

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

**Prof. Rajiv Ratn Shah**

**Department of Computer Science and Engineering  
Institute IIT Madras**

### **Lecture 2 Part 2**

Hello everyone, welcome back. This is what we have discussed in the previous lecture. We discussed what is interaction design and with different use cases, we have discussed what to design. We discussed the example of remotes for smart TV, how we can basically come up with different possibilities and we discuss what to design. So, let's go ahead and discuss user experience in interaction design. As we discussed in the previous lecture, user experience is one of the key aspects in the success of any product.

So, in interaction design, user experience focuses on creating products that are not only functional but also intuitive, delightful, and ensuring that they meet users' needs and expectations. This involves understanding users' behaviors, motivations, and challenges to design interfaces and interaction that provide a seamless and meaningful experience. So we have discussed what all kind of designs are there. So several terms are often used to highlight specific aspects.

what is being designed for. So we discussed user interface design, software design, user centered design, product design, web design, and experience design. Interaction design is an umbrella term that encompasses all these areas. It is core concept for all disciplines, fields, methods focus on the research and design of computer-based systems intended for people. This is clear from this picture that different disciplines contribute towards the interaction design.

So that includes academic disciplines where the people from different academic areas, from ergonomics, psychology, informatics, engineering, computer science, social science, and many others contribute towards the interaction design. Similarly, there are graphics. Similarly, there are design practices. People from design backgrounds such as graphic design, product design, artist design, industrial design, film industry also contribute towards interaction design. And there are interdisciplinary fields such as human factors, cognitive engineering, human-computer interaction, cognitive ergonomics, computer-supported, corporative work, information system and so on, they also contribute towards interaction design.

And they all work together to come up with solving a problem which user faces in real life. So let's see this example. So here people from different background participate in

solving the problem which user faces. So it basically many people from different background is involved. different perspectives and the ways of seeking and talking about the things because different people bring their own different expertise their suggestions more ideas and so on but at the same time when there are so many people there may be conflicting ideas as well and often it is difficult to communicate and progress forward the design being created and there are so many interaction design companies which providing consultancy and helping the different other companies in shaping their products from interaction design point of view.

So these are a few of them. So as we mentioned that They are multi-disciplinary team working on any real-time product that we are having. Suppose you have to build an interactive app for running, what all kind of people you are going to work with? So again, as I said, we are going to involve people from academic discipline, design practices, and other interdisciplinary fields to contribute towards its development, its design. So these are few popular running apps. Are they solving everything? So we can ask, imagine your brain behind a new running app, list different types of designers and specialists you would have in your design team and why.

If you look at all these existing apps, do they support all kind of people? So let's talk about the project guideline as we discussed. It help a visually impaired person to participate in a marathon. A visually impaired people to do running can do they so. So if we have to build such an app, what all kind of people you are going to include? So let's categorize them into a few kind of people. So user experience and interaction design.

So that includes people like UX designer, who primarily focuses on overall user journey, usability testing, and creating a seamless user experience. So again, usability testing, as we talked about, talking about how easy to use it, is it able to complete the task it's supposed to do, how efficient it is, how effortlessly people are going to use it and so on. Interaction design. So interaction designer basically contribute how user interact with an app through different interaction ways. So that could be gesture, that could be transition, that could be any interface elements which are there.

You may also require information architects. So that organizes the app structure, content hierarchy, and navigation to the enhanced findability and ease of use. If you recall one of the bad design thing we discussed, if the user is not able to locate or if the user is not able to find the information they are looking for, they are not going to use the system. Similarly, we also required service designer who design the end-to-end user experience considering all user touchpoints and the holistic service model. Similarly, we also require behavioral designer, so who focuses on influencing user habits and behaviors through the app's design and features.

So these are primarily the people who are involved with user experience and interaction design. Similarly, we need people for user interface and visual design, so where we may require UI designer. Who designs the visual layout? There should be definitely consistency in that. Interface elements, color schemes, typography, and aesthetic components. Similarly, we need visual designer or graphic designer who develop visual assets, illustrations, icons, and branding elements.

we may also require motion designer who creates animation and transition for ui elements for example whenever the person is running what all analysis can be done what all kind of direction can be done and so on augmented real reality designer so who designs AR elements, creating interactive overlays or feature for app. So you can think an example of Pokemon Go, right? So where a virtual object is overlaid on physical world. So where the person is running from here to there, and once the person reached to the destination, virtual object appears in your camera. So, and that in a way, I mean, it shows we have achieved something. Data visualization designer, so visualizes complex data like performance metrics using graphs, charts, and infographic.

So that is primarily how well you are achieving your task. You supposed to probably complete five kilometers every day in probably say 30 minutes. how far you are in achieving that goal. In a month, you want to probably run 100 kilometers, how far you are in achieving that goal. Another kind of people that you need to involve in building this app is accessible and inclusive design.

Accessibility designer, who primarily focuses on designing the users with disabilities. So likewise here, talking about the person with visual impairment, So ensuring compatibility with the screen readers, voice commands, and other accessibility features. We need voice interface designer where a user can directly interact with voice. And so designing commands and dialogues for hands-free navigation is essential. If we can make this interaction more in natural language, then it would be even better.

rather than more command-based and action-based and so on. We also need localization designer who adapts the app's content for various languages, regions, or cultural context to be inclusive of diverse audience. We also need ethical designer ensure design decisions respect user privacy data ethics and inclusivity a few more that that can be required specialized design for content and communication so where a ux writer or content designer craft the apps text including instruction prompt error message and engaging content or probably encouraging content what if you are missing your goals what message should be given Brand design, so focuses on the visual identity and the branding, including logos, style guidelines, maintain consistency across platforms. Social

media designer who design content and visual for social media platforms, integrating apps, content with social media, sharing feature. Because often you want to let world know what you are doing, how you are progressing.

And when people react to it, you also get encouraged. So that's where often completing, for example, marathon or even just two kilometers running, you tend to share so that you feel motivated. We also need product and physical design. So where industrial designer can design any associated physical hardware like variables or sensors focusing on ergonomics and aesthetics point of view. Same we can think for the gamification and healthcare wellness design where in case of health and wellness, dietitian and nutrition consultant is one of the key thing for any healthcare based or running a based app.

You also need probably sports doctor or medical consultant to ensure safe practices rather than stretching yourself too much, focusing on injury prevention, recovery and personalized health recommendation. Similarly, to make it more gamified, you may need probably a game designer who develops gamified elements like challenges, leaderboard, rewards to enhance engagement and motivations. Last but not the least is more additional roles like AR-based designer or front-end developer who bridges the design and development implementation and the visual and interactive aspect of the app, ensuring functionality and performance. So this breakdown allows the team to cover every aspect of the user journey, ranging from doctors, ranging from achieving the goals, ranging from getting motivated, gamifying it, content, design, also the technology, front-end developer, AR developer and so on, in creating a high quality user centered running app. Now, given the learning that we had from the running app, can we do something similar for other thing? Suppose you have to list designers and specialists for elderly care support app.

What can you do? How you can do that? So here the purpose is provide support for elderly individuals and their caregivers. And the feature it should have, medication reminders, health tracking, emergency contact, social connection features, and cognitive exercises. And many of these features are inspired by their needs they have. So they must have involved these people, both elderly people and their caregivers, to understand their requirements. And the human-centered elements which are involved here It's large, high context text, simple interface because many of them are old people.

Voice commands for those with limited dexterity and features for caregivers to manage and monitor, even remotely. Another such interesting application that you can think of, accessible fitness and workout app. we can again figure out the purpose features and human centered elements here and accordingly we can find out what all kind of designers we have we need to have here in the team same for mental wellness and mindful app the purpose feature and human elements are listed here how we can basically perform the

same task that we have done for running app here similarly diet and meal planning app it is also one of the key thing key requirement for any people we have in real life last but not the least these are other popular or useful apps you can think of in case you are willing to build it you can also pursue them as part of their project and we can figure out like what are the multidisciplinary team you need to have here to come up with the best solution for these mentioned work. So be it like language learning app, smart home management app, job search, public transport, accessibility, parenting and child development app and so on. So this comes up with, Interaction design is one of the key components of human-centered design, and the core characteristics should be users should be involved throughout the development of the project.

So all the people that we have mentioned for the running app, be it like dietician, be it designer, be it like sports doctor, dietician, everything should be involved throughout the development of the project. Specific usability and user experience goal need to be identified. And most importantly, it should be clearly documented and agreed at the beginning of the project. Otherwise there will be gap between the expectation the users have and probably what you have built. And as I mentioned earlier as well, iteration is the core of human centered design Because even the user don't know all the requirement in the beginning.

Even designer don't know all the situations in the beginning. So you have to work towards building it iteratively. And interaction design basically helps designer in understanding how to design interactive products that fit with what people want, need and may desire. And it also appreciate that one size does not fit for all. For example, teenagers are very different to grown up people as compared to the older elderly people.

Identify any incorrect assumption they may have about particular user groups. For example, not all people want or need big phones. Not all old people are hard of hearing. So be aware of people's sensitivities and their capabilities. So now we are going to talk about specifically inclusivity, accessibility and the design principles.

And so that you can also learn how to incorporate that in your projects. So inclusivity, that is primarily about designing products that consider the diverse need of all potential users, regardless of their background, abilities and experience. So for example, if you are running, if you are building and running app, as we discussed earlier, then it should not just be for expert runners. It should not only for the people without disabilities. It should not be the people who are short, it should not only for the male or only for the females and so on.

So accessibility, so making product usable by the people of all abilities and disabilities

and design principle is a guideline that ensure products are intuitive, usable effective for the widest range of people and when we talk about widest range of people here we are again talking about inclusivity and accessibility so good design is accessible design because if it is not accessible to everyone then it's not good design at all so why inclusivity matters because it embraces diversity in race gender and age, culture, abilities, and many other differences that you have. It creates technology that reflects the needs of the global audience. And it increases market reach and customer satisfaction by catering to different demographics. Lastly, it enhances creativity and innovation through diverse perspective. And Donald Norman rightly said, designed for the real world and not for the ideal world because in real life we have all kind of people we will have all kind of environment your running app should not only work good say in winter season so we have all kind of seasons and so on so you can expect the world is full of noise and you need to design accordingly So, design for the real world and not just for the ideal user.

So, what is accessibility in design? So, it is designing technology to be usable by the people with disabilities, visual, auditory, physical, cognitive, neurological or it could be any other kind of disabilities. We have to ensure that equal access to information, services and opportunities to all kind of users that we have. It addresses common accessibility features like screen readers, closed captions, color contrast adjustment, keyboard, navigation, etc. And that's where Antonio rightly said, accessibility is not a feature.

It is a social trend. And if you don't follow the social trend, you are going to be outdated. Your product is not being used by the people. And that's where basically well-standard guidelines there for accessibility and the companies should follow this. There are many countries, they have very stringent rules and penalty for not following these guidelines. So WCAG, Web Content and Accessibility Guideline, it's a global standard for digital accessibility.

Area accessible rich internet application enhances accessibility of web content and applications. 6 and 508 US, standard for electronic and information technology accessibility. And universal design principles that design the usable by all need for adaptation. So, we have to follow these guidelines in our solutions.

to make it more accessible. So co-design principle for inclusivity and accessibility. So it should have simplicity. It should be consistent. It should have the flexibility.

It should have the feedback. It should have the error prevention and recovery. And if you recall in the earlier lectures, we discussed what you should not have in your system. So that was exactly opposite to what all. So that list is less as compared to what all good practices that you have.

So here we should have simplicity. Design should be clear and intuitive and minimizing the complexity. Use consistent layout controls and navigation patterns accommodate diverse abilities with the x adaptable interfaces you should provide very clear feedback for users it could be visual auditory haptic or many others or even notification itself minimize potential for errors and offer easy solutions so error prevention in the beginning and if any error happens then how do you recover from that and the practical tips for accessible design so there are couple of things you can see here use alt text for images to assess screen readers so provide keyboard shortcuts and navigation apps ensure sufficient color contrast for readability include Closed captions or transcript for multimedia content. Design for scalability, allowing user to adjust font size or zoom. So here you can see this is the one of the Eventbrite website and BBC websites where you can see that they have followed different accessible guidelines and so on.

Why design for everyone? I think the answer is clear. It increases usability for everyone and not just for people with disabilities. It improves SEO and digital visibility. It builds brand loyalty and reputation as socially responsible. It minimizes the risk of legal issues related to accessibility non-compliance. As I mentioned, different countries have stringent rules for non-complying to the accessibility guidelines.

So it's better to have it. And Tim Berners-Lee said, the power of the web is in its universality. Access by everyone regardless of disability is an essential aspect. So in a way, they're trying to make it accessible to everyone. And all the data which are there on the internet is the foundation built by Tim Berners-Lee this dub dub dub so in inclusive design as you can see here so we need to have both accessibility usability and so on so inclusiveness basically making product and services that accommodate the widest possible number of people and Inclusive design is a methodology that enables and draws on a full range of human diversity. For example, smartphones designed for all and made available to everyone, regardless of their education, age, disability, income, region and so on.

And accessibility, the extent to which an interactive product is accessible by as many as people, So accessibility is a quality that makes the experience open to all. And we have to make such experience. So focus is on people with disabilities, for instance, those using Android OS or Apple VoiceOver and so on. And if you see the difference, they are closely related. Inclusive design is a process and accessibility is an outcome of it.

And there could be different kinds of disabilities. So it could be sensory impairment. It could be physical impairment. It could be cognitive impairment and so on. And each type can be further defined in terms of capability. Someone might have only, for example,

peripheral vision or maybe colorblind or have low light perception.

And these Impairment can be categorized primarily into three groups situational permanent and temporary Situational for example in noisy environment you can't hear doesn't matter You can hear everything you have good ear, but still you can't hear so it's more situational Permanent for instance long-term wheelchair user so that is the long-term permanent disability they have Temporary so for example person was driving and met with an accident or he was ill and now he is on wheelchair so that is more on temporary basis so so one thing about a disability is that nobody want to show the disability that they have so but sometimes it's hard to hide it so can we basically make it cool So like in this case you can see here so disability prosthetics can be designed to move beyond being functional like many such prosthetic legs you might have seen which has been probably distributed by the some NGOs or government and so on can we make it better to being desirable and fashionable so that people wear their wheels rather than using a wheelchair So, in the picture you can see that Oscar Pistorius is a South African sprinter who doesn't have legs but at least through his blades he can run very fast and participate in different events. He is one of the champions in this sprint racing. So, based on the different disabilities that you have, you can follow these guidelines, do's and don'ts. designing for the user with autistic spectrum so these are do's and don'ts you can see here similarly for the screen readers as mentioned alt text should be used and you should not use probably only show the illustrate information in an image or video and so on Similarly, designing for the users with physical or motor disabilities.

So make large clickable icons. And it's not basically the demand precision like you'll have to just click here. Even you can see here I missed it. So similarly, I mean, for different kind of disabilities, you need to have different do's and don'ts you need to follow. and there are many research papers which are highlighting all those often there are cultural differences in design as well so understand the culture of your target audience before designing because if you don't follow that probably you may end up with some problems so for example colors hold meaning across cultures like what is positive in positive in one culture may be negative in another so for example in western countries white is for purity and red is for passion but in eastern countries white can symbolize mourning and red can be a sign of luck so ignoring these cultural differences will land you in some problems so it's better to know about these cultural differences know your users who they are and so on So incorporate cultural sensitivity to avoid misinterpretation. So like thumbs up is positive in West, but offensive in part of the Middle East.

Similarly, localize not only language, but visual symbols and interaction patterns as well. So that's where basically Donald Norman said, design should be adapted to the diversity

of user and not only the other way around. And these are some successful examples of inclusivity and accessibility. So Microsoft's inclusive design, developing the product with diverse user input to create accessible tech like adaptive controllers. Apple's accessibility feature like voiceover for the visually impaired, assistive touch and the customizable gestures.

And similarly, government.uk website, as you can see here, a government website that follows WCAG guidelines that we discussed in earlier slides, providing a clear and simple interface for all users. So if you design for everyone, everyone benefits. So why not benefit everyone? And that is the idea behind accessibility and inclusivity. So some common challenges, how to overcome them. So, balancing aesthetics and accessibility, addressing the needs of a diverse user base without making compromises, keeping up with evolving standards and the technology, and budget constraint for implementing accessibility feature because there is no freelance.

In order to incorporate something, again, there will be cost involved. So what's next for inclusivity and accessibility? So AI-powered accessibility could be the one. AR and VR, we have also discussed for accessible experience. Voice interface and natural user interface for inclusive tech. Cross-culture design, design for global diversity with localized solution. and designing a better world for everyone so you need to include inclusivity and accessibility are essential to reaching a broader audience good design improves usability satisfaction and overall user experience and follow design principle to ensure clarity consistency and accessibility so keep involving keep evolving with new trends to meet the need of all users.

So let's come to the design principle. So it's generalizable abstractions for thinking about different aspects of design, the do's and don'ts of interaction design. So though we briefly discussed some of them in the previous slides, earlier slides, what to provide and what not to provide at the interface. Derived from a mix of theory-based knowledge, experience, and common sense, and the key principle involved, visibility, you should be able to find what feature or functionality you're looking for without much effort. Feedback, you should be able to receive some feedback for the action performed or which action you're going to perform. There may be some constraint in navigability, so that should be visible, that should be clear.

You should follow consistency and you should have affordance. You know what action is going to be performed by doing something. So let's talk each of them one by one. So first, visibility or findability. So visibility is defined by ensure that most important options, features, and the actions are easily visible and accessible to the users. And why does it matter? Users should not have to search for essential functions because if you are, and

that's where basically on different application that you use, you see the most common feature should be on the top for example we are talking about different cab booking apps so if you go to ola uber blue cab rapido or anything first thing or probably quite easily you can able to find book your ride similarly if you're talking about payment app like Paytm, PhonePay and others you can simply see that I mean very clear option how to pay someone so there are either you can scan the QR code or probably select the contact and accordingly you can easily pay the amount to the person and the key tips you need to follow place crucial function where user expect them use clear labels and icons for easy recognitions make navigation paths straightforward and intuitive so if you follow these three key steps in any project that you're doing i think that will make the visibility better and the best way to find something is to make it visible right so like in this case this is the website of y combinator this is one of the top investment companies you can say that which invest in startups so here basically there are few kind of people will be participating like startup directory which is founder directory and launch yc and so on and you can see the website is quite clean and i believe you can remember this persons and altman who is basically one of the founding member of yc competitor and so on And so far they have funded 5,000 startups and their combined valuation is \$600 billion.

And some of the big companies where they have invested, you can see here, Airbnb is one of the big company they have invested in early stage. Similarly, there are many others like Coinbase or Stripe. That is something you may have come across. Okay, so next we will be covering feedback. Feedback provides user with immediate responses and updates on their actions, informing them of the results.

So like in this case, in this picture, you can see that a user is clicking a click button and you can see he's getting an impression the button has been clicked. And also the person may hear a sound clicks. What happens? So white matters, it timely provides feedback and trust user what is happening. It helps avoid confusion and reduce user errors.

So the key tips here is use visuals, auditory or haptic feedback. Provide loading indicators for longer processes. So for example, if some page is getting loaded, you need to probably show how much progress it has been done, 10, 20, 30% and so on. Display confirmation message for completed actions. So for example, if the payment has been done, you need to inform the payment has successfully completed.

So design is not just what it looks and feels like, design is how it works. That's what Steve Jobs said. Similarly, the next one is constraints. So constraint limits the user's options to guide correct uses and prevent errors. Because sometimes if you have so many options, you tend to commit some errors. So like in this case, you might have seen in the Google doc or Word doc, if you go to some options that is disabled because it's not

allowed at that situation.

Like in this case, you can see here, the cut and copy options are disabled because you already copied something in the in your thing so the only enable option is the paste here. And white matters because constraints make the user interface simpler to navigate, reducing the chance of errors and confusion. So the key tip is gray out or hide out unavailable options. Like in this case, it has been grayed out. And in many places, you might have seen that the things which are not allowed are basically hide out.

Use clear labels and disable buttons when actions are not possible. Keep navigation path clear and straightforward. And the next is consistency. So human-like clean design and human-like be consistent. If you are going to change design layout very frequently in different pages, It's basically unnecessary to create confusion and frustration in the users. So consistency is about keeping design, navigation, and interaction patterns uniform across the interface for predictability.

And why it matters, consistency helps users understand the system quickly, making it easier to learn and use without errors. So like in this case, you can see that This is the old logo of Gmail and this is the new one. This is the old logo of Google Calendar and Drive and these are the corresponding new one. One can easily relate the new logo if you have worked on the previous one.

Similarly, you can see an example of Paytm. So here the first page is about booking a bike insurance and the second one is about booking a car insurance. I believe you can see the issue here here they are showing two bikes but here they are just doing one car and here basically this bike logo coming on top of the text they have again which is not letting user to read what all those and so on so that is the issue they have and that make the bike user frustrated and they may not able to use their insurance policy. So the key tips here, maintain consistency and consistent use of colors, fonts, icons and layout. Stick to established convention for common elements like buttons and menus.

Don't come up with something novel which nobody understand. Provide a unified look and feel throughout the product. So consistency is the key to understand. That's what Donald Norman said, and I believe you all are again with this. Effordance. So affordance are cues that indicate how an object or element should be used, making interaction intuitive.

So like in this case, you can see that. I believe it's intuitive by clicking this, you want the page to go up, similarly here down by clicking you want the page go down and similarly these elevator button you can just simply drag and drop the slide to make the page go

faster up and down and so on and it is quite intuitive similarly here you can see that so these are buttons intuitive to play to pause to record to stop to forward to backward and so on So, affordance matters because it make interfaces self-explanatory and prevent errors by suggesting the appropriate actions. The key tips here, buttons should look clickable, sliders draggable, use visual cues to guide user interactions, shadows, shapes, and sizes, keep functionality clear and intuitive without instruction. And that's what Donal Norman said, affordance provides strong clues to the operation of things. So the summary is interaction design is concerned with designing interactive products to support how people communicate and interact in their daily lives. It concerned with how to create quality user experience for services, for devices, and interactive products that they are using.

Optimizing the interaction between users and interactive product requires considerable number of independent factors, including the context of use, type of activity, user experience goals, accessibility, cultural difference and user groups. And design principles such as feedback, simplicity are useful heuristics for informing, analyzing and evaluating aspects of interactive product. And when inclusivity, accessibility and solid design principles are applied together, They create products that are not only usable and functional, but also welcoming and empowering for everyone. And these are the additional materials which will be provided after this.

So there will be a tutorial by Rithvik on inclusivity, accessibility, and design principles. We have also a demo on Canva by Tony Thomas. And there will be a design principle discussion by Ritvik, Syed and Rahul. With this, these are the further readings that you can have about the different topics. And thank you.