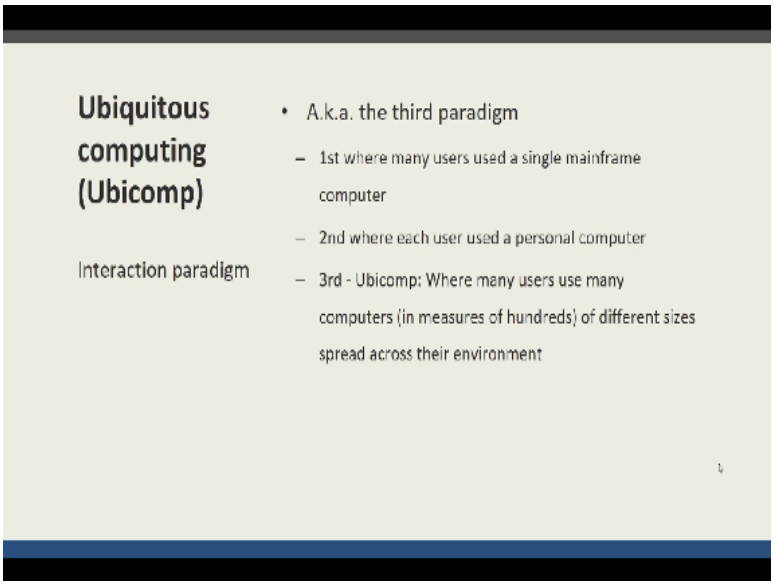

Essentially because you had the first paradigm as mainframe computers where a number of users are using a single computing machine. So that was first paradigm. And then you had the second paradigm, which is using personal computers, where each user has an individual machine to interact, individual machine to accomplish different tasks that he has in his mind. So that is the second paradigm.

Mainframe, the first paradigm. Second paradigm is the personal computing. And then he is talking about the third paradigm which is ubiquitous computing where different users, number of users use hundreds of these computers, okay. And these computers can be left once used so the other user will come and use the same computer and these are in hundreds of numbers. So he is now imagining different users many computers, okay.

We also call it as the third paradigm. So as we are saying that, you know, the first paradigm had a single mainframe computer using different user. Personal computer is the second paradigm and ubicomp where many users use many computers in measures of hundreds of different sizes spread across the environment.

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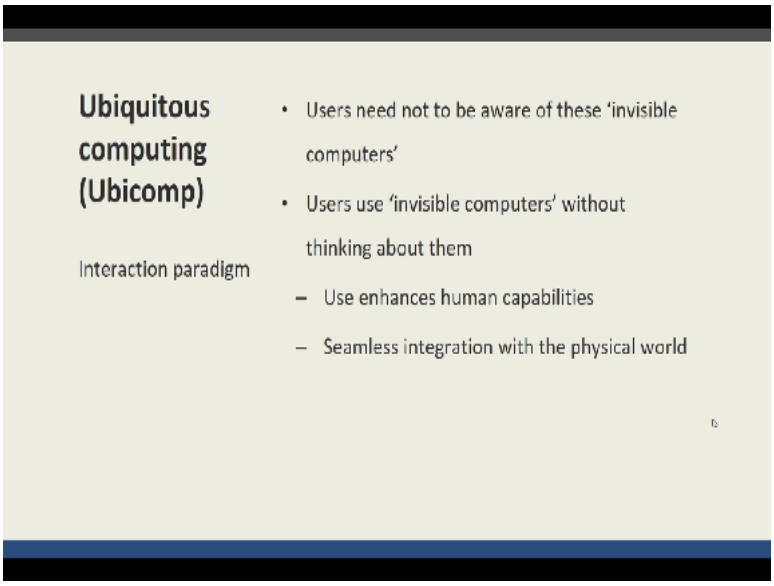

Users need not to be aware of these invisible computers, okay. By awareness, it means the very conscious of awareness that, you know, there is a personal computer towards the right side of me and that is a conscious awareness of, presence of a computer next to you. What Mark Weiser is trying to say that in ubicomp, users need not to be aware of these invisible computers and users use invisible computers without thinking about them, okay.

So that is what he means by disappearing technology. Technology that fades out into the environments. So users use invisible computers without thinking about them in such a way that that particular use of technology enhances their own capabilities as human beings and it is a seamless integration with the physical world. So it is pretty much seamless, very much real time and a very well integrated world where technology enhances human capabilities.

So that is what is imagination and if you remember the third point in the first slide of interaction paradigm, that it is a particular way of thinking about the interactions. It helps people imagine future interactions. So you see, Mark Weiser is trying to bring before you a, his imagination of what computers would be when it comes to a paradigm of ubicomp. So let us move to the next slide.

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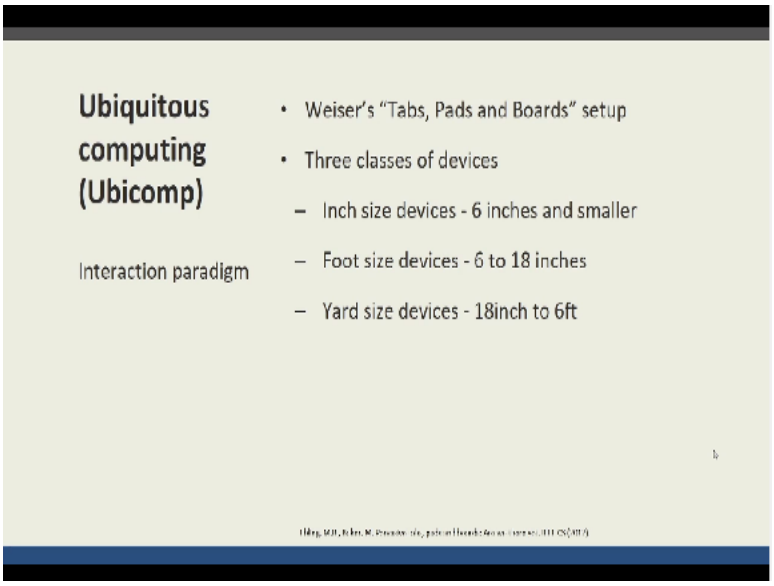

In this paradigm, Mark Weiser also propose a certain set of prototypes and these prototypes were meant to illustrate his paradigm of ubicomp. So he proposed tabs, pads and boards, a setup which illustrates the ubicomp paradigm. And there are 3 different classes of devices. So there are devices, remember the first point that we said that in ubicomp, many different users use hundreds of computers of different sizes.

So these are the classes which are based on the size of the device. So the first class is inch size devices where you have devices which are 6 inches and smaller. The second class is foot size devices where you have devices which were ranging from 6 inches to 18 inches dimensions. And then you have yard size devices which are 18 inches to 6 feet, okay.

So these are 3 different classes of devices which are proposed by Mark Weiser with reference to his paradigm of ubicomp. Let us look at what these devices and their class are? So when it comes to tabs? tabs belong to the inch size device class. Pads belong to the foot size device class. And boards, they belong to the yard size device class.

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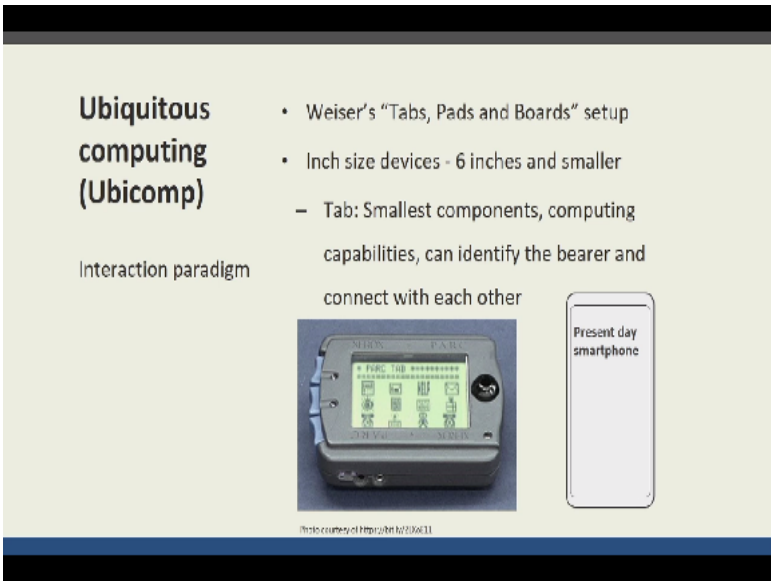

So let us talk about tabs a little more in detail. So these are the smallest of all the components and they had computing capabilities. They can identify the bearer and connect with each other. So these tabs much like, you know, they are like different small size computers which are spread across your environment and as soon as you step in and you pick one computer or a tab, it identifies you as a user.

So it quickly reconfigures the entire setup and then it becomes your computing machine. And once you have used it, you can leave it there and that tab reconfigures itself and gets ready for the next use by another user. So this is the way the different users are using many different computers and they are using them, leaving them and tabs being the smallest of them, they have the capability to identify their users, their bearer and then connect with each other, they can connect with each other.

So you see that ubicomp, you were saying that it is highly relevant paradigm and because they are direct incarnations of Mark Weiser's vision in today's world. So we have smart phone which is an inch size class device. It is 6 inches or smaller. And it almost performs the same set of functions as proposed by Weiser when he was talking about tabs.

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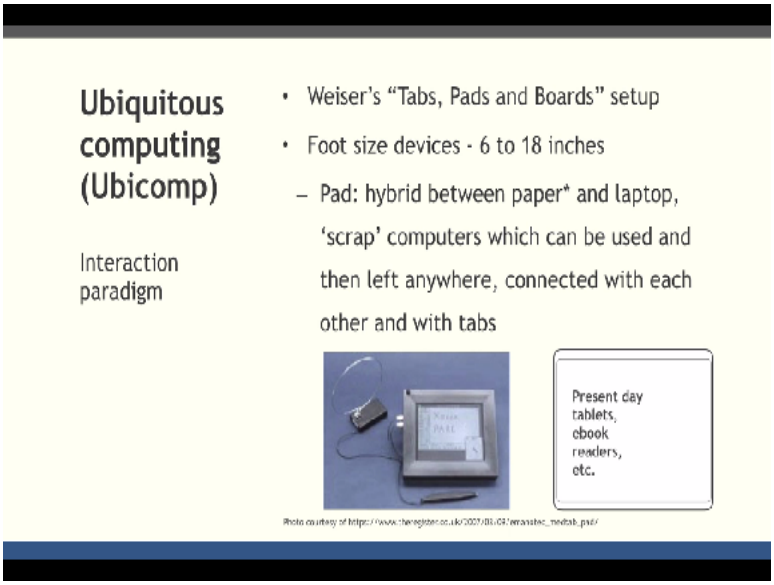

The next set of class of device is the foot size class, okay and within that, he is proposing pads. So these are hybrid between paper and a laptop. These are again scrap computers. You can use them and leave them back into the environment. They reconfigure themselves for use by another user. So these are scrap computers in that sense which can be used and left anywhere. So tabs not only are they connected with each other, they are also connected with pads and again pads not only are they connected with each other, they are also connected with different tabs.

So connectivity is a big proposal in ubicomp and just like tabs, pads are also a hybrid between paper and a laptop. Scrap computers which are connected with each other and with tabs. And again a direct reincarnation of Mark Weiser's vision is seen in current day world which is present day tablets, eBook readers and etc.

So eBook readers are in particular, they are mostly imitating paper and if you imagine tablets also, they have the capability where you can read different documents, assess them, do some computing with them and you have your basic goals realized by use of a foot size devices. So that is the relevance of Weiser's ubicomp paradigm. We are still left with the third class of devices which is the yard size devices.

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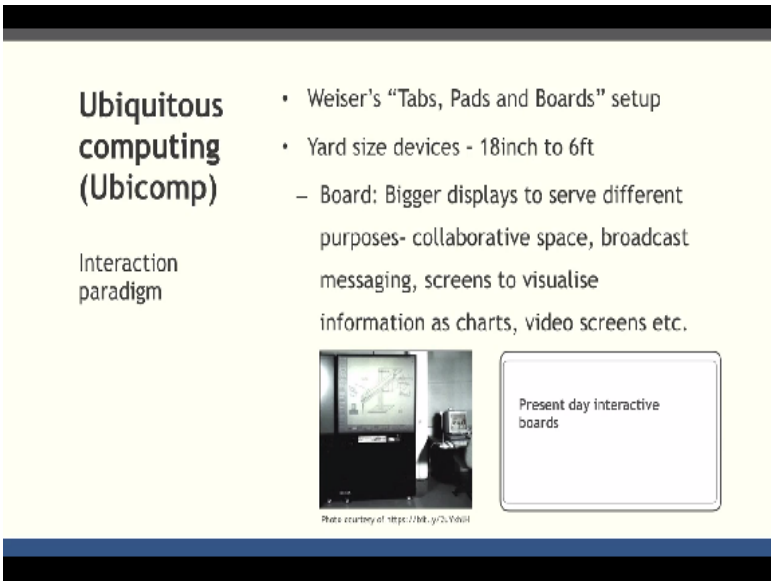

So these are the boards bigger displays to serve different purposes, okay. They are also collaborative spaces. They are broadcast messaging, screens to visualize information as charts, video screens and many more other use of boards. So present day interactive boards are reincarnation of boards in Mark Weiser's term.

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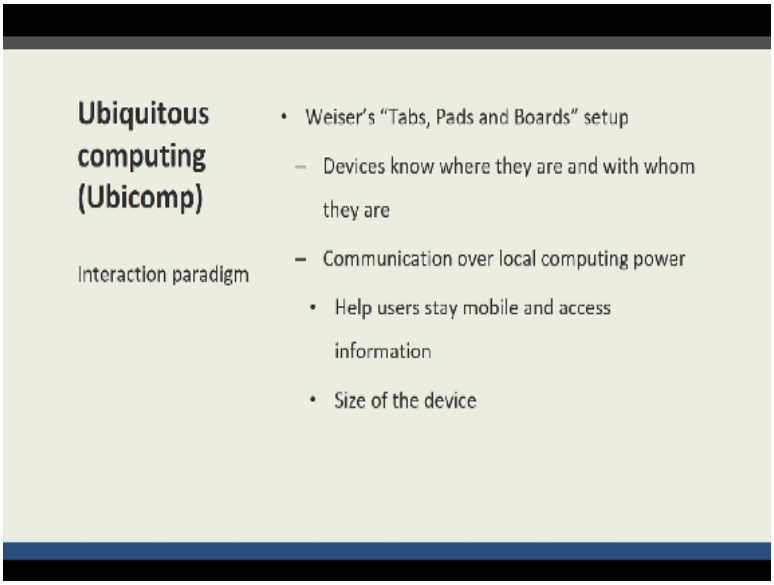

So again, let us look at how these devices are configured with respect to each other and their connectivity. So they know where they are and with whom they are. They not only can identify their bearer but they also can identify their locations. They are location aware devices and they, and in these devices, the communication is given more priority over local computing power.

So we have different small size devices from tabs to pads to boards where communication is given priority, where connectivity with each of them is given priority over whether the device is highly capable of computing complex operations, okay. So it helps users stay mobile and access information and the size of the device is definitely a classifying factor when it comes to different classes. Remember inch size class, foot size class and yard size class.

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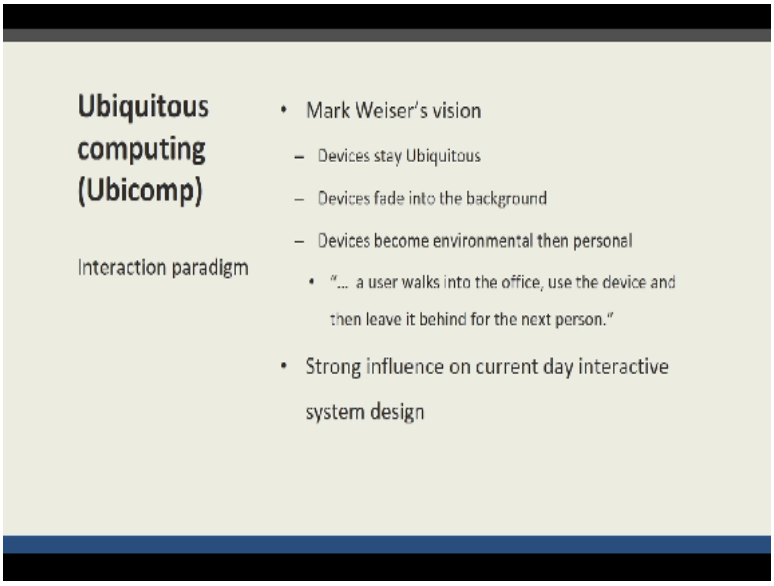

Mark Weiser's vision was also about saying that devices stay ubiquitous. They are present everywhere and can be picked, used and then again can be left back in the environment. And devices which fade out into the background. Devices become environmental then personal. Again one another way of saying that devices can be used by multiple users and they reside into the environments.

They are more environmental than personal. Once you pick them, they reconfigure themselves for your use but once you leave them, they could reconfigure themselves back as environmental devices. So a user walks into the office, this may be one of the lines in the scenario that comes to ubicomp which is a user walks into the office, use the device and then leave it behind for the next person.

So that is what we mean by saying that devices become more environmental than personal. So there is a strong influence on current day interactive system design. We have seen right from

smart phones which signify inch size class of device to interactive tablets and eBook readers which signify a foot size class of device to interactive boards which indicate a yard size class of device. So his paradigm, the ubicomp, paradigm is highly influential in terms of giving rise to present day interactive products.

Now there are other different paradigms which are direct influences of ubicomp and we understand them in that sense.

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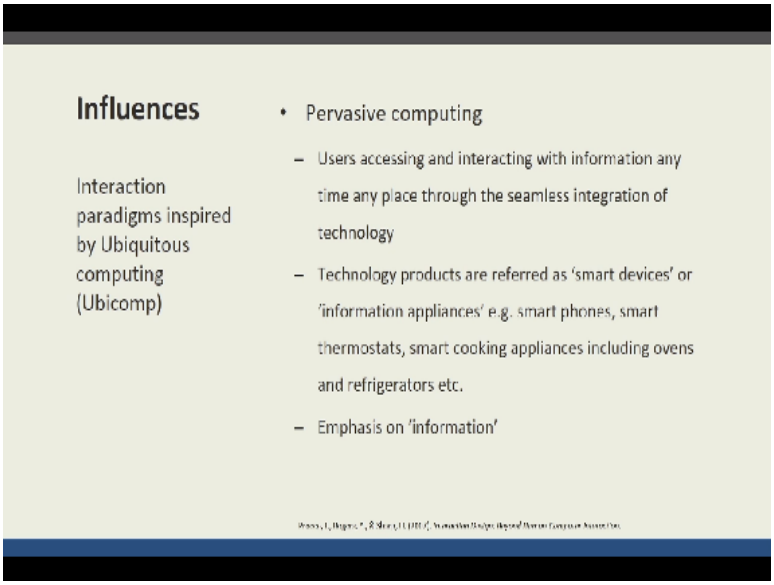

This paradigm of pervasive computing is one such influence of ubicomp. Remember ubicomp started in 1991 that is when we had the proposal and then following 1991, we had different paradigms which are direct influences of ubicomp. One such paradigm is once again on your screen is pervasive computing. Here the users access and interact with information any time any place through the seamless integration of technology.

And technology products are referred as smart devices and information appliances. So again we have so many examples which are smart devices or can be termed as information appliances. Chiefly among them are smart phones, smart thermostats, cooking appliances which, you know, take recipes from the internet, can cook it for you and including ovens and refrigerators. In particular, we have smart refrigerators now which can tell you that a particular commodity is going out of stock.

So you better go and buy it and they can send reminders to your other smart device which is a mobile phone when you are in the market. So technology products here are referred in particular as smart devices or information appliances. And there is a huge emphasis on information. So in ubicomp you had a lot of these things already in place but in pervasive computing, that nomenclature is hugely emphasizing on use and retrieval of information.

So that is why we have this nomenclature of information appliances. The second paradigm which is again an influence of ubicomp is wearable computing.

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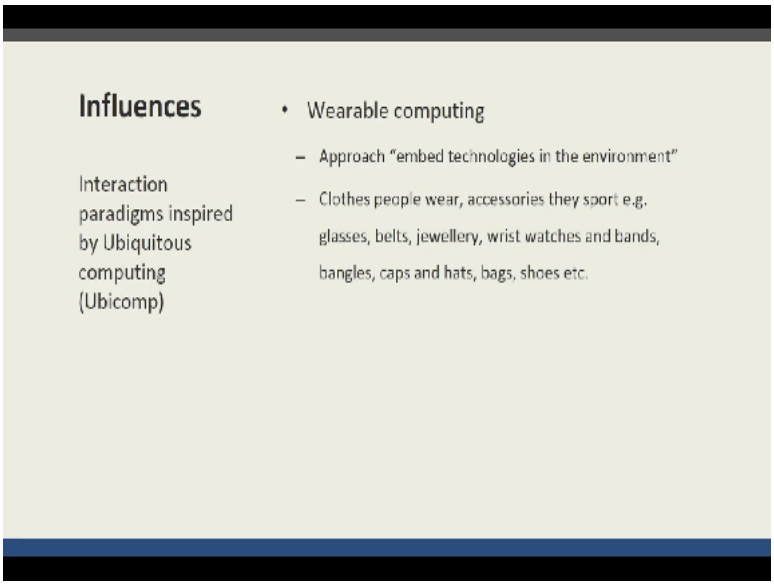

Within this paradigm, different researchers and designers, they are trying to see if technologies could be embedded into the environments and into our clothing and into a lot of things that we use on a very day to day basis. So it includes clothes people wear, accessories they sport something like your glasses, your wristwatch, belts, jewellery, bands, bangles, caps and hats, bags and shoe etc.

So different things which you come across as personal commodities like clothing and accessories which people sport, if technology could be embedded into them, those kind of interactions fall into the category of wearable computing which is an interaction paradigm itself. And then we have tangible user interfaces or tangible bits given by Hiroshi Ishii and Ullmer in 1997

interactions based on physical virtual integration and that is also one influence of ubicomp.

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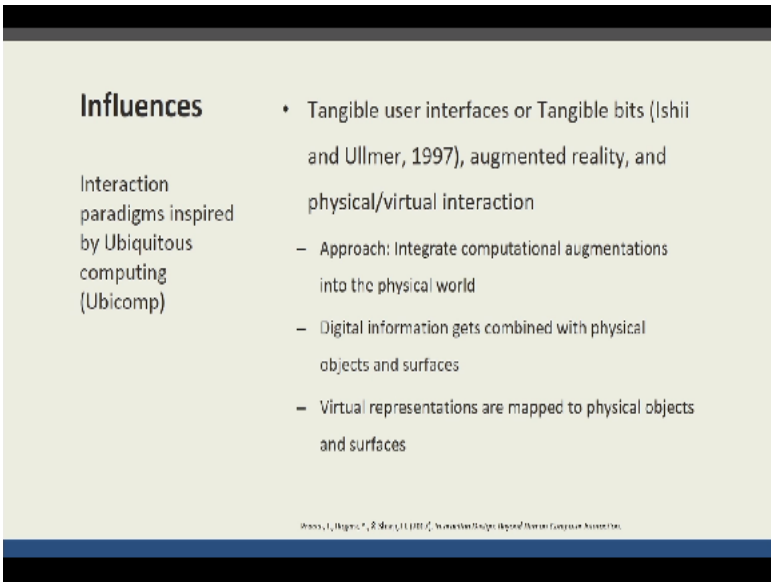

Here the approach is to integrate computational augmentations into the physical world. So imagine if a pen next to you is computationally empowered or it can do more than just writing on a piece of paper. So if you could integrate computational augmentations into the physical world, then that kind of interaction falls into the paradigm as mentioned on your slide.

So digital information gets combined with physical objects and surfaces and virtual representations are mapped to physical objects and surfaces. So these are the different things which are happening when it comes to a paradigm of tangible use interface, augmented reality of interactions based on integration of physical and the virtual objects.

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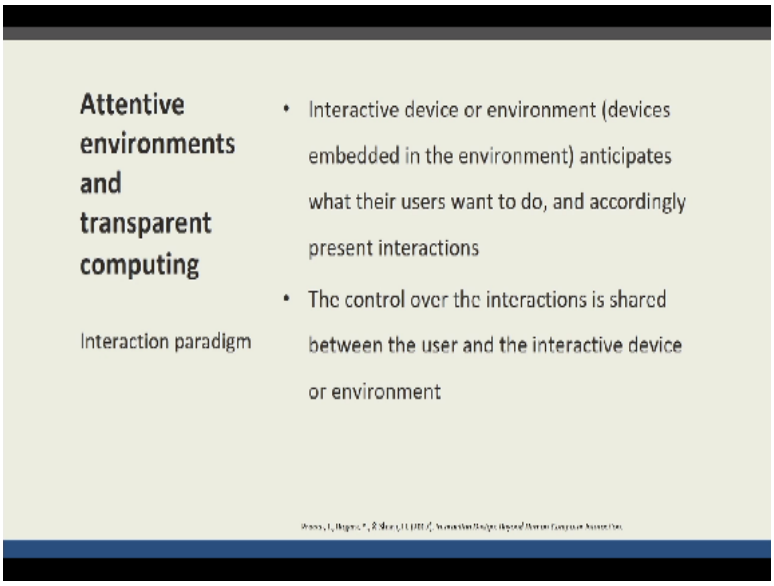

Now if you leave ubicomp, you come on to the next paradigm which is attentive environment and transparent computing. Remember that till now, we have understood ubicomp as a paradigm and then there are 3 different paradigms which are further based on, based on ubicomp or influences of ubicomp in some sense. Now we have the other paradigm which is different from ubicomp and the paradigm is called attentive environments and transparent computing.

So in this paradigm, the interactive devices or environment anticipates what their users want to do and accordingly present interactions, okay. So they anticipate, this is a new element in this paradigm. The element of anticipation by the smart technology which reside into the environment or into the device, if that technology, if the device could anticipate what their users want and then present interactions accordingly, they fall within the category, within the paradigm of attentive environments and transparent computing, okay.

The control over the interactions is shared between the user and the interactive device or environment and that is the second facet of this paradigm. So here if the devices or the technology behind the devices and the environment has to anticipate what a user is thinking, they have to sense physiological characteristics or physiological attributes of their users.

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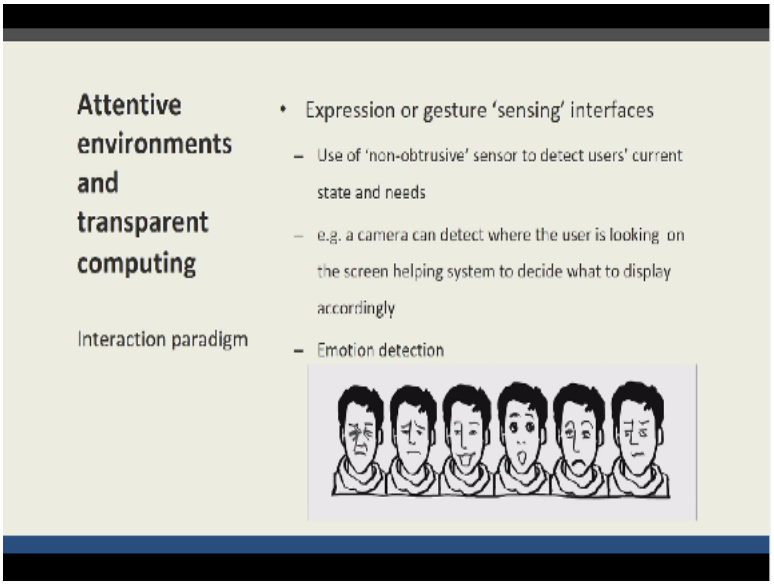

So expressions or gestures, sensing interfaces, you know, they arise as part of this paradigm. So use of non-obtrusive sensors to detect users current state and needs that is exercised in this paradigm. So for example, if you have a camera or some kind of technology embedded into your glass which constantly monitors the size of the pupil and you know that there physiological states which are associated with the size of the pupil, then you can very well anticipate what the user is trying to do.

So emotion detection is one major exercise which is carried out within this paradigm. People have different expressions and according to those expressions, if the computers could make sense of those expressions, if the interactive device could make sense of those expressions, then they can anticipate what the user needs and then present the interactions accordingly. Within this paradigm, the whole emphasis, a major emphasis is on anticipating knowing a priory what your user needs, okay.

So you keep that in mind when you think about attentive environments and transparent computing.

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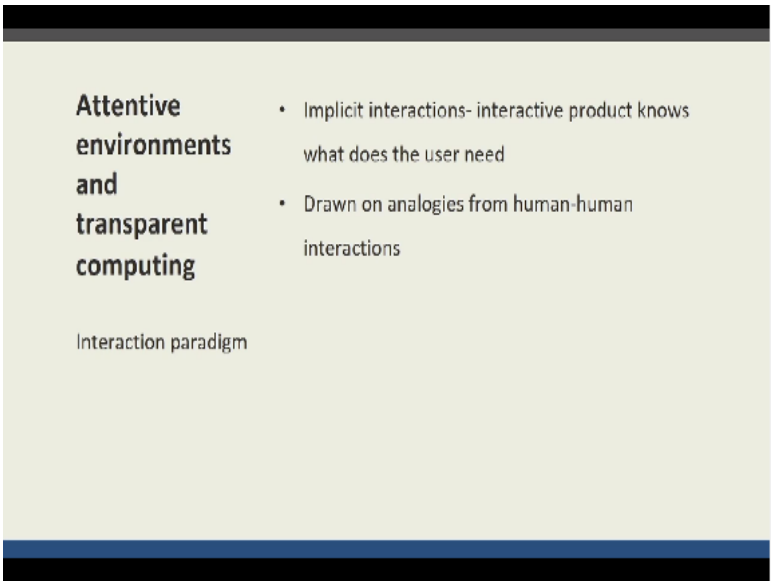

And these are implicit interactions, interactive product knows what does the user need. And they are drawn on analogies from human-human interaction. So again remember the first slide of this session which is when it comes to interaction paradigm, they are a particular way of thinking about the interactions. So here when you are thinking about attentive environments and transparent computing, you are thinking about, you know, how would the case be when 2 human beings are interacting.

Because we as human beings have the ability to anticipate what others are thinking that is something that we call theory of mind which needs a different session by the way but keep that phrase in mind if you have more queries, you can Google about it. It would be a very interesting read I am sure. So human beings, they have the ability to anticipate each other's response to different situations.

Based on that activity, we constantly improve or improvise on our behaviour, on our responses to other human beings. So this is the analogy which is taken forward when people are thinking about interactions in attentive environments and transparent computing paradigm. We have one such illustration of this paradigm.

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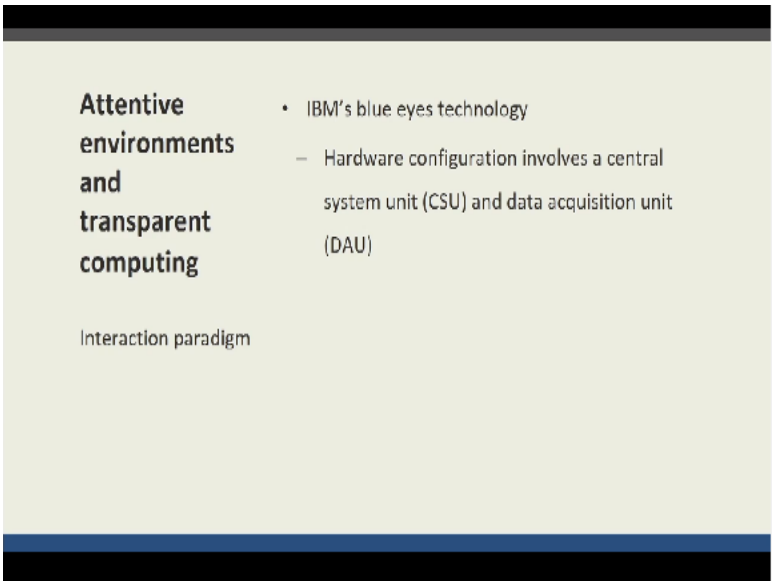

So IBM's blue eye technology is a hardware configuration which comprises a central system unit and data acquisition unit.

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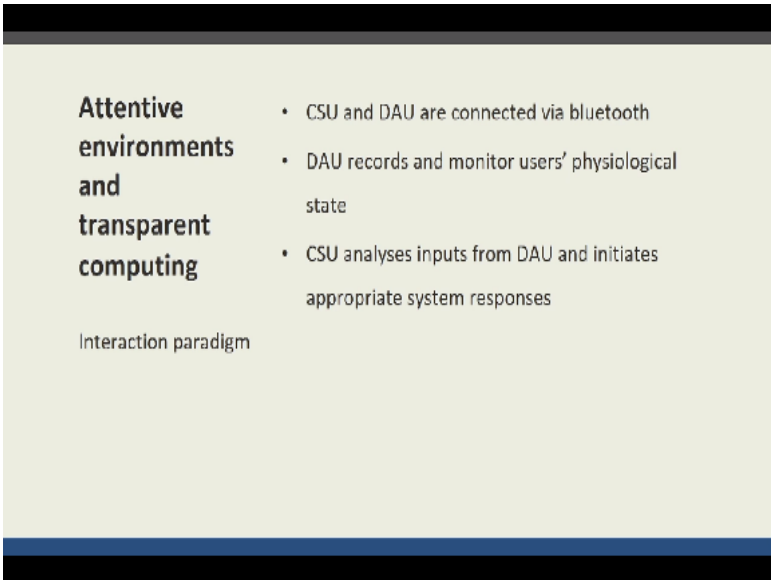

They both are connected via bluetooth and data acquisition unit has range of relevant sensors which records and monitors user's physiological state while the central system unit analyses these inputs from data acquisition unit and initiates appropriate system response. So I would definitely encourage you to Google some of these technologies when you have time.

So apart from all the paradigms that we have understood till now, what we are going to see is again a different way of thinking about interactions and this is a different proposal altogether. In

this proposal, the paradigms are given as part of 3 primary paradigms, okay.

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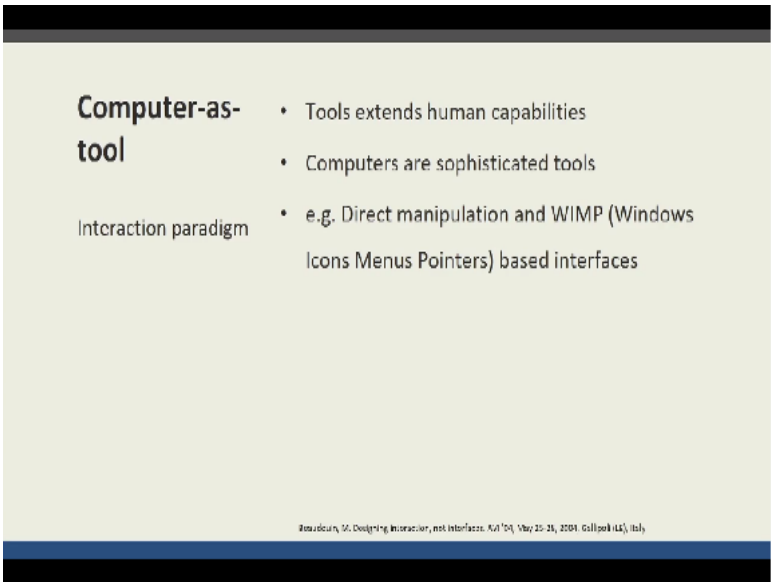

The first paradigm is computers as tool. In this paradigm, once again do not confuse it with the paradigms that you have studied till now. This is a different approach. This is a different proposal. In this proposal, we have 3 primary paradigms. First one is computers as tool. Now it, again it is a different way of thinking about the interactions. So in this stream of thoughts as interaction designer, you see interactions with your computers as you interact with a tool.

So tool extends human capabilities like a pliers that you keep in your hand to turn a tightened knob somewhere. As a human being, your fingers are not that strong enough to turn a tightened metal screw, you use a plier. So a plier becomes the tool that extends your capabilities as human beings. So in a similar way, computers are highly sophisticated tool if you think about it, okay.

So in this paradigm, we think computers as tools and direct manipulation and the windows icons, menus and pointers, those 2 different interaction models, they are based on thinking about computers as tool.

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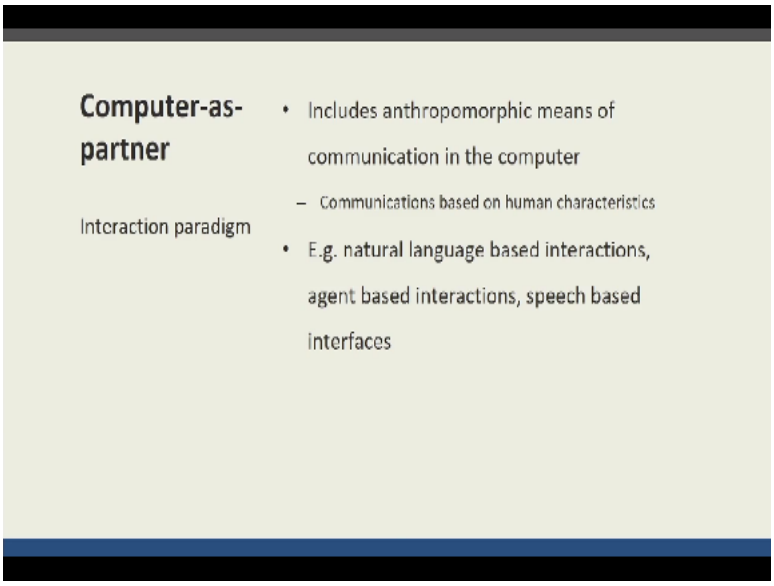

Then the other, the second dimension, the second primary paradigm is thinking computers as your partners, okay. So in this particular paradigm, you imagine all different interactions which are around anthropomorphic means of communicating with the computer. So if you remember the, in the last session, we were talking about natural language search engines where you can just type a query like how do I resolve this part of the problem or what do we mean by any particular query that of your interest.

So this is a natural language search engine where the engine is behaving or you are asking questions to a search engine as you would have asked to any human being. So that is an anthropomorphic means of communication with the computer and your search engine is also acting just like a partner, okay. So you are trying to resolve a certain set of problems while your computer becomes your partner. So in this paradigm, in this way of thinking about interactions with the computers, computers are imagined as partners.

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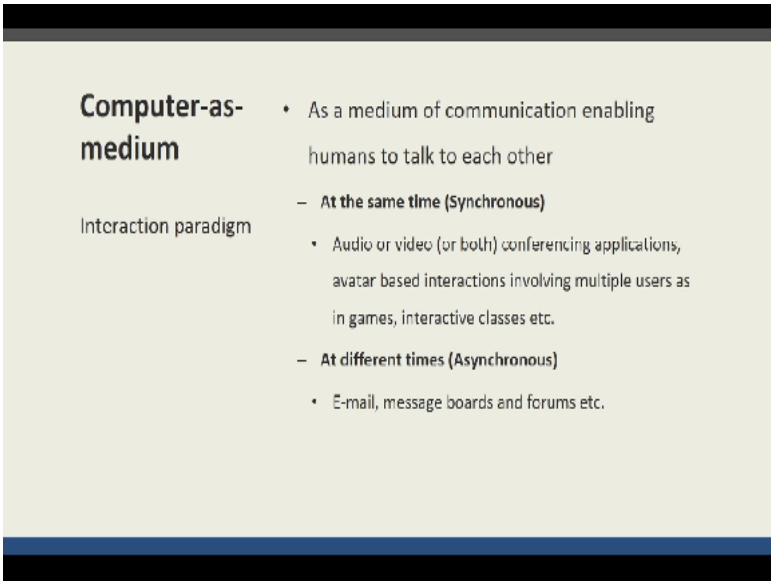

And the third primary paradigm is computer as medium, okay. So here the computers are imagined as means of communication enabling humans to talk to each other, okay. So at the same time if you do it, it is a synchronous communication. If you do it at different times, it is a asynchronous communication. Here the medium of communication is computers, okay. Let us look at few examples of synchronous communication.

Audio-visual conferencing applications, avatar based interactions involving multiple users as in different games, interactive classes are all different interactions where you are going to use your computers as a means of communication, as a medium to communicate with each other or with other human beings, okay which may be geographically distant or may be at different times attending your sessions.

Like the MOOCs, is an asynchronous communication between me and you as an audience and if you see, we are essentially using computers as medium of communication with each other. So MOOCs as an example fall into this paradigm and at different times, so yes of course, MOOCs, you can see these videos at all different times and that is the convenience behind this learning mechanism. So here in this paradigm essentially once again computers imagined as a medium to communicate with each other. This brings us to the closure of today's session on interaction paradigm.

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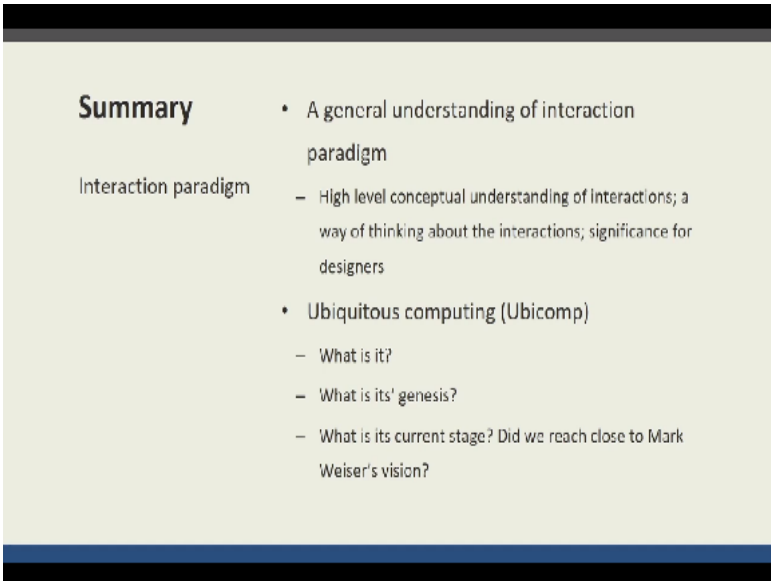

Let us look at the summary of this session. We begin with a general understanding of interaction paradigm, higher level conceptual understanding of interactions, a way of thinking about integrations and we saw why is it important for designers and researchers to know about interaction paradigms.

And then we had studied, we had seen different facets of ubiquitous computing, what is it, what is its genesis, what is its current state and is, are there any influences on current state interactive technology and products? What is its current stage? Did we reach close to Mark Weiser's vision? We had a discussion around that.

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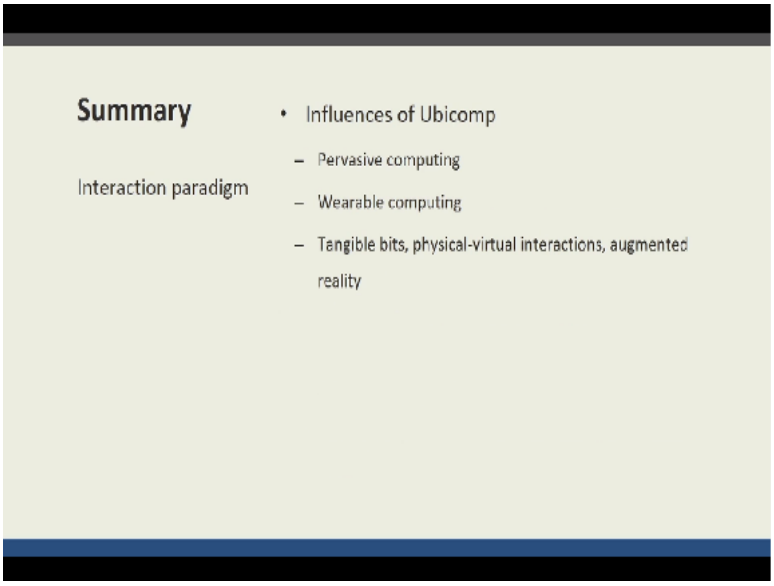

And then we had seen some influences of ubiquitous computing as pervasive computing, wearable computing, tangible bits, physical-virtual interactions, augmented reality.

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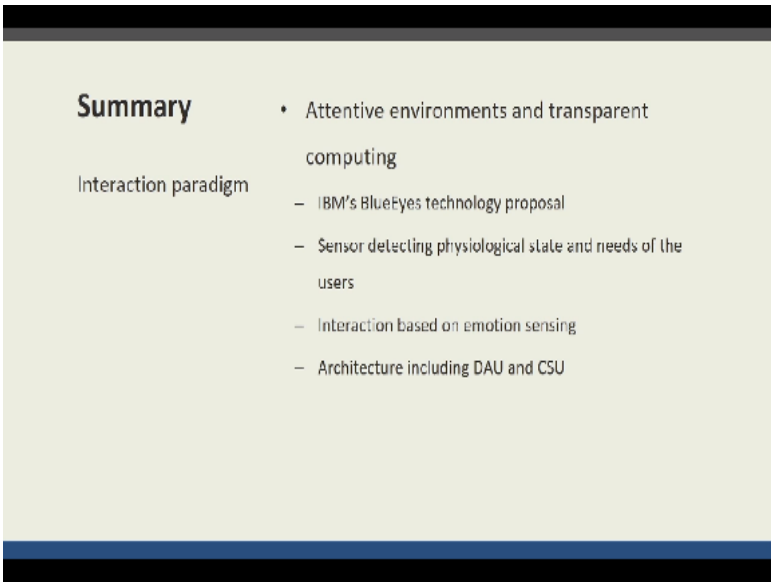

And then we had seen another way of looking at paradigms which is in terms of attentive environment and transparent computing, IBM BlueEyes technology, sensor detecting physiological state and needs of the user, interaction based on emotion sensing and the BlueEyes technology architecture where you had data acquisition unit and central system unit.

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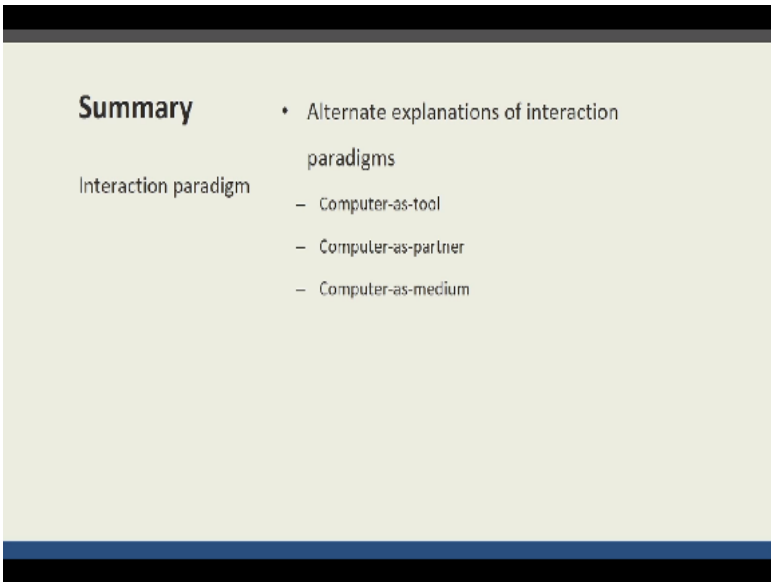

And then we had alternate explanations of interaction paradigm in terms of computers as tool, computers as partner, computers as medium. That brings us once again to the closure of

interaction paradigm as a topic. Thank you very much.