Usability Engineering
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Module - 01
Lecture - 02
Usability - Historical Foundations

Hello everyone. In this lecture, we will discuss about the Historical Foundations of Usability. It is important for us to know the historical antecedents of this discipline, because then it will help us to understand how the entire movement of usability engineering or the concept of usability started.

Though, it has some bloody history in terms of when it was first conceived or the idea started during World Wars, but then later as the movement towards graphical user interface started, it became more prominent. And researcher, scientist, designers, started working in these phenomena in a much more extensive way. So, we will all discuss about all these topics in this lecture.

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So, let us begin. The concept of usability is a product of millions of designers trying for decades to describe what they are doing to make technology easier and pleasant. Now, this is very important to understand. The advent of industrial revolution, the advent of human civilization having access to machines started this concept of how can we make machines more effective and efficient, so that human drudgery, human effort is reduced and machines become pervasive. So, that without a major effort the activities and the tasks can

be achieved, with ease, you know. And that is what you would see and realize when we talk about the historical foundations of usability.

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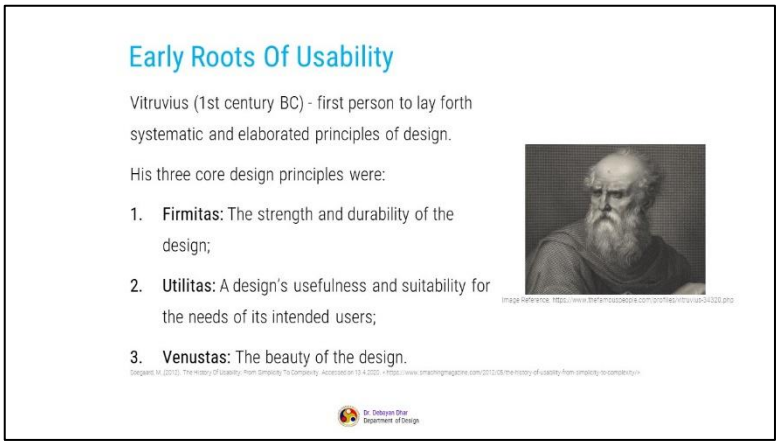

Vitruvius was the first person, if we can trace back in history who actually laid the foundations of systemic systematic and elaborated principles of design.

Now, Marcus Vitruvius Pollio was a Roman architect. He was a civil and military engineer who around in the first century BC explained or defined the 3 core design principles. And these were Firmitas, Utilitas and Venustas. Now, by farmitas, he meant the strength and durability of the design. By utilitas, he meant a designs usefulness and suitability for the needs of its intended users. And third venustas, he meant about the beauty of the design.

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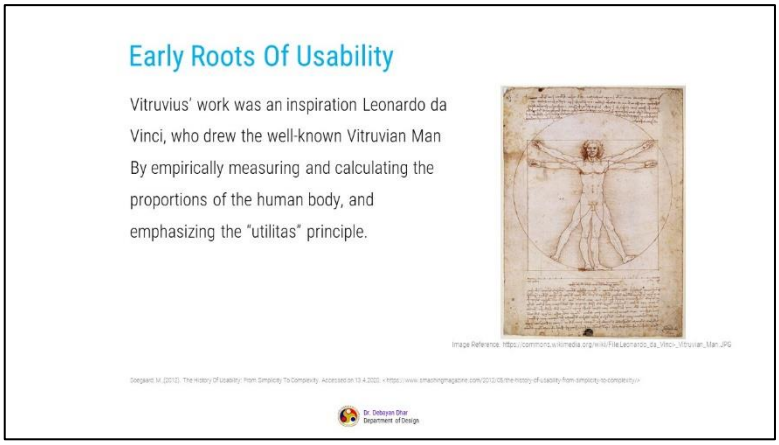

From Vitruvius, if you see you can now in the literature or in the history, history, you can now see that his philosophies have a direct relationship to the work done by Vinci

Leonardo da Vinci, an Italian engineer, scientist, painter, sculptor, architect, what not. He can be classified as a human being who excelled in every sphere of discipline and knowledge.

And the essence of Vitruvius theories and philosophies can be found in the work of Leonardo da Vinci's the well-known Vitruvian man. And what he did is he empirically measured the proportions of human body and then created the image that you see in the slide which is known as the Vitruvian man. So, here what you would see is the emphasis of the principle of utilitas professed by Vitruvius around first century BC.

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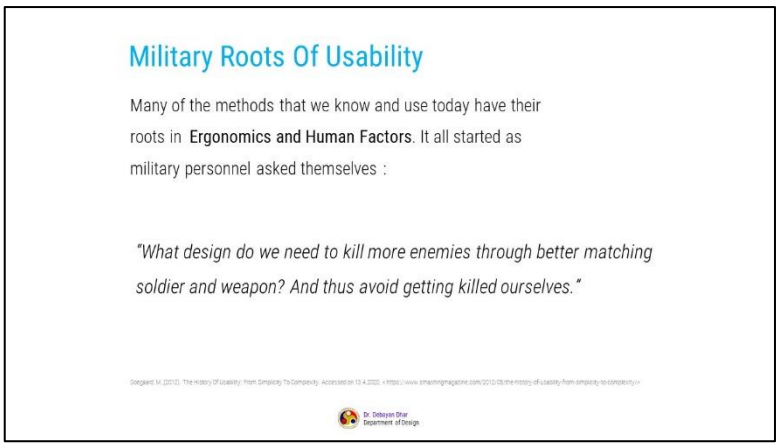

Later, as we move ahead, we can figure out that the early traces of usability can be figured out when World War I started and it extended to World War II. Many of the methods that we know and used today have their roots in the concept of ergonomics and human factors.

And you all these phenomenons started during World War I, when military personnel were focusing on what design do they need to kill more enemies through better matching soldier and weapon and thus avoiding getting killed. So, that was the essence of the World Wars which made the discipline of usability initially started as human factors and ergonomics as being widely accepted by military and engineers and scientists.

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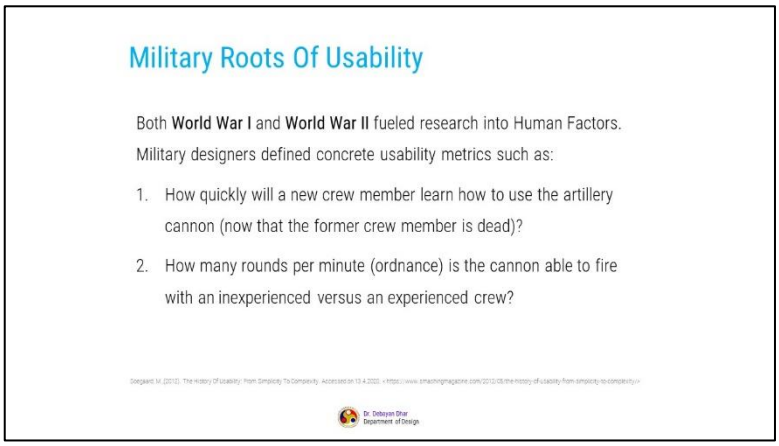

Now, in both the phases, in both the World War ones I, World War I and World War II, the research conducted by the military engineers and scientists involved in machinery design fueled extensive work in the field of human factors, early human factors.

And during those times, the military designers defined the formative metrics of usability and these are; how quickly will a crew will a new crew member learn how to use the artillery cannon? Now, this was important because there was a lot of casualties during that period, and it was utmost important for a new crew member to get himself accustomed with the machines, with the war machines, and therefore, it is very important that the crew members could adopt to this machinery as fast as possible.

Second, how many rounds per minute is the cannon able to fire with an inexperienced versus an experienced crew? Now, here what you would see that the first philosophies of a comparative evaluation between user characteristics which are the military personnels here started developing. The focus was essentially on people who were experienced or crew members who were experienced in handling these military arsenals or machines versus the novice or the new or the first time military personnels who started using these equipments.

Now, understanding both the characteristics of a novice crew member and an expert crew member becomes then very important that is what the military engineers realized during those periods. And they wanted to identify this in terms of the task completion. And in this context task completion became what? Became the rounds of fire, the cannon can make,

right, and that was compared between an expert crew member versus a novice crew member.

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Third, they were focused on, how will the design improve, the design of the cannon improves target acquisition? So, here you would realize that the formative concepts of effectiveness started emerging you know. Finally, any war machine is evaluated based on the goal that it achieves. In this case, the goal of the cannon is to kill or make a devastating effect on to the target. So, the military engineers focused on how the accuracy of the target can be improved.

And finally, how does a design improvement decrease soldier fatigue? So, drudgery, the effort that was to be made by the soldiers, the crew members, became of paramount interest because that has an effect on the efficiency of the crew members in using those machines.

Now, here what we see that the for the first time the philosophies of cognitive load; that means, mental processes started emerging. So, these are very very cruel and bloody moments in the history, but then all these moments provided the foundational philosophies of usability and human factors being conceived.

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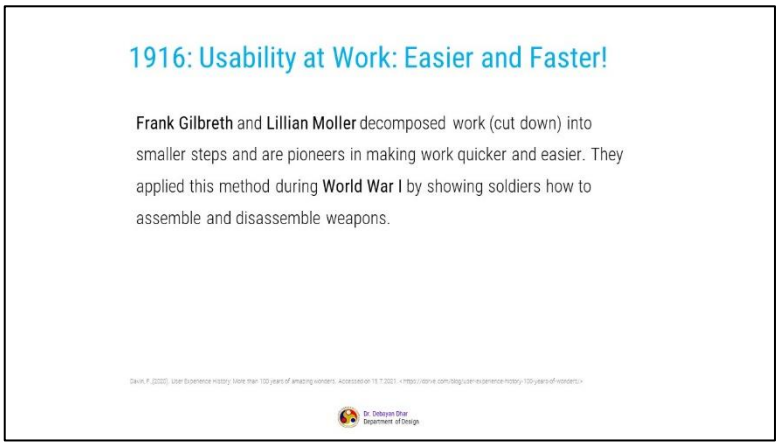

Now, during in the late later stage of the World Wars, World War I in 1916 Frank Gilbreth and Lillian Moller decomposed work, they cut down work into smaller steps and they become pioneers in making work quicker and easier.

Now, Frank Bunker Gilbreth was an American engineer and his wife Lillian Moller Gilbreth were known as industrial engineers, and they were experts in efficiency philosophies, in defining the concept of efficiency working out in tasks defining tasks flows to identify and optimize efficiency concepts.

Now, they were the first person who ensured that these kinds of investigations were carried out to identify how a particular task can be broken down, can be decomposed, and aspects of how efficiency can be improved, can be studied. Now, they applied this method during World War I and this helped the soldiers, the crew members in the assembly or the disassembly of the weapons of their cannons and that is how the early concepts of efficiency started.

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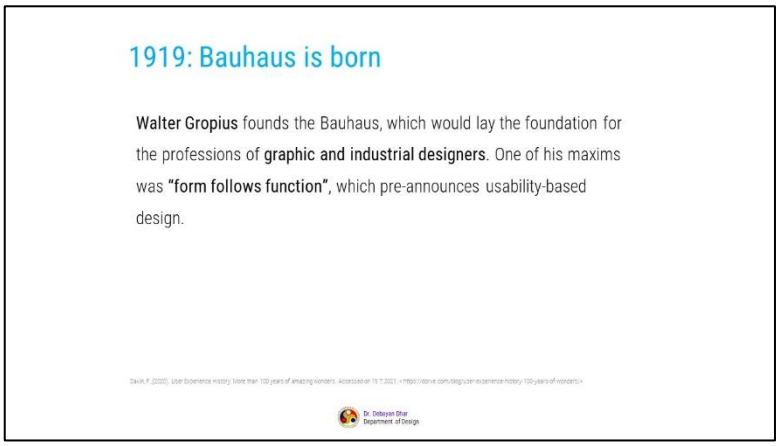

Later on, one of the famous movements happened started in 1919, in Germany, and that was started by Walter Gropius, a German architect. And Walter Gropius founds the Bauhaus. Bauhaus is the first school of industrial design; in Bauhaus, founds the Bauhaus school of design.

Now, this school laid the foundation for the professions of graphic and industrial design. And those who are aware of Bauhaus and design philosophy, you would realize that his famous maxima statement or philosophy "form follows function", was professed during that period of time which even now we follow.

And this has laid the first foundational aspects of usability-based design, "form follows function". So, Walter Gropius and his contribution in the history of design played an very significant role in the design history and the design movement in India as well. We have many design schools and design movements in India that was inspired from Bauhaus and the Ulm School of Design lately.

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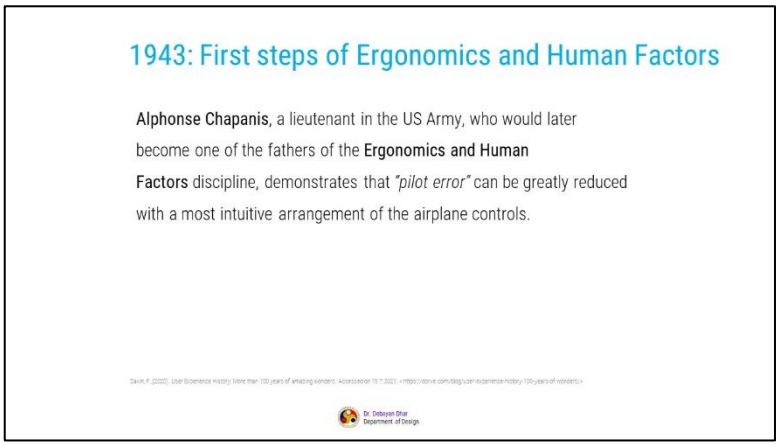

Now, in 1943, Alphonse Chapanis, a lieutenant of the US army, who would later would be considered as the father of Ergonomics and Human Factors Discipline, he for the first time demonstrated that a "pilot error" can be greatly reduced with a most intuitive arrangement of the airplane controls, right. That is a significant study and investigation that happened during those periods of time. And these ensured that the concept of human factor, that the philosophy of human factors ergonomics was laid while product design was carried out extensively during those periods.

Lately in 1954, Fitts law was proposed by none other than Paul Fitts. And this laid down the fundamentals of user interface and physical product design. This was followed by 1969, when Xerox started the GUI revolution and created the Xerox PARC machine. They invented the first mouse object-oriented programming and was the first group or the organization who started the concept of user interface.

Later, in 1984, Steve jobs introduced the Mac, and he for the first time established the design guidelines on user interface design. This was followed by in 1986, when John Brooke for the first time provided all design practitioners and usability practitioners with the system usability skill.

That was a great movement or great anecdote rather for the movement of usability because now we have a scale, we have an instrument through which we can get feedback, we can measure the experiential part the of our actual users, and this paved a extensive revolution in the lines of designing usable systems. And this was followed by in 1987 by Ben Schneiderman's, the 8 golden rules of interface design.

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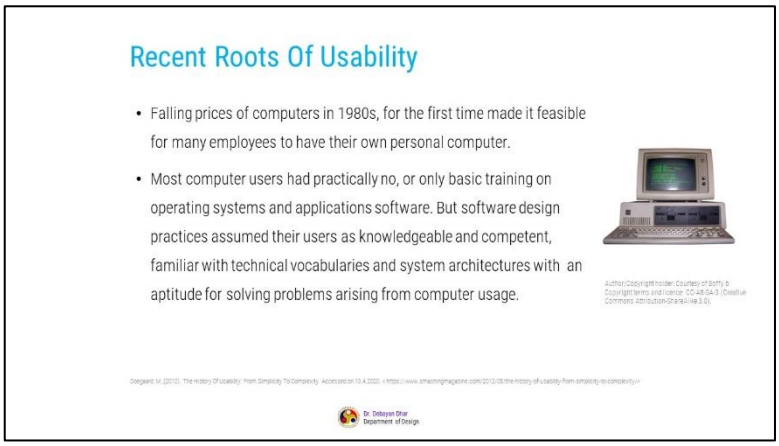

Now, if you see the historical foundations of late 1980s, you would realize that the prices in the late 1980s, the prices of computer started falling, and for the first time it was made feasible for many employees to have their own personal computer. That was something very significant, because until then the computers that were designed and invented was used in organizations in closed rooms across research groups who were highly trained and expert in using those computers.

But it changed in late 90s, 1980s when the prices started falling and employees in organization started owning computers or started accessing these computers, and then we see the era of personal computing happening.

Now, most computer users had practically no or only basic training on operating systems and application software. But software design practices assumed their tasks their users as knowledgeable and competent, that was the issue that majority of the computer users faced, that the softwares, the operating systems, were designed keeping in mind people who are trained, who are experts, and who can only use these after an extensive training. These operating systems and softwares were not being designed keeping in mind the first-time users or the early adopters of these technologies.

And therefore, what happens? What happened? Majority of the early adopters they faced issues with technical vocabularies, because they were not aware of system architectures, and therefore, they lacked aptitude for solving problems arising from computer usage. These were the early issues that happened.

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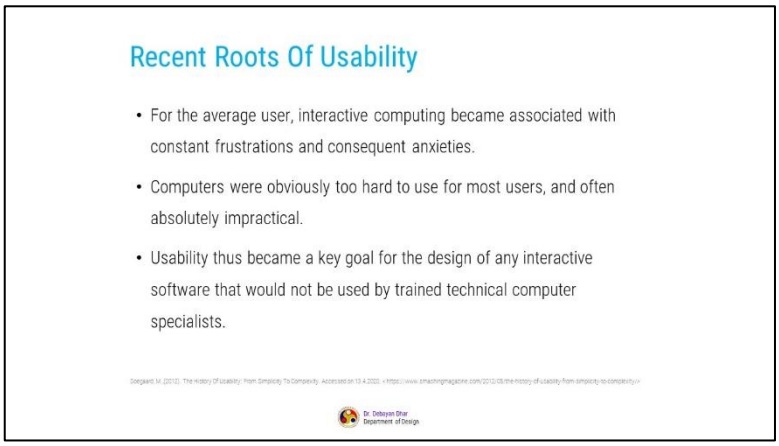

Now, for any average user a interactive computing became associated with constant frustrations and consequent anxieties. And the foremost reason being it was not decided keeping designed, keeping in mind the characteristics of the novice people who would adopt these personal computers and start using it. They were designed keeping in mind the expert and trained actual users.

Now, computers were obviously too hard to use for most of the users. And often what happened? They turned out to be impractical you know, people could not use it. Those who bought them, who started using them, they failed in adopting those computers and using it. So, usability became a key goal for the design of any interactive software that would not be used by trained technical computer specialist. That is how the concept of usability started.

It started with focusing on the early adopters of computers, on those users who lacked technical expertise, who did not have an iota of understanding about system architecture, who did not have or lacked aptitude to solve critical errors arising out of computer usage. It is during that time that usability of these systems became essential, so that early adoption can happen, early adoption of these systems among the novice actual users happen, and the life of these people can become easy, less drudgery, and effortless in order to help them reach their goal.

All these happenings across 1980s and early 1990s made sure that designers focus on usability as a major area of focus for design of interactive systems.

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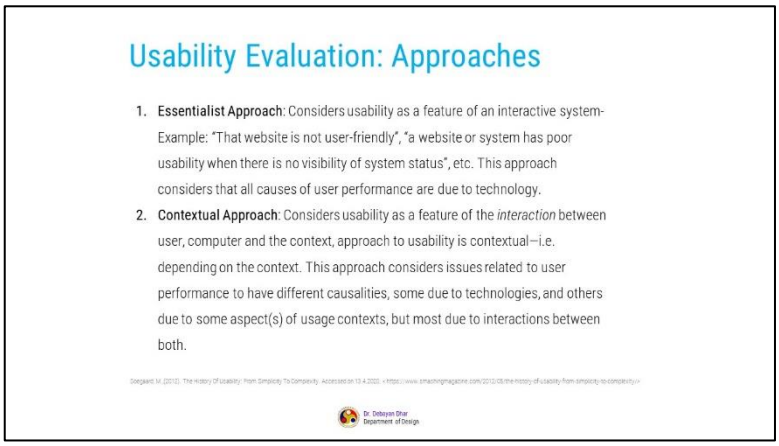

Now, while all these were happening, if you go back and take a look at the literatures you would realize that designing search interactive systems focused among the design community specifically based on two approaches. The first one was the essentialist approach, the second one which was considered as the contextual approach.

Now, in the essentialist approach, it is considered that usability is a feature of an interactive system. Like, you know you see a website and any designer or an invisibility expert can make this point that the website is not user friendly, he or she is not able to complete his task by accessing or using the web page.

A website or a system has poor usability when there is no visibility of the systems status you are not sure, as a user, at what location, at what stage of your activity you are currently positioned. And therefore, even no, you have no idea about the status of their, of the system in terms of your activity.

Now, this approach considers that all causes of user performance are due to technology, in a sense because of the wrong design of the interface or the faulty design of the interface or the faulty design of the back-end technologies.

The second approach which is the contextual approach, it considers usability as a feature of interaction between user, computer, and the context. Now, this is very important that we can; this is very important here to understand that for the first time the concept of context is introduced. If you see here, the concept of context is introduced, right. Now, therefore, this approach became contextual approach.

The reason being the focus of the user and the computer that is being used is on the context. The focus is on the context. The designers, the usability practitioners, focused on the context. This approach considers issues related to user performance to have different causalities; that means, instead of only saying that this issue exists because of the technology or the design, it considers that the different reasons of usability issues can be related probably to technologies or to usage context or it can be attributed to the interactions between technologies and the usage context.

So, here for the first time, you would realize the apart from the focus on technology, the focus also shifts on how the product is being used. So, the user comes into the fray. The way he uses the system, the way he thinks while he is using the system, the surrounding situations that governs his or influences his mind or his mental moral to take a decision while using the system. All these parameters became of utmost interest.

And therefore, the second important approach becomes critical for us to understand because in this approach it is important that we realize at what circumstances, at what situation, at what context ideally our actual users are going to use the system. How and in under what circumstances, they are going to use the product, the software, the web page, the interface, right.

These were the early approaches which also extends to now. Many of our techniques, tools can be divided across this early, I mean this kind of approaches of usability evolution.

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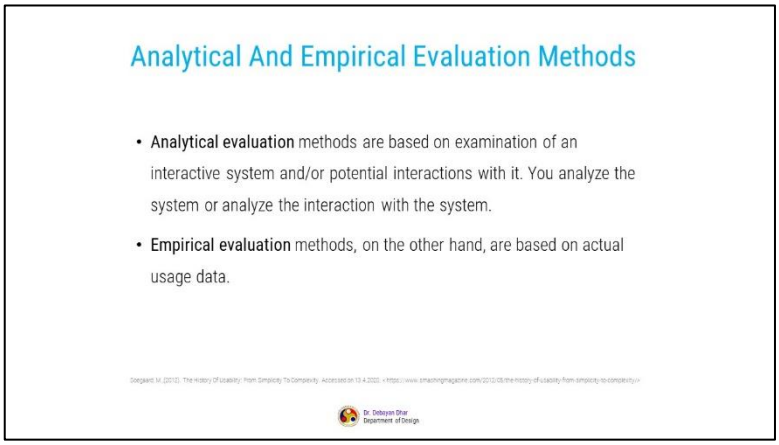

Now, adopting these approaches requires using tools and techniques for conducting the evaluation. And the major types of, the two important types of evaluation methods that our

literature suggest that have been used by early adopters of usability discipline were the analytical and the empirical evaluation methods.

Now, analytical evaluation methods are based on examination of an interactive system you know or the dialogue the potential interactions that the system has with its user. Now, you can analyze the system or the interaction with the system, that is what is the focus for the analytical evaluation methods.

In the empirical evaluation methods, the focus is on the usage data, how the system is being used, those datas. And those datas are analyzed and then decisions regarding whether we have a good usability or we have a bad usability is being arrived.

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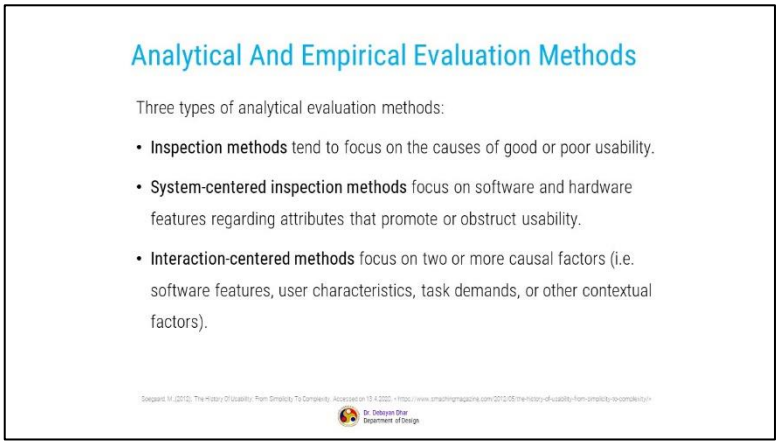

Analytical evaluation methods were further divided into 3 major types. These are the inspection methods, the system-centered inspection methods, and the interaction-centered methods.

Now, the inspection methods tend to focus on the causes of good or poor usability, right. The system-centered inspection methods focus on software and hardware features regarding attributes that promote or obstruct usability. While, the interaction-centered methods focus on two or more causal factors software features, user characteristics, task demands or other contextual factors.

Now, what you see here is the difference across these 3 techniques that are essentially known as the analytical evaluation methods. In cases of inspection methods, which are often conducted by usability practitioners or designers, they inspect the interface, they

inspect a software product and the focus is on to identify good or poor usability issues based on principles of usability or heuristics of usability.

In the second approach, what you see is the focus which is more towards the software as well as the hardware features, so integration of both. What you see as an interface and what happens behind it, both these features and the attributes are considers while identifying the issues that support or that are detrimental to the idea of usability.

In a third evaluation method, the focus is more on the causal factors, what are the causes behind the usability issues, is it related to software feature, is it related to the user characteristics. So, here more than as a characteristic of the product, the focus is more on the defining issues of the users, their characteristics, their personality traits, their task demands, and other contextual factors, like environmental issues, the factors that influence your users to take a decision. These are considered as the 3 analytical evaluation methods.

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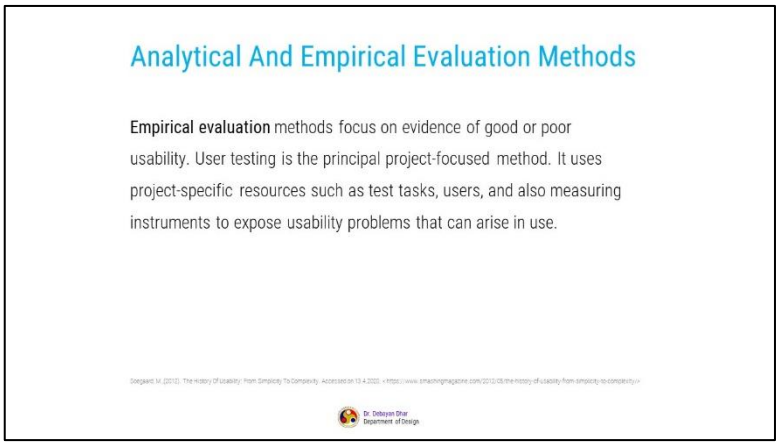

In empirical evaluation methods, the focus is on evidence of good or poor usability. So, user testing, right, user testing is the principal project focused method. You have an interface, you have a product, you have a software design, go to the user and test it out. They will let you know about good or poor usability.

They will not tell you about good or poor usability, their actions will help you to interpret good and poor usability of the product. It uses project specific resources such as test tasks, users, and also measuring instruments to expose usability problems that can arise in use.

If you remember, the advent of system usability scale by John Brooke in 1986, this these are the instruments that we are referring to. These scales many valid, reliable, and good quality scales have been being referred by usability practitioners, as measuring instruments to identify and extract the usability issues and problems that arises because of use of those products in the context of the user.

Now, all these are the issues, the philosophies, and the approaches that can be traced back in the calendars, in the formative years of when human factors started and usability as a discipline grew. It is evident from here that what started as the early adoption or of usability in terms of how war machines can be designed later with the advent of graphical user interface became usability that we use more so often now.

And the focus though remained same, but the approach of working towards a usable system changed. It is not only about effectiveness of efficiency, it is about experience, that is what has changed over the years. It is just not sufficient for your software, your web page to have an effective design, so that your users can reach or complete their task in the most effective way, without errors, with higher accuracy, with high efficiency. But it is also important that your users can achieve this goal, can complete this goal with a high degree of satisfaction.

It is also important that you design your system in a way that you take into consideration the user characteristics; so, that your interface can cater to the variable needs of a novice user, of an intermediate user, of an expert user. Why this is important? This is important because each of these categories of user shall have variable demands, shall have variable requirements, and therefore, it is important as a usability practitioner that you consider these important issues while you conceive a design intervention for them.

These important facets from history, the foundations of usability from the history, provides us with an idea about how the formative year started, how it got evolved, and where we are standing now. The different paradigms that can be observed across these historical foundations or the historical period will allow us to understand how the concept or the philosophy of usability has changed over the period of time and where it is moving.

In the next lecture, we will now take up on the different terminologies that are adopted across organizations like ISO and how that definitions allow us to see usability and its characteristics and its parameters, and governs the future use of principles related to

usability when we start designing for systems. We will delve deep into those concepts and discuss about them.

Thank you.