

## **Human Computer Interaction (In English)**

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### **Lecture 2 Part 1**

Hello everyone, welcome back to the lecture of human computer interaction. So, let us see what we have covered so far. So, this is the outline what we have covered so far. We primarily discussed why do we need to study design, we have discussed several real world examples around us which includes good design, bad design, what could be improved whatever the usability aspects, what do we expect in human to computer interaction and so on. We have also discussed what HCI is, how we can finally build a sample project around us so that you can start with. We also had several project demos and also a tutorial on what is good design and bad design.

So let's get started this week. This week, primarily we'll be talking about what is design, what are the different design principles, and we'll be going through. In the last week, we have primarily discussed what is the thoughtful design of user interfaces. We have also discussed the creation of intuitive systems, inclusion of diverse needs, because we are going to build the system which has been used by all kinds of people.

some product for example voice assistant based system alexa it can be used by old people young people people from different races people of different speaking culture and so on. HCI maximizes human potential by enabling people to perform tasks more efficiently, learn more effectively, communicate and collaborate seamlessly and access opportunity that may have been otherwise inaccessible. So we have also discussed about there are people with a disability, how we can make the system accessible to them. So this is not only enhances individual capability, but also contributes to the collective advancement of society, making technology a tool for empowerment, creativity and innovations. So that's where we have also discussed project from Google project guideline, which enables visually impaired person and enthusiasts to participate in running and marathon.

As digital experiences become central to our daily life, understanding human computer is more critical than ever. We have also discussed how bad design lead to a failed product and a good design can lead to a very successful company. So that's where it emphasizes what Thomas Watson Jr. said, good design is a good business. So this is the outline of this week.

We will be primarily talking about what is design, what to design, what is interaction design, and what are inclusivity, accessibility, and design principles. What is design? Henry Dreyfus, a renowned American industrial designer, he talked about what is design. in his work he has mentioned what we are working on is going to be ridden in set upon looked at talked into activated operated and in some way used by people individually or in a group so this also basically emphasizes about it is going to be part of your life, right? So because when a product that you are using, you are riding in, you are sat upon, you are looking at, interacting, talking, in a way it is going to be part of your life. And the purpose of HCI is to build a system which can keep human in the center and solve human problem that they have. If the point of contact between the product and the people become a point of friction then the industrial designer has failed right because if there is a friction between the way human communicate with the machines friction here primarily talking about it's more not the way human perform the task not the way human like the task to be done or probably it is limited by some Challenges or limitation the person has let's say a person with Visually impairment or probably the person who can't speak or can't hear On the other hand people are made safer more comfortable more eager to purchase More efficient or in simple term we can say that more happier the designer has successful because the task is of a designer to design a system so that the people who are using are happy after using it.

They should be able to complete the task which they're supposed to do. So let's decode this further because that's where we have to start. It's one of the most important definition that we have for what is design. So in his quote, he captured the essence of human-centered design. basically an approach that places the needs, comfort, and the safety of the user at the heart of design process.

And he basically described in such a way that we can further break it down primarily into the four key components. First, interaction as a key to success, because if you're building something for the human or people or user, then you need to keep them in the center you need to understand their needs you need to understand their limitations you need to understand their constraints and accordingly you need to build the system for them and ideally it should be close to the way they work on such system in real life so it should be mimicking the way they handle or probably perform the task in real life We have to also work on reducing the friction that we briefly talked about. We have to see if the point of interaction that they may have is somehow hindering the task that they need to do. Are they able to somehow not complete the task due to the differences they have in the interaction point? Positive outcome for the people. When can we say that the is a positive outcome for the people.

It is only possible when the people can complete the task they supposed to do in a

pleasant way. If there is not the way human like in their life, probably they tend to avoid it. Probably they tend to not use it. One popular example you can think of as Google Glass. It has launched in 2013, but later in 2015, it was stopped.

And the primary reason for its failure was due to its privacy concerns with the camera. it looks socially awkward design because nobody want to probably look different limited functionality that does not justify its high price it was very costly device and that too with very little functionalities and short-term battery life that hindered usability so the persons can't use for whole day because We also have to, as I said, I mean, if you're building any product, ideally it should be close to the way you are using in real life. If I'm using Google Glass, you can see here, I mean, it looks quite different. It's not similar to probably the kind of glasses that we use in real life. On the contrast, if you look at Mark Zuckerberg here, he's wearing one of the latest launch glass which is basically basically launched in collaboration with Ranbe so you can say that it looks quite similar to what a normal glass a person wear in daily life so it doesn't doesn't look socially awkward because it looks similar but at the same time it has It has many features, as I mentioned in previous lecture, while looking at some document in other language with the glass.

Basically, it's kind of it is an AR technology where basically an object basically overlay on the camera that you have in a way basically you can say that while reading a document in other language you can probably see in your glass itself how it will be look like if it is in your own language and so on it has many other features that is somehow getting popular these days so let's see how the future holds this but so far it looks good Reducing friction so point of friction here refers to any aspect of the product that could disrupt or hinder the user's experience It could be anything for example using a website if the fonts are too small if the fonts are too big or probably the color combinations are Is not good enough so that you can't distinguish between the text or it could be anything which somehow disrupt the uses of the system. So friction could be caused by the confusing control, uncomfortable material, lack of ergonomic consideration and so on. So one example you can see here, a chair designed without a proper back support would create a physical discomfort for the user and eventually failing its purpose as a functional object. So a designer's job is to anticipate and minimize this point of friction. They also need to probably discuss this point of friction with the discussion with the user, with the discussion with the expert, to find out priorly what could be basically the points where a user can face challenge, a user can face discomfort.

so that here a designer's job is to ensure a smooth and pleasant experience finally the positive outcome for the people the mark of successful design is whether a product makes people's life better because eventually the purpose of human computer interaction is to build something which can make the human life easier comfortable which eventually they

may not be able to do in that way. So we discussed several examples. In the previous lectures, we discussed about cab booking. We discussed about ticket booking. We discussed about making a credit card payment.

All these eventually are easier now with the devices or the mobile apps that we are going to build. So if people feel safer, more comfortable, more eager to purchase and more efficient. So in a way it is indicative of you need to make user happy, you need to let them do the task with more pleasant and fun way and the system should also support any kind of failure happen during the process. A well-designed smartphone is not technologically advanced, but it is easy to hold, intuitive to use, and because a tool that simplifies an enhanced daily activity. So in a way, we have not to just think about how to build a system, but in a more pleasing way a user can use it.

Finally, the success criteria for designer. So it outlining a framework for evaluating design success. A designer's role goes beyond creating something aesthetically pleasing because you can't sell something which is just look good, but probably doesn't have good functionalities. It's not up to the task and probably it's not that efficient to use. So true success is achieved when the designer's work resonates with the users on a functional as well as emotional level, fostering a sense of connection, usability and satisfaction.

So in case of SCI, there are different user goes through different emotional states and you have to make sure that user doesn't go from happy to probably sad state while using the system or get frustrated. So there is an area called affective computing. That is something, I mean, you can have look for the greater details on emotional state of user in SCI. There is an already one NPTEL lecture on affective computing by Dr.

Janan Sukra. His work highlight the responsibility of designer to think beyond aesthetics, focusing instead on how their design will make people feel and perform in real life. If they are as close to the real life, the experience, I think that is something they are looking for. This philosophy laid the foundation for modern human-centered and user experience design, which remain fundamental to how we approach design challenges today. So let's go into what to design. So let's consider our previous example we discussed in the previous lecture, remote control.

So often we come across different kinds of remote control, how close they are to the need of different users, because different users may have different expectations, different needs. So how we can make the remote control using experience a better one. So we can ask the same question that we discussed in previous lecture. What bad design that we have seen in remotes? What problem did you face while using different remotes? What was your experience? Probably there were some good experience and there may be some

bad. have you ever thought about solutions for the bad one and do you think you have an optimal solution and how to find the best solution because there may be different approaches to solve a problem so that is something we are going to discuss here so given remote control problems especially let's discuss this in the context of smart tv what are the different solutions are there and how to choose the probably the optimal one again with some reasoning with some justification so we have to ensure that the solution solves a problem indeed so that is something we also have to be careful about and as i said in the previous lecture you can't come up with a perfect solution in just one go design is about iteration you build on top of the previous version that you have and keep coming up for the better solution even that you have before so let's go back to the example as i said remote control for smart tv so your dilemma is what to design what is the best way to interact with a smart tv and Donald Norman said, technology should adapt to our needs, not the other way around.

So, for example, adaptive and predictive typing on smartphones like autocomplete or autocorrect features are found in keyboards. So that was not there before. But with the technological advances basically help you in achieving these goals. So can we think of something similar for TVs? What all kind of solution you can think of? Let's think about it. so here are a few possible ways to interact pecking using a grid keyboard via remote control swiping across two alpha numeric rows using a touchpad on a remote control voice control using a remote or a smart speaker gesture control mobile app remote smart watch control voice and touchpad ar or motion control remote and so on so there are numerous possibilities are there so what to design so let's briefly go into each of them one by one so the pecking using a grid keyboard via remote control so here basically on the screen itself you'll see i mean how to basically pick the different buttons that you have to type something and one thing probably you can see that it's very cumbersome and it's slow especially for long text input and non-intuitive for modern users similarly in apple you might have seen that they have a grid keyboard where basically you pick to type something though it's familiar and precise for the accustomed to the traditional remote interfaces but it is not quite efficient, which is defeating the purpose of usability, which is defeating the purpose of human-centered design.

So this is not quite optimal. Similarly, swiping across two alphanumeric rows using a touchpad on remote control. So swiping is faster, so faster than pecking for sure. Uses familiar gesture like swiping and more intuitive. But the cons is, again, limited speed and accuracy because while swiping, you tend to make a lot of errors. So it requires coordination and might be challenging for older or less tech-savvy users.

We have all kinds of users. You don't have to design this remote primarily for tech-savvy or probably the millennials who are probably spending a lot of time on smartphone or

probably they're quite fast in tapping and so on. Similarly, voice control using a remote or smart speaker. Naturally for human, it's easier for them to speak, communicate rather than typing. Again, typing in different constraint environment, be it on the grid keyboard or be it on small remote itself. So definitely voice control is one of the natural and probably good way of communicating and probably controlling the remote.

So it is fast, hands-free, intuitive and ideal for the quick amounts like searching for shows or controlling playback. Cons may struggle with accuracy in noisy environment because if there are parties happening in your house and if you are trying to give a voice control, it is going to fail. Accents, not everyone speak quite fluent English or probably in the language or accent of where your recognition model has been trained on. It requires quite clear speech, which is not always possible. Children are playing in the background or some construction work is happening beside your house.

So this can be used probably with intersection of more the predictive and more you can say the advancement of llm can be done so where what all you have spoken there may be some mistakes in the recognition but can llm recover with this so that would be another best way of going going next so there are many other ways so it could be gesture control using camera sensor again it has different pros and cons similarly mobile app as a remote because often you tend to miss the remote itself maybe below the pillow or somewhere drop below the table or so so in that case or even sometimes remotes are out of battery or many other reasons so in that case can you use your smartphone itself but often it's not that it's not that intuitive and it's not that simple so it requires having a smartphone on hand potential connectivity issues because you need to connect your phone with the your televisions again so that is the issues it has smartwatch control again it's quite similar to the smart it is quite similar to the mobile itself but with more limited cons like limited functionality due to small screen, not suitable for complex interaction, and so on. So, voice and touchpad combination on remote control. So, pros are combines the flexibility of voice with a precision of touch and allows for a seamless switch between input modes. And the problems that you may face is maybe confusing for user to decide which input method to use for different tasks. And another possibility would be AR based interfaces using smartphone or AR glasses.

Similarly, motion control remote, you can see in some way it is useful, but not that intuitive and simple enough. So the conclusion is, The best choice, at least in this case, we can see that voice control, probably with some combination of other methods for flexibility. And why? Because voice commands offer the most natural and hands-free interaction, enhancing the usability. Combining voice with touchpad or mobile app can provide a balance of convenience and the precision. Advanced methods like gesture or AR are promising, but currently limited in accessibility and accuracy.

So goal is not to make people interact with the technology, but to make technology seamlessly integrated with their real life. So these are some other similar work that you can visualize what could be the possible ways of interacting with them and what to design for them. So for example, in this case, in the first task, What are the possible ways to interact with a map in a car? Are you going to print a map and use it? Of course not. Or probably use a tablet like this and hold in your other hand while driving.

Again, I believe it's not that intuitive. It's not good. So what are the other ways? Should we mount your phone there? Should we mount your camera there? Should you mount your tablet there? What should we do? Think about it. So what is the best option among them? Similarly, what are the possible ways to interact with the family member when you are in the class? Sitting in the first row in front of the instructor, will you pick the call like it and speak in front of your teacher? I believe not. Will you start messaging just in front of it? Can you find a better solution? What to design here? So what to design basically to answer this question.

So we have to identify who the users are. What are the stakeholders you have? Understand the activities they are performing and determine the context in which interaction is happening, because a lot of changes for doing the same task in different contexts makes a lot of difference. So we need to focus on optimizing user interaction with the product and ensure they align with the user's task and requirements. So to define interaction design, designing interactive product to support the way people communicate and interact in their daily working lives. So that is interaction design. There are other researchers have defined in other ways, but the essence is same.

So, but the goal of interaction design is to develop usable product and by means of usability here, as we discussed earlier as well, easy to learn, effective to use, provide an enjoyable experience. And in order to do all this, what you will have to do? In order to achieve the usability goals, we have to involve users in the design process itself. So if you want to involve user in the design process, your primary goal is to improve the user experience, increase the user experience. So user experience is defined by how user perceive a product such as whether a smartphone, smartwatch is seen as sleek or chunky and their emotional reaction to it such as whether the people have positive experience using them or not. So the key here is it is not enough that we build product that function because there are numerous product can be built or even probably may have better functionality.

If they are not easy to use and if they're not able to understand or usable, they're not going to use it. So we need to build joy and excitement, pleasure, fun, and yes, beauty to

people's life. So that will eventually increase the user experience. So how a product behaves is used by people in real world. So the way people feel about it, their pleasure, satisfaction when using it, looking at, or probably holding it, even opening or closing it.

Everything basically contribute towards the user experience. Many of you use smartphones. How do you unlock it? How do you lock it? that is also contribute toward the user experience every product that is used by someone has a user experience even newspaper ketchup bottles reclining armchairs cardigan sweaters everything has user experience so one thing to note that we cannot design a user experience only can design for a user experience so here it means that we can design the product in such a way that easy to use again that is also again easy to use learnable pleasant again in having all the functionality that will eventually contribute for a user experience so this is how the visualization you can see here here the usability user experience and user interface are connected to each other and eventually we have to find what is the best way of taking the best of all world. So selecting terms to convey a person's feeling, emotion and so forth can help designer understand the multifaceted nature of a user experience. How do usability goal differ from user experience goals? So that is something we are going to see.

Are the trade-off between two kinds of goals? Can product be both fun and safe at the same time? How easy it is to measure usability versus experience goal? So that is the trade-off we have to achieve here. And there are some desirable aspects that contribute towards these goals. These desirable aspects are, it should be satisfying, helpful, fun, enjoyable, motivating and so on. These are undesirable aspects that you should not have. These are undesirable aspects that you should not have.

For example, it should not be boring, it should not be frustrating, it should not be annoying and so on. At the same time, we should work towards these desirable aspects, entertaining, rewarding, exciting, surprising, pleasurable, experiencing flow and so on. So can we see the same? How does the user experience for Tesla? So why was the Tesla car user experience such a success? Quality user experience from the beginning itself. see how smooth is to probably drive what kind of design it has what kind of features it has what are the name environmental friendly and so many things so many aspect of ux that can be considered and many ways of taking them into account when designing interactive products and of central importance are again the reusability functionality aesthetics content look and feel and emotional appeal so here the one can make emotional appeal making friendly to environment that's where we are using ev cars same thing you have seen that recently in the launch of iphone 16 in mumbai A huge crowd gathered outside the Apple store at Mumbai's BKC to buy Apple iPhone 16 Pro and they want to be the first user. Another activity you can see, for example, HDFC net banking experience.

So HDFC is one of the biggest private bank in India and they are doing great. and they are doing great for the reasons you can see the kind of netbank experience interfaces they provide to the users so they have worked really hard towards usability functionality aesthetics content look and feel and so on so here basically you can see that here the different buttons in a way showing different design principles so that ends to the Part 1.