Human Computer Interaction (In English)

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Cognitive Aspects in Human-Computer Interaction

Hello everyone, I'm Ritwik Bamba and I'm your teaching assistant for the course on Human-Computer Interaction. This is the tutorial on cognitive aspects. First, we are going to be looking at what we have studied previously in the past tutorials. The first thing that we covered was good design versus bad design, which was followed by what makes a design good. Here as you can see in this picture, This is a plant holder that actually helps you get out the potatoes without actually taking the whole plant out of the soil. The next topic we discussed was inclusivity and accessibility along with the design principles, which were visibility, feedback, consistency, constraints, and affordance.

Inclusivity and accessibility make up an important part of an inclusive design. Next, we looked at the four basic activities in the interaction design process, which were establishing requirements, designing alternatives, prototyping, and evaluating. The process iterates further and further until we achieve a good enough product. Then we looked at the double diamond of interaction design, where as we start off, We first diverge and learn everything about a problem and then we narrow down to just one problem.

This is the stage where we can define the problem statement. Then we again diverge to consider every potential solution and then converge to find the perfect solution. And this is the part where we find our final product. Furthermore, we moved on to user personas, how to create user personas, and empathy mapping. As you can see here in the image, this is an example of a user persona which includes the user's demographic details, his core needs, his motivations, something about his personality.

Next we moved on to user perspectives where we discuss mental model, conceptual model, as well as information architecture. That was it for the previous parts. Moving on to the cognitive aspects, the first topic we have is what is cognition? Well, cognition and cognitive processes define how the human brain processes information. Various forms may include thinking, remembering, learning, daydreaming, problem solving, visual perception, reading, writing, speaking, etc. Cognitive processes.

Well, cognition has also been described in the terms of various cognitive processes,

which may include attention, perception, learning, memory, reading, speaking, listening, as well as problem solving. planning, reasoning, decision making and much more. Now we will be looking at a small example for selective attention. You just need to count how many times the players wearing the white pass the basketball. In the starting, it's easy to keep track of it, but as the play goes on, it gets increasingly difficult.

As more and more things are introduced, the attention decreases. What do you think was the attention count? Well, the correct answer was actually 15. If you were focusing on just counting the passes by the people we are right, you wouldn't have probably noticed the gorilla. Okay, after this small example, we move on to what exactly is cognitive load? Well, cognitive load is just the amount of energy used by our brain while performing any task or the amount of mental resources which are required by our brain to operate us. Well, you can also think of cognitive load as the power of the mental processing required to use a particular service or a feature.

You can think of it similar to a computer where the processor power required to perform a specific operation is similar to the cognitive load on the human brain. If the amount of information that needs to be processed exceeds user's ability to process it, the overall performance suffers, which is again similar to what happens with a computer. If the user feels confused or overwhelmed, it may actually lead to a negative user experience and many tasks being dropped. Now we move on to the types of cognitive load. These may include Intrinsic cognitive load, which is simply the inherent mental effort which is required to learn and gain information about anything new.

It is unavoidable and it is very much essential to perform any task. For example, when you are using a product or a website for the first time, you may experience some intrinsic cognitive load to have a look at where the buttons need to be used are present. The next we have is extraneous cognitive load. It is the mental effort required to deal with a product but may not help with understanding the product. It is usually avoidable.

Well, think about some irrelevant symbols or multiple fonts in an application. It may actually increase your cognitive load. Then we also have the germane cognitive load, which simply refers to the mental effort required to memorize some information. Okay, so here we have an example. As you can see in the first example, the option A, it shows and highlights only the necessary components before you move on to a checkout screen.

In the option B, there is excessive information, multiple fonts, call to actions, and also it fails to highlight the proceed to checkout button. This makes it a high cognitive load interface. See here, the proceed to checkout is very much clear. While it may be a little clear here as well, but it is not so much prominent with too much going around the

screen. Now, after we've learned about cognitive load, we need to see what actually causes cognitive load.

Well, several things can contribute to the excessive cognitive overload. These may include inappropriate typography or irrelevant images. The user is directed several times and has to make multiple clicks to reach their goal. Basically multiple clicks for the Same small thing to be achieved. And then we have not receiving feedback when a form submission fails, it creates confusion among the users.

Then seeing unnecessary information or actions. For example, in the last slide, we looked at how the option B contains several other irrelevant options and unnecessary information like you may also like these products. Now we know what causes cognitive load. So we need to look at what actually reduces cognitive load as well. Well, it is pretty simple.

First, we organize information. The user should be able to find the information where they expect it to be. Then we remove the unnecessary actions, the increase in actions actually to an increased mental effort. If we minimize the number of steps and the call to actions, it may actually help in decreasing cognitive load. Then we declutter the design overall.

We avoid using excessive fonts, different fonts, colors, animations, symbols, as well as images. Finally, we can also use some consistency, or as we call it, using familiar designs. We can use the elements and components which are already familiar to the users and do not require much mental effort to discover their functionality. Now we also have some of these laws that help us reduce the cognitive load of an interface or a product. The first we have is Miller's law.

Miller's law just simply states that an average person can hold seven plus minus two number of items in their working memory. Miller's law simply says that an average user can contain five to nine items in their memory at a time. This allows designers to maintain a visual hierarchy while highlighting the most relevant information and features. As you can see here, well, you see a lot of words. These are actually something like 20 words.

while you may actually just remember some of these, the easier ones, which may be a shoe, circle, cactus, nose, or whatever. You can also see the use of Miller's Law in UI. Here, as you can see in the notification panel, the toggle keys are actually limited to just six, which help in reducing the cognitive overload. Once we slide the notification panel, we get a view of quick panel or settings. Basically, settings where we get to see all the

toggle keys placed in rows and columns, which makes it easier for the user to follow.

Then we have some more laws, which include the guest alts law. These are actually a set of laws, which includes the first is the law of proximity. which simply states that elements placed close to each other are often tend to be perceived as a single group or a unit. In this example, each dot of groups communicate that they're related to one another. These groups right here seem to be related to each other.

We can see the use of gestalt stores in various logos. The first logo we have is Unilever where Unilever is written very close to the U, which symbolizes Unilever. Similarly, the second example we have here is from MasterCard, where both the circles are placed very close to each other, signifying that they're related to one another. Next we have is Gestalt's law of continuity. Well, it just states that elements which are arranged on a line or a curve are perceived to be much more related than elements not on a line or a curve.

Again, this can be seen in various logos and website designs. The most common example of this is the logo of Coca-Cola. Here, as you can see in the image, with the sweeping nature of both the Cs in the logo, our eyes follows the C in the cola to the right which ultimately leads to the L and finally to the A at the end of the loop. Here as well, this is a simple tutorial on how to make T. The images are put together in a straight line and then hence they are perceived to be related.

Next we have is Gestalt's law of common regions. Elements which are in the same closed space seem related to each other. Well, the most common example we could find is Facebook posts or Instagram posts or LinkedIn posts or whatever. The posts on the social media platforms usually have all of the information in one single closed space. As you can see here, the user who posted this, the caption, the image, details of the post when it was posted, and all the other details like comments, retweets, like, et cetera.

And if you would like to comment something here, it is all put together in a single box. Here as well, as you can see in the right one, the boxes which are in the same closed space they seem related to each other and thus much more organized while to the left it is very haywire and hence the squares actually may not seem so much related to each other we also have chunking where if we just took a web page and remove the separation and containment and the closed space it would actually make it very much less appealing visually and more difficult to read. Have a look at this example. Here, most of the Gestalt's laws like law of proximity and continuity are being used. When information is put in a closed space, it distinguishes it from the other information as well as relates it to each other.

If it were included with the boxes that we have here, you may actually see that these are different items. While if you just see here, they may actually look something similar. And hence, chunking gets very important in website design. Now we move on to the next topic, which is recognition versus recall.

Let us understand this using an example. Imagine you are at a party and you see someone whose face is familiar to you in the crowd. You might not immediately remember their name, but you can recognize them. That is simply recognition. It's when you know something because you've seen it or encountered it before.

That is recognition. When you look at an options, and think, oh, that may look familiar. That is what recognition is. It is easier because it just requires you to spot something familiar, like picking out your favorite snack from a menu. Recall is different.

Recall is a bit trickier, in fact. It's like you try to remember that person's name from scratch without any hints. You have to dig through your memory and pull out the right answer. It's what you do when someone asks you a question and you have to come up with the information on your own without any prompts. Now we look at some different types of cognition. These include distributed cognition is simply the teamwork for the brain.

Instead of thinking your mind as the only place where thinking happens, this idea says that thinking can be shared or spread out across people, tools, and the environment. I think the best example for distributed cognition is the cockpit of an airplane. The different cognitive processes are distributed across various activities, which may include pilot's knowledge and experience, having a look at the cockpit instruments, the navigation systems, checklists and manuals, while also communicating with the air traffic control as well as with the cockpit. We also have external cognition where we use the world around us to help us think, remember, and solve problems. It is like outsourcing some of our brain's work to the environment outside.

For example, you remember the sticky note revolution where you just wrote something on a sticky note and put it on your fridge or your desk with sticky notes. That's external cognition in action. You're turning your environment into a memory aid that allows you to free up some of your mental space for other important tasks. Then we also have experiential and reflective cognition. Experiential cognition is simply the state of mind which involves perceiving, reacting, and acting to the events in the world with ease and efficiency.

It is simply based on your real world experiences rather than reasoning and knowledge.

This includes driving a car, reading a book, or having a conversation, or maybe something like playing a video game. While reflective cognition is different, it actually involves considering multiple options and uses reasoning to determine the best one. It involves considering multiple solutions and then ultimately uses reasoning to determine the best solution. For example, an individual might think of an idea of eating outside.

He may consult his family's preferences and refer to a cookery book for inspiration before actually reaching the final product. Then we move on to cognitive loading and computational offloading. Then we move on to cognitive offloading and computational offloading. Well, both are helpful in the sense it helps us free up some of our mental space using the environment outside and free up our mental space to focus on some more tasks. Cognitive offloading is when we simply rely on the tools on environment.

to reduce the mental effort that is needed to think about things, or recall them. For example, instead of remembering the shopping list, we can just write it on a piece of paper so we remember all of it, thus offloading the task from your brain to the paper. Computational offloading is similar, but it's more about using technology to do calculations or complex tasks. Instead of doing math in your brain, you use a calculator or a computer to handle that. Well, both are similar in the sense that we make our lives easier by handing off the work, whether it is remembering or processing, to something outside your brain.

When you remember, It is cognitive offloading. When you do the processing part, it is the computational offloading. Okay, now we move on to our in-class assignment. What we need to do is that we need to examine Amazon.in, either their application on the mobile or their website. And we need to identify two features in Amazon that actually reduce the cognitive load.

and explain why it leads to a reduced cognitive load take some time and do the exercise okay welcome back so here the first feature that we identified which reduces the cognitive load may be The layout of the menu is very uncluttered with simple black text on a white background. The navigation is also highly simplified and the component reduces the cognitive load. The next feature that reduces cognitive load in Amazon is the settings page. It is pretty straightforward with amiable empty spaces resulting in a reduced cognitive load on the whole. For the next part of the assignment, we need to identify two features in Amazon that actually increase the cognitive load and explain why it leads to increased cognitive load and also suggest some improvements.

The first is the options of category to be left out of the search box. It just opens a very long list of item categories. This may actually confuse the users and hence increase the

cognitive load. How we can improve it is that maybe instead of these long lists that include so many categories, we could use a hierarchical visual representation of the same. The next feature that increases the cognitive load is the gift idea section.

Well, it doesn't give an ordered or a group choice of products. This design increases the cognitive load because the user is confused and frustrated on how to go around the gift ideas section. These are some of the further readings that you can refer to if you would like to read more about the topics that we have covered in this class. Thank you so much.