Usability Engineering
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Module - 07
Lecture - 26
Cognitive Issues

Welcome to module number 7, lecture number 26. This is the last lecture for module 7.

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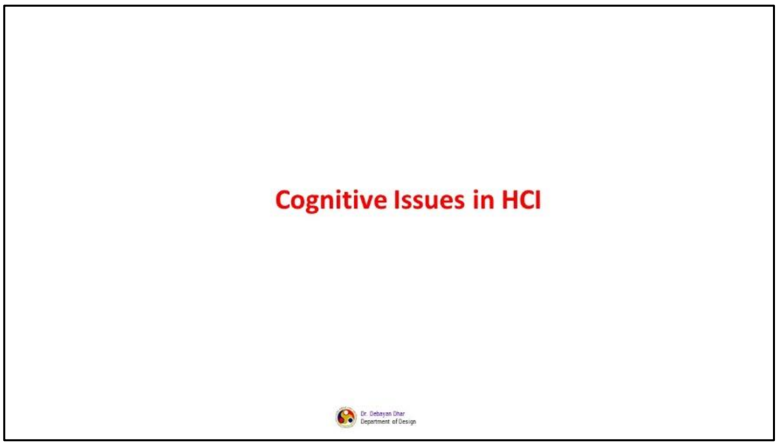

In this lecture we are going to discuss about various Cognitive Issues specifically in the context of human computer interaction design.

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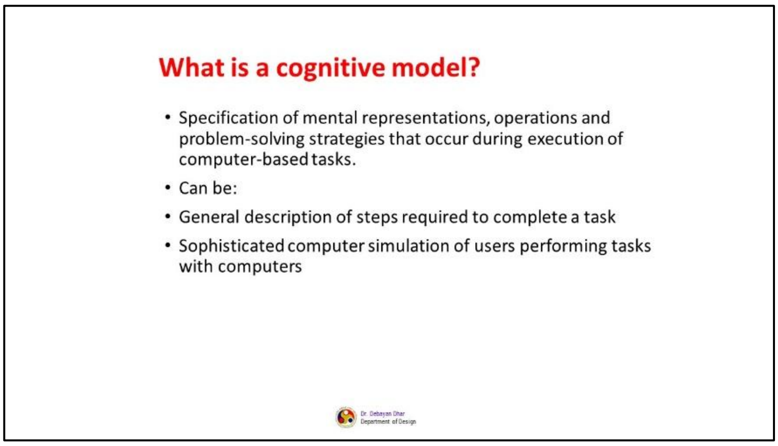

Now, the two most important frameworks of the cognitive models that we are going to discuss are the KLM and the GOMS now these are referred primarily as cognitive models.

Now, let us first understand what is a cognitive model? Now specification of mental representations operations and problem-solving strategies that occur during execution of computer-based tasks can be it can be general description of steps required to complete a task and it can also be sophisticated computer simulation of users performing tasks with computers.

See first of all it is very important for us to understand the issue that cognition or the mental processes that we have been discussing until now plays a major role in decision making, the way we react to a particular stimulus and the way our tasks are being completed.

So, when you are designing for a user, when you are designing for a particular user group, it should be very crucial for us to understand the basic the threshold the structure based on which we know that ok this is how they are going to behave, this is how they are going to react to a particular scenario; it is a kind of threshold value right. And cognitive model allows us to understand those threshold practices.

Now, these threshold practices or the values that we are going to talk about or the strategies that we are going to talk about has been specifically derived from studying various mental representations various activities as in such operations or strategies as in for problem solving that users have undertaken while these models have been prepared. And these models take you and reference from these literature studies which has extensively reported on these strategies.

And these are general description of steps required to complete a task. It can also be sophisticated computer simulation of users performing tasks with computers; these are referred to as cognitive models.

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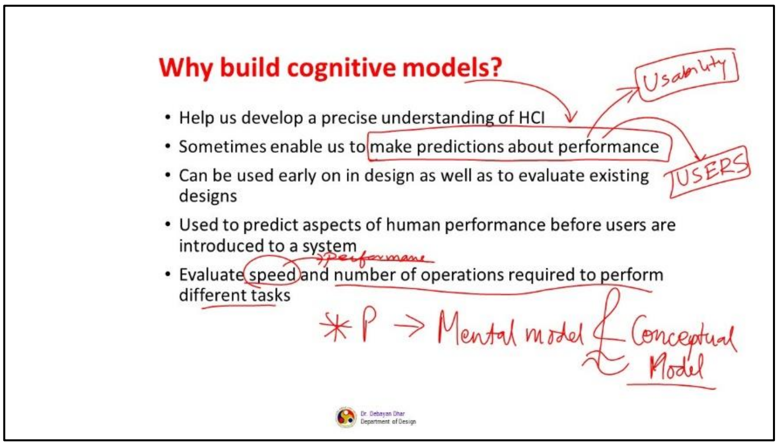

Now, why it is important to build cognitive models? Why should we build cognitive models? Now we must understand that cognitive models help us understand a precise structure the way human computer interaction happens or it gives us a precise understanding of the human computer interaction issues its paradigms.

Sometimes it enables us to make prediction about performance I would like to draw your attention here that it enables us to make predictions about performance. What helps us? Cognitive models; about whose performance? For whom we are developing or building this product; that means, for our users.

And why we are so concerned about performance? Because it is the performance that affects usability. And how does this performance affect usability because this performance we can write it here this performance is an interplay it is an interplay between the mental model and the conceptual model that we have discussed.

If you refer to the discussions that we had earlier you would understand that performance would enhance or the conceptual model of the product would support performance in an endeavor to increase it if the difference or the mental model and the conceptual model of the product matches; that means, the gulf of execution is equivalent to 0. There is no gulf of execution the amount of effort that the user has to undertake to reach the conceptual model is equivalent to 0.

That means there is a thorough there is a direct representation of the mental model in the conceptual model. This can be one of the scenarios seldom this happens; because the situation is there are ways through which you will realize that it is very tricky or very hard to have you the conceptual model of the product being exactly similar to the mental model of the user. Or representing the mental model of the user in its completeness as the conceptual model of the product.

And therefore, the performance gets affected and once the performance gets affected the idea of usability from the perspective of the user and the actual performance of the user also gets affected right. So, therefore, it is important for us that before we embark on designing a particular activity before we embark on designing a particular feature that addresses the requirements of our user we must ensure we or we must have some kind of models, some kind of theories that would allow us to predict the performance of our user based on those designs that we have conceptualized.

And this would help us greatly in minimizing our effort to go for a user testing because beforehand we will know that ok with this design our user is going to take a longer time or a longer effort to complete the task while this design would provide us with a much more comprehensive and quicker quickest possible way to complete the task. This is just an example that I have been discussing.

So, therefore, it provides enables us to make prediction about performance. Third; it can be used early on in design as well as to evaluate existing designs. See one of the major situations where the designers would find themselves engrossed in is a situation where you would be asked to redesign a particular interface redesign an existing product right.

Now, while you are redesign an existing product? You must have a referential matrix, you must have a reference frame of reference based on which you are going to take decisions. And these with the help of these cognitive approaches or models you would be able to evaluate the existing interfaces the activities of the product and see how you can ensure that these activities can be optimized for enhanced usability for enhanced or a meaningful interaction.

So, therefore, a cognitive model can also be used in a very early stage when your concepts are not there, but existing product redesigning is happening to evaluate those existing designs to use those models.

It is used to predict aspects of human performance before users are introduced to a system see in my class whenever I am talking about usable usability and user research and user study one of the major questions that I often come across from my student's community is the question that sir how many users are sufficient for me to conduct user testing.

Or is there a study or is there a magic number that tells me that if you conduct this many study with your users; you would be able to should be sufficient able to gauge the situation the predominant factors which is required which would give you an idea about the opportunity areas. My answer is in a very different way I answered that question in a very different way. It all depends on the number of patterns dominant factors that starts emerging from your study.

Now, all these are in relation to when you are having a situation or when you have a situation where you can access the users. Consider this situation where you do not have the privilege to access your customers, your users then, what will you do? Have you ever imagined this situation? In majority of the design firms or design studios it happens that you do not have the financial leverage or the time there is a lot of time constraints for you to deliver designs.

And in those situations, it is not possible for the design team to go and conduct user study to go and test the solutions or the ideas that the team has generated in those situations these cognitive models plays a major role to give you an insight about how your users are going to get affected because of the concepts or the proposed designs by the team design team. Is not that so nice, is not that so important, is not that so beneficial for team.

Even without going to your actual users you would be able to know at least gauge to some extent how your interface how your activities how your proposed concept is going to perform therefore, this cognitive model is important and finally, it evaluate speed and number of operations required to perform difference task.

So, one of the major factors that you will see that we are going to discuss as we start discussing about these models are speed and number of operations required to perform different tasks. Again, one of the major factors of performance and number of operations we will discuss about that number of operations it takes to complete an activity to complete a task to reach a goal right. Therefore, we build cognitive models.

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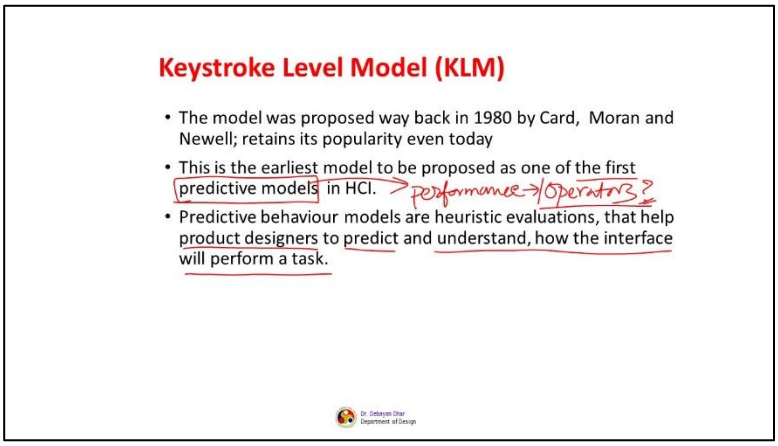

The first cognitive model that we are going to discuss today is known as the KLM model. KLM is the acronym it means keystroke level model. Now this model was proposed way back in 1980 by Card, Moran and Newell and it retains its popularity even today. It is extensively used to understand the issues that we have discussed right now.

This is the earliest model to be proposed as one of the first predictive models in HCI see this is very important about KLM model it is one of the first predictive models in HCI prediction about performance and operators we are going to talk about this in detail soon operators. So, predictive behavior models are heuristic evaluations.

See whenever we talk about heuristic evaluations in the context of usability often heuristics is has become synonymous to Norman and Nelsons heuristics, but it is not that. Heuristics means principles or theories of evaluation. So, predictive behavior models are a class of heuristic evaluations techniques that help product designers to predict and understand how the interface will perform a task.

So, this KLM model allows us the designers to predict and understand how the interface will perform a task interface means the design the concepts that you are proposing your user is supposed to complete an activity complete a task based on the interface that you have proposed. So, by using this KLM model we would be able to understand in a sense that we would be able to predict how the interface will perform a task given a set of users how will they perform right and how will they do that we will see to it.

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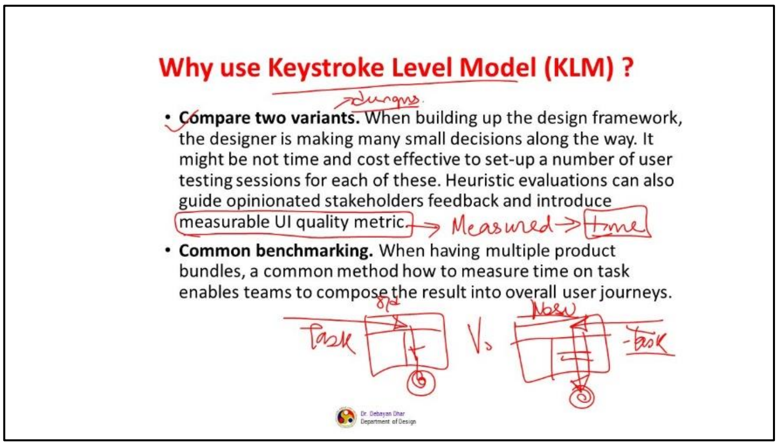

So, why do we use keystroke level model? One of the foremost reasons why we intend to use the keystroke level model is to compare two variants. Here comparing two variants means designs two designs we have two designs and we want to compare them ok.

So, when building up the design framework the designer is making many small decisions along the way it might not it might be not time and cost effective to set up a number of user testing sessions for each of this. In those situations, heuristic evaluations can guide opinionated stakeholders' feedback and introduce measurable UI quality metric.

So, here KLM model helps the design team in order to have a measurable UI quality metric it can be measured and how it can be measured? It can be measured in terms of time. So, it introduces this time component which is used as a measurable UI quality metric to provide feedback to the stakeholders and other team groups to see and compare between the old design and the new design. So, you have two designs right.

And there is a task similarly a task is also performed here. Now based on this KLM model what you are going to understand is you are going to measure time which is a UI quality metric in terms of the task that is being executed through your proposed design. So, here you are comparing between the old versus the new; that is what we are saying as comparing two variants.

The next one is common benchmarking. So, when having multiple product bundles a common method to measure time on task enables teams to compose the result into overall user journeys; you know you have multiple product lineups product features there is a standard practice of how that task has to be completed in that particular measured metric it provides us to benchmark there.

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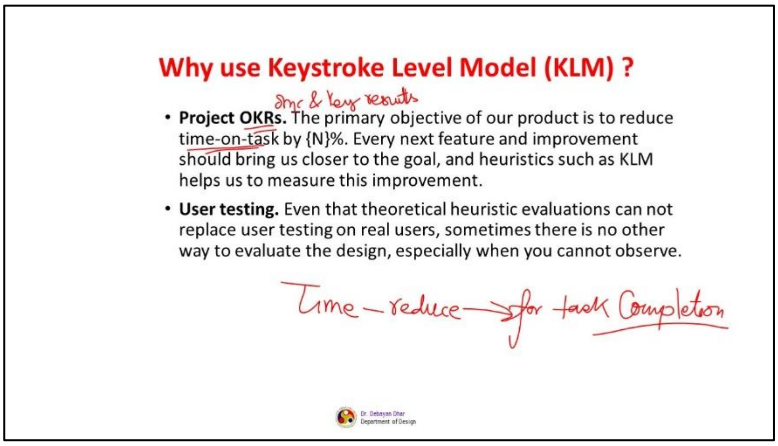

Third; project OKRs means; project objectives and key results ok. OKRs means objectives and key results. So, the primary objective of our product is to reduce time on task see what is that primary. So, in KLM which is keystroke level model the primary objective is to reduce time on task we are interested to reduce this the time metric we want to reduce time for task completion.

See if you get confused with this let me explain with this situation whenever you design an application software application or a web application; what is your focus? The focus is information is presented call to action buttons are there now you want your user to complete to use your web interface. It can be a mobile application it can be a desktop application.

Now, you want your user to use your software product in order to attain a particular objective his objective can be booking a bus ticket, booking a flight ticket, writing a word file doing a nice logo design or can be a CAD modeling right or can be doing some kind of analysis or doing some statistical analysis whatever it may be.

The software or the application that you have designed is a medium to reach that. So, now, the intention of KLM model is to allow you to analyze this interface with an objective of calculating how much time does your user take in completing the task using your interface and the objective is always to reduce that time to make it highly optimized.

So, that instead of spending too much time in focusing on the UI elements he can ensure that there is a smooth run while he is using the interface and he reaches his objective at the quickest possible time. So, every next feature and improvement should bring us closer to the goal us means to the here us means designer to the goal and heuristics such as keystroke level model helps us to measure this improvement.

Fourth is user testing. So, even the theoretical heuristic evaluations cannot replace user testing on real users sometimes there is no other way to evaluate design especially when you cannot observe. So, these are some of the constraints you know when you do not have access to your users. Though it is widely accepted and known that theoretical this model cannot replace the feedback that you would observe or get from conducting actual user testing, but then it is better to have something than nothing.

So, therefore, in situations where you do not have any access to your users. You ensure that you use these models to at least gauge some idea about the improvements that you are proposing whether they are actually improving the user in reaching their goal or it is being used being or it would be causing a detrimental effect on your user in reaching the goal.

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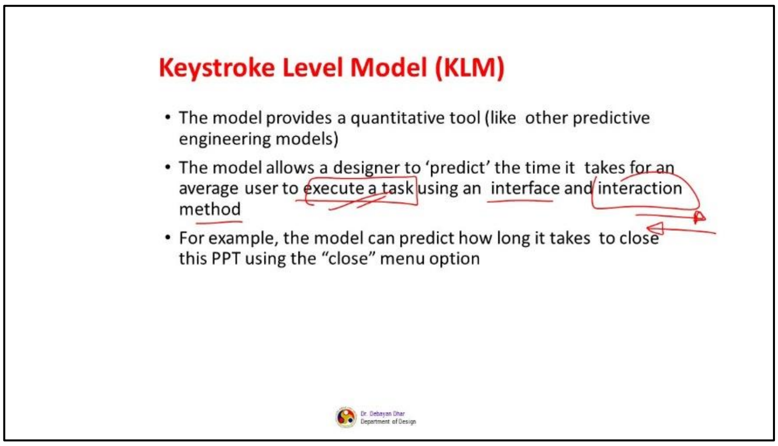

So, now let us see some way of how it can be implemented. So, the model provides a quantitative tool it is a quantitative tool like other predictive engineering model. Then model allows a designer to predict the time it takes for an average user to execute a task using an interface and interaction method.

So, you have the interface and then you have the interaction method when there is a trigger and there is a response right and the idea is to see how much time is being taken to execute a task. So, for example, the model can predict how long it takes to close this PPT that we are looking at right now using the close option from the menu how much time we can see to it right.

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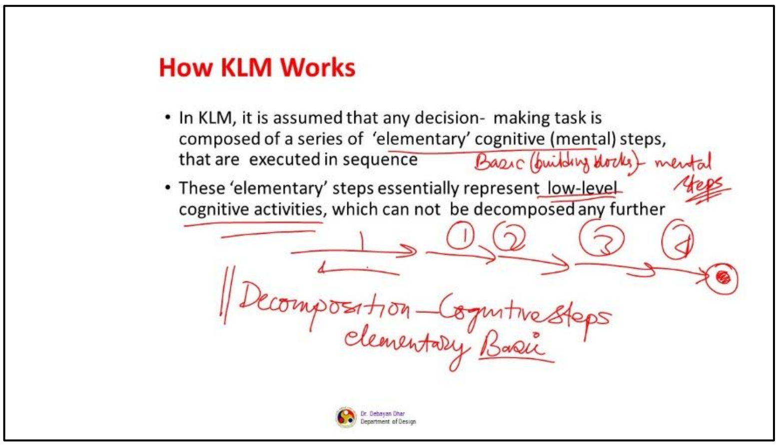

Now, let us see how KLM works? Now in keystroke level model it is assumed that any decision-making task is composed of a series of elementary cognitive steps; that means, basic mental steps elementary means basic building blocks basic these are basic building blocks basic mental steps.

These are basic mental steps that are executed in sequence; that means, these are not in random like these then that then no there is a sequence there is 1, 2 then 3 and then 4 and then the task gets completed ok. So, these elementary steps essentially represent low level cognitive activities. These elementary steps are what we represent as low-level cognitive activities which cannot be decomposed any further.

So, the idea is the basic philosophy is on the concept of decomposition of cognitive steps and this requires practice for you to understand how you can break down a cognitive step into its most elementary level into its most basic level. Now one way to understand that you have reached the optimum level if you can no further break down that step into its much more elementary level; that means, you have reached to that particular state right.

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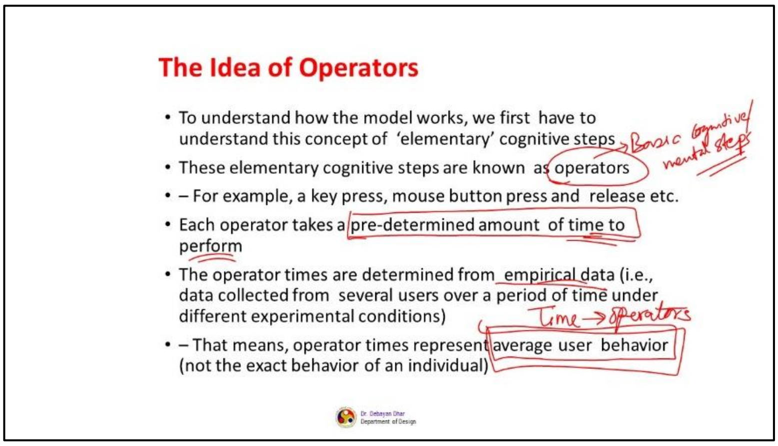

In order to do that in order to break down or decompose the task we must understand the idea of operators now what is an idea of operator to understand how the model works we first have to understand the concept of elementary cognitive steps right basic cognitive steps and these elementary cognitive steps are known as operators. In KLM model the basic elementary steps the most basic cognitive or mental steps or mental steps are called as operators.

So, for example, a key press you press a key you press a mouse button or you release the press these are all elementary steps. So, each operator takes a predetermined amount of time to perform this is what we are said that there is a threshold value perform. Now the operator times are determined from empirical data.

So, you can ask that how these operator times have been determined pressing a key, releasing a mouse button and then pressing a button, moving the cursor from one step point a to point b hovering on a particular thing all these are considered as basic cognitive or mental steps. And each of these steps there is a time component associated to it.

That means how much time it is required to press a key, how much time it is required to release the key, how much time it is required to move a cursor from point a to point b; it is a average thing ok. And all these data have been since many years have been empirically studied and gathered and a threshold value have been defined ok. That the data collected from several users over a long period of time under different experimental conditions.

When we say empirical data, we mean this that data has been collected from several users over a period of time under different experimental conditions; that means, operator times represent average user behavior. Yes, this is what we are trying to understand. So, these time components that we are talking about of the operators are essentially the average user behavior. These are not the exact behavior of an individual, there might be some element of error that can be plus 0.1 or 0.2 some minus 0.1 a range of errors can be there, but this is an average user behavior.

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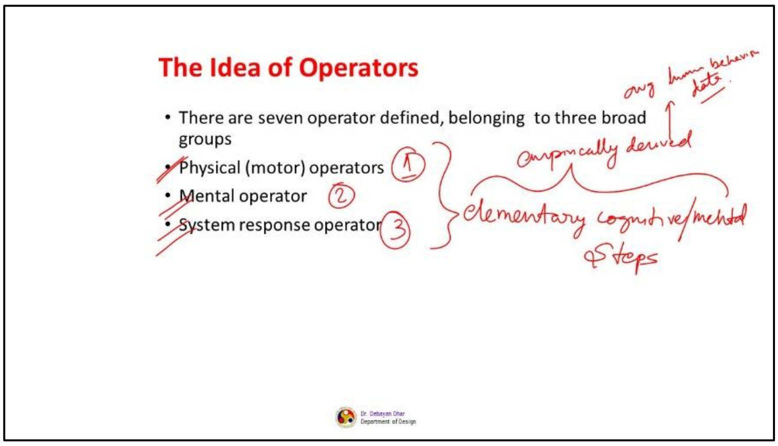

Now, having understood the concept of operators; let us know how many types of operators are there. There are seven operators defined that that belongs to three broad categories and the three broad categories are; the physical operators, the mental operators and this system response operator. Understand, these are considered as the elementary cognitive or mental steps and these data are empirically derived and referred to as average human behavior data right.

So, there are seven operator and they can be classified in three broad groups; one is the physical operator the physical operator, the mental operator and the system response. So, physically you know what we are talking about that is a physical activity the mental operator means there is a mental process associated to it and the system response operator that is the time amount of time taken by the system to respond to the trigger that you have initiated.

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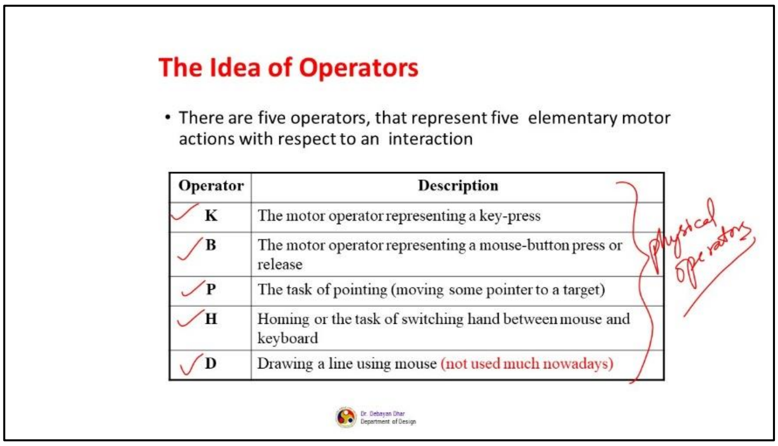

Now, there are five operators that represent five elementary motor actions with respect to an interaction. So, when we talk about interaction. These are physical operator's operator K, operator B, operator P, operator H and operator D. Operator K means the motor operator representing a key press. Operator B mean the motor operator these are all physical operators remember representing a mouse button press or release.

Operator P mean the task of pointing means moving some pointer to a target right. Operator H means homing or the task of switching hand between mouse and keyboard it can be anything between these two homing or switching the of task between mouse and the keyboard. And operator D is drawing a line using a mouse though these are not this is not used nowadays.

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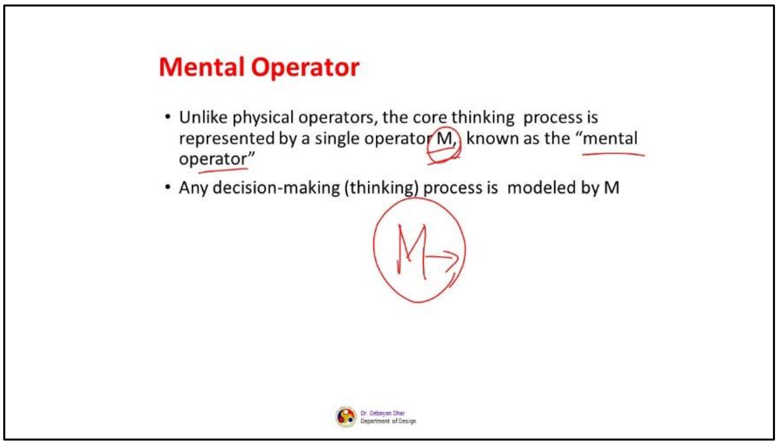

So, unlike these physical operators the core thinking process is represented by the operator M which is called as the mental operator. So, until now what we have discussed these all actually are physical operators these are all physical operators. Now we are talking about mental operator the mental operator is being represented by M ok. And any decision making or thinking process is modeled by this M its only one operator.

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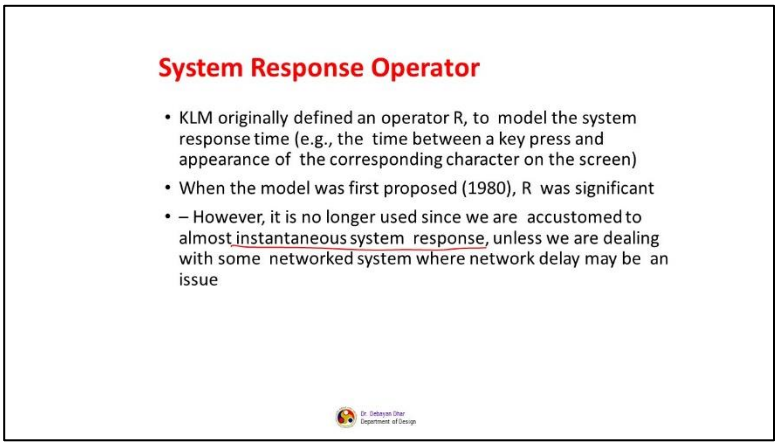

Now, we come to the third broad type of operator which is the system response operator. Let me give you some background to it now when KLM was originally defined as an operator R to model the system response time that is the time between a key press and appearance of corresponding character on the screen. It was way back in 1990 and at that time R was very significant because of the amount of speed that we had the internet speed response time was very low. It was not like instantaneous response time we used to get.

Processing speed of competence was much lower as compared to what we have now; however, it is no longer used since we are accustomed to almost instantaneous system response current system responses are almost instantaneous in nature and unless we are dealing with some network system when network delay may be an issue this kind of operator which is called the system response operator is not being used nowadays ok.

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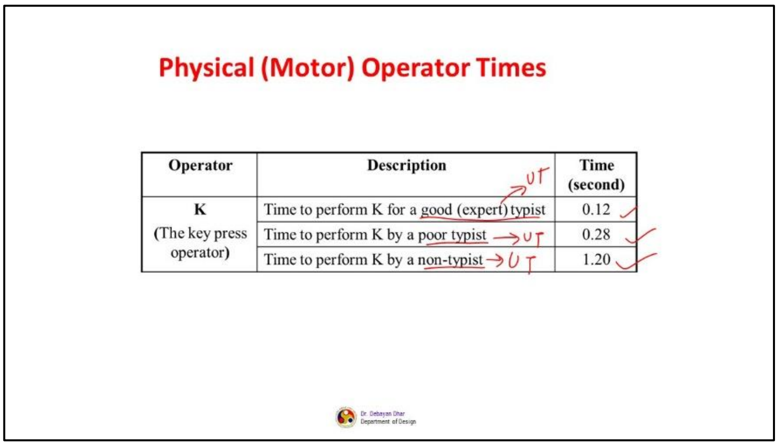

Operator	Description	Time (second)
K (The key press operator)	Time to perform K for a good (expert) typist	0.12
	Time to perform K by a poor typist	0.28
	Time to perform K by a non-typist	1.20

Let us now see some of the average time that has been considered for the physical operators. For example, operator K; time to perform K for a good typist. So, these are some of the average time periods which is 0.12. You have to keep this table in order to ensure that you calculate this time. So, that you know how much time is required for a particular user type to complete the task. Time to perform K by a poor type typist is 0.28 seconds and time to perform K by non-typist is 1.20 seconds.

These are all empirically validated data which are average human user behavior and these are all your user types. So, non-typist is a user type port typist is a user type and a good typist is a user type these are all different user types.

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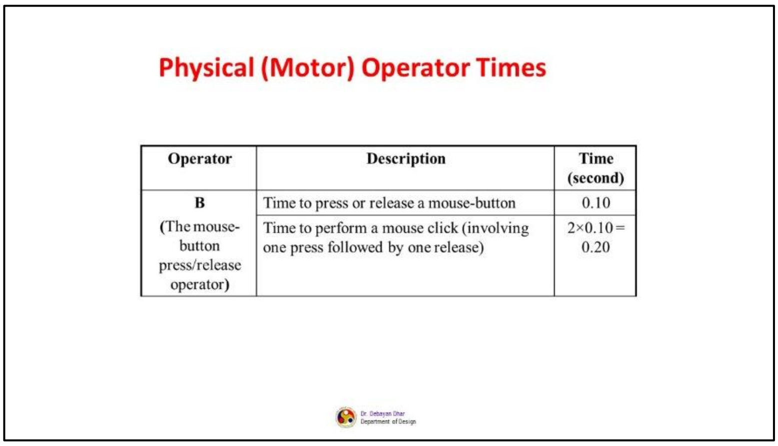

Operator	Description	Time (second)
B (The mouse-button press/release operator)	Time to press or release a mouse-button	0.10
	Time to perform a mouse click (involving one press followed by one release)	2×0.10 = 0.20

Operator B the mouse button presses release operator time to press or release a mouse button is 0.10 seconds, time to perform a mouse click involving one press followed by one release. So, these are two activities. So, 2 into 0.10 is equal to 0.20 seconds.

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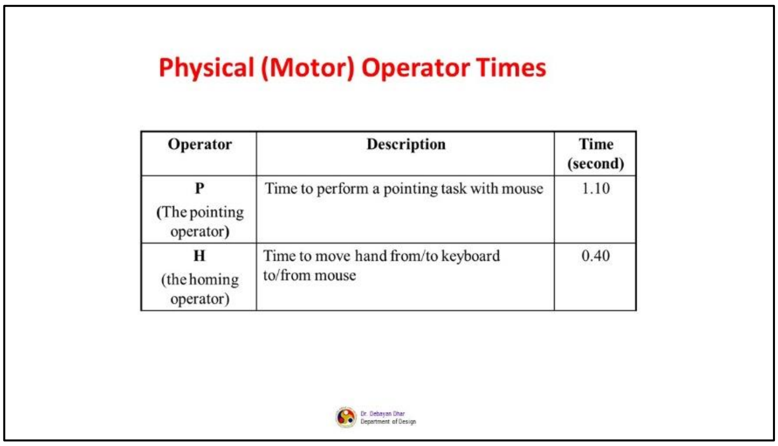

Operator	Description	Time (second)
P (The pointing operator)	Time to perform a pointing task with mouse	1.10
H (the homing operator)	Time to move hand from/to keyboard to/from mouse	0.40

Then P the pointing operator time to perform a pointing task with mouse is considered as 1.10 seconds this amount of average time is required while h the homing operator time to move hand from or to the keyboard or doing some simultaneous switching to and from mouse is 0.40 seconds.

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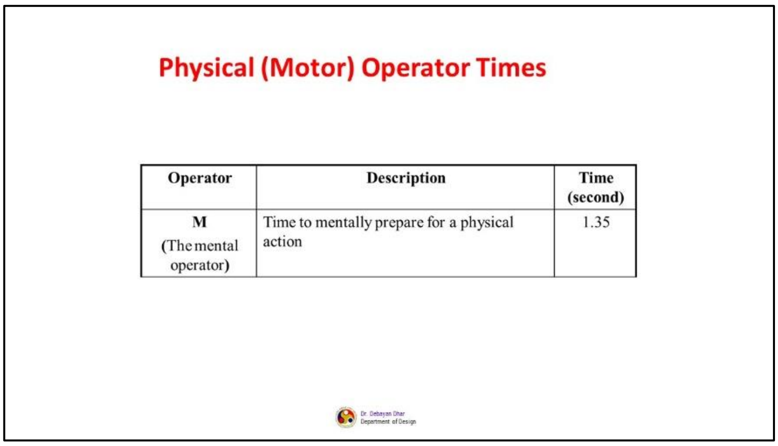

Operator	Description	Time (second)
M (The mental operator)	Time to mentally prepare for a physical action	1.35

Now, the mental operator which is used is time to mentally prepare for a physical action this much amount of time is being taken by an user to physically process information in order to take a decision whether to take a physical action or not the average time that is taken is 1.35 seconds.

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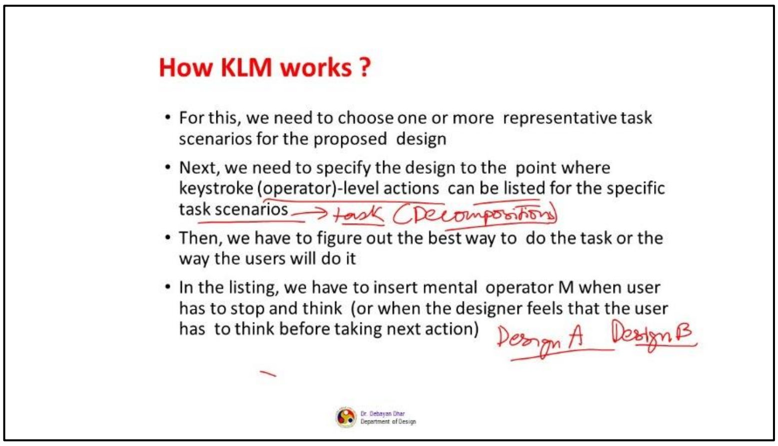

So, let us understand how KLM works. Now for this we need to choose one or more representative task scenarios for the proposed design we must have a scenario. Next, we need to specify the design to the point where key stroke or the operator level actions can be listed for this specific task scenario.

So, we have a task and the decomposition has to be done to such extent that this operator level actions can be listed for that specific scenario or that is for specific task scenarios decomposition of mental steps cognitive steps. Then we have to figure out the best way to do the task or the way the users will do it. In the listing we have to insert mental operator m when user has to stop and think or when the designer feels that the user has to think before taking next action.

See you might be wondering that why do we have all these you know these operators are there and these timings are there let me give you a scenario. Consider this scenario that you are designing a login screen and there are two designs. In design A you have chose a particular type of interface element and in design B you have a particular type of design element.

So, you have two designs your design A and design B. Now what happens? In design A in order to login if this is the activity if you consider the task as the user has to login into his dashboard or he must be in the on boarding screen post login. How can you break down that activity? You write down in a piece of paper or any word processing file the steps that these are elementary steps.

So; that means, first he would move the mouse cursor from some position to that field, he would click there is a mouse release then he will type then again, he will press tab and then he will again write the password then he will press a mouse or he will execute the enter function and then he will login.

This is one so, you have broken down this entire task into its elementary functions elementary steps and the objective is you break it down or decompose it to such an extent that further decomposition is not possible that is the criteria; that further decomposition is not possible right. So, now, you have design A and then you know ok for this and I know ok this user is an expert user. So, for him he is pressing the mouse. So, now, from the table I know that for pressing the mouse this is the average time.

So, you consider that time for the press release this much amount of time for moving the cursor this much amount of time for typing this, this much amount of time for pressing another tab or keypad, this much amount of time. So, you know average how much amount of time will your user take to complete this task.

Similarly, what you do you take design B. Now in this case it is different say for example, you have a UI element where he cannot type using his key physical keyboard he has to he needs to type using a virtual keyboard I am just giving you a scenario. So, what he will do? He will first use his mouse go somewhere click that situation that icon a virtual keypad comes up then he goes and searches for that letter he takes time and then clicks and then again, he searches he then clicks right.

All these are broken down into elementary steps and then summation happens and then you know total time and now you compare between design A and design B. So, this is an ideal way to understand time on task how much time does a user same user will take in order to execute this function which is logging in through design A versus design B. Using these operators, the KLM operators and you have the standard operators being given from empirical studies I will also share here.

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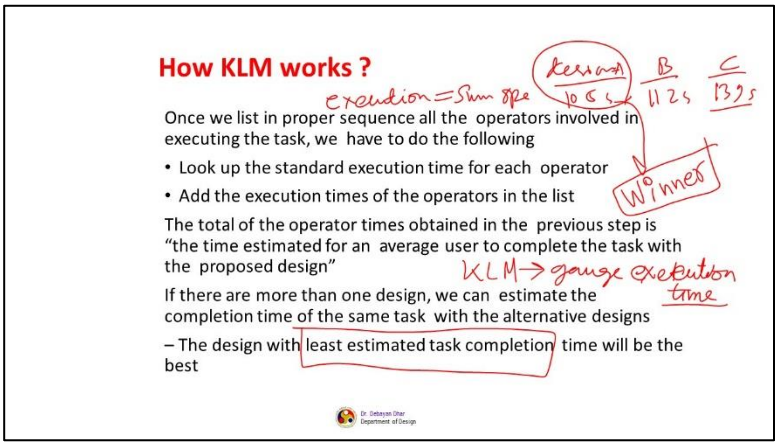

Now, once we list in proper sequence all the operators involved in executing the task we have to do the following. What we have to do? Look up at the standard execution time for each operating. So, you have the list you look at the standard execution time add the execution times of the operators in the list the total of the operator's time obtained in the previous step is the time estimated for an average user to complete the task with the proposed design.

And if there are more than one design we can estimate the completion time of the same task with alternate design. So, the execution time using if you sum up the operators you will have for design A say 10.56 for design B 11 26, for C 13.99 seconds right. So, now you have a quantitative value that tells you what is the execution time for design A, for design B and for design C.

The design with the least estimated task completion time that is the goal. So, the design with the least estimated task completion time will be the best. So, probably in this case we will go with design A is the winner. So, instead of going to the user's actual users if we do not have access to them we can use KLM in order to gauge execution time execution time of the tasks based on the summation of the operators. The basic elementary cognitive steps that is KLM for you.

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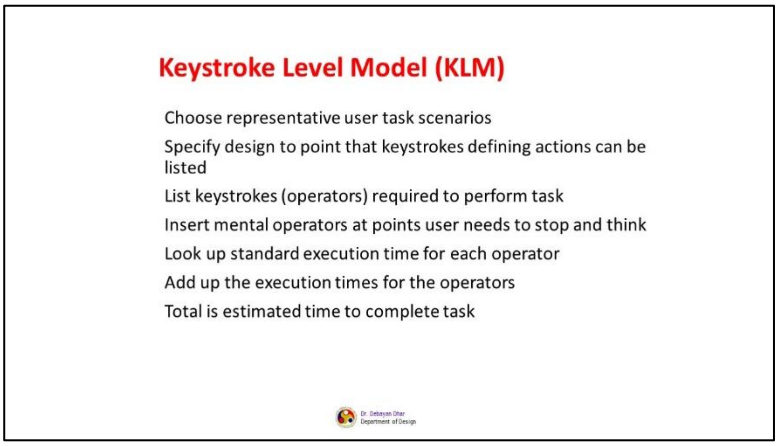

So, summary summarizing what we have discussed for application of KLM choose representative user task scenarios specify design to point that keystrokes defining actions can be listed. List the keystrokes or the operators required to perform the task insert mental operators at points when you think that users need to stop and think. Look up standard execution time for each operator add up the execution times for the operators and then calculate the total estimated time to complete the task.

And you have the time average time that your user will take to complete the task right at front of you.

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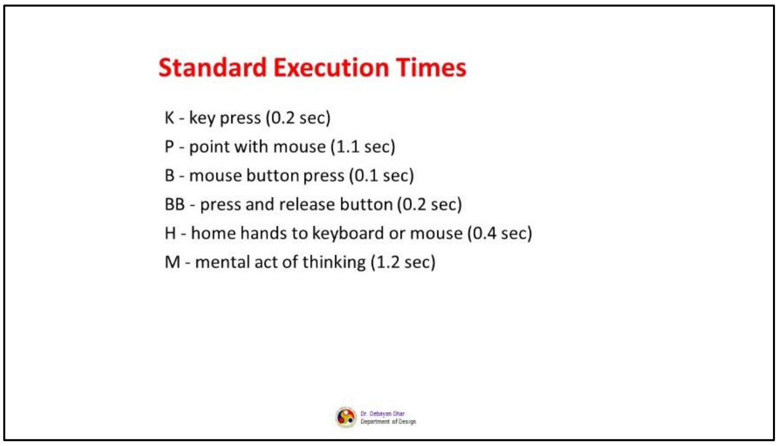

Some of the standard execution times are for key press it is 0.2 second, for pointing with mouse it is 1.1 second, for mouse button press it is 0.1 second, for press and release button it is 0.2 second, for home hands to keyboard or mouse it is 0.4 second, for mental act of thinking it is 1.2 second these are average human behaviors.

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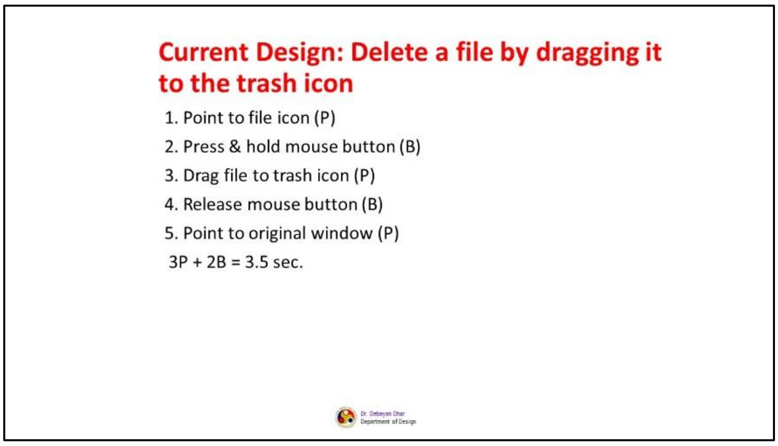

Consider this current design, current task. Delete a file by dragging it to the trash icon. So, you have this desktop and you have probably you are looking my video at the at your desktop only and you have so many files in the desktop now you want to delete a file by dragging it to the trash icon.

So, first this is just an example that might be fault here, but I am trying to explain how you can calculate this. So, here first is point to the file icon this is P, press and hold the mouse button that is B, drag file to the trash icon P, release mouse button B point to the original window P. So, 3P you have 3 Ps and 2 Bs which if we take from here 3 Ps and 2 Bs it will come to 3.5 seconds that is how we calculate the estimated execution time.

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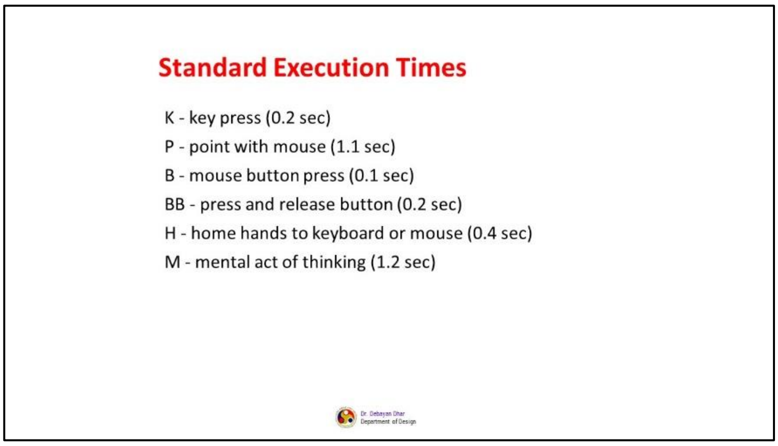

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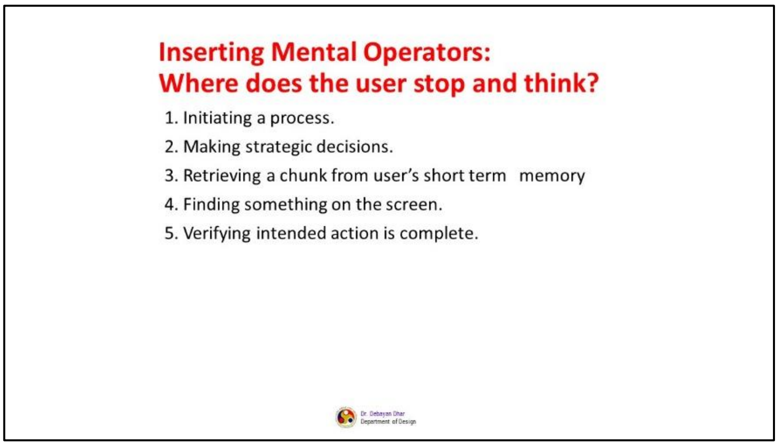

Now, one of the major things in KLM that we need to understand is when do you insert mental operators, where does the user stop and think; can you guess? Is it random that ok I feel the user will stop here or the user is thinking here or I feel he will take some time to execute this function? So, let us insert the operator M is it that way no it is not.

So, whenever there is an initiation of a process whenever there is making strategic decisions retrieving a chunk from user's short-term memory, finding something on the screen, verifying the intended action; that means, is looking for feedback is complete or not there is a situation where a mental operator has to be inserted or considered while you break down decompose the operators.

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There is also a situation which demands how mental operators can be used and the situation is when you consider new versus experienced users. Consider users who are new to your system or consider users who are expert with your system. Now you new users stop and check feedback after every step. So, then after every step you will need to have a mental operator. New users have small chunks because the information has is for the first time coming and there are no available schemas for the earlier experience.

Experienced users have elaborate chunks and experienced users may overlap mental operators with physical operators. So, they can overlap, but in case of novice users the overlap does not happen because it is their chunks of information are very small, it is not elaborate because they are first time users.

So, one way to differentiate between a decomposition of a particular user type say novice user type and an experience user type is from the perspective of mental operators that they are going to have. More mental operators after each step to check for feedback he is a novice.

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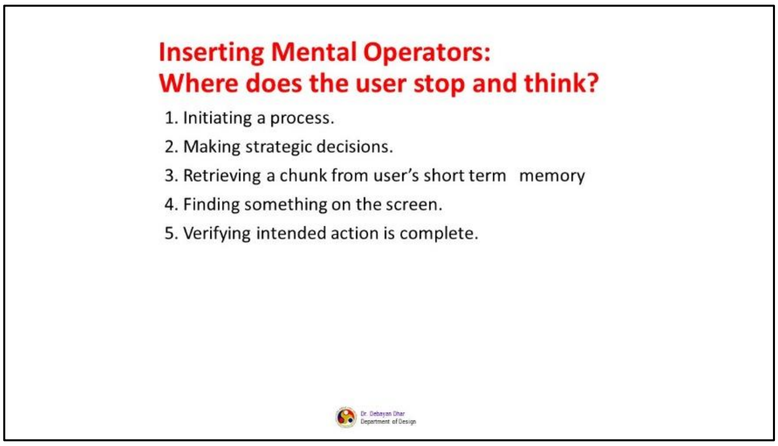

Otherwise consider these situations where mental operators are must. This is irrespective of whether it is a you know new or next, but though expert have already know the system they will their mental operators will overlap the physical operators, but during initiation of a process, making strategic decisions, retrieving a chunk from users short term memory, finding something on the screen, verifying intended action is complete or not mental operator has to be used.

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Operator	Description	Execution time
K	Keystroke	0.28 sec. *(40 wpm: average non-secretary typist)*
P	Pointing	1.1 sec.
B	Press or release mouse button	0.1 sec.
H	Home hands to keyboard or mouse	0.4 sec.
M	Routine thinking or perception	1.2 sec.
W(t)	Waiting for the system to respond	-
C	Click a Link/ Button	3.73
P	DropDown List (No Page Load)	3.04
D	Date-Picker	6.81
CP	Cut & Paste (Keyboard)	4.51
SC	Scrolling	3.96
T	Typing Text in a Text Field	2.32
T(@)	Type email - 25 Keystrokes	7.0 sec.
T(P)	Type password - 8 keystrokes	2.24 sec.
T(U)	Type username - 12 keystrokes	3.36 sec.
T(W)	Type webpage address - 30 keystrokes	8.4 sec.

These are some of the list of KLM operators which are extensively used now. I have collected these from various research papers. You can take a look at it you would see that keystroke 0.28 seconds, pointing 1.1 second, press or release mouse button, home hands to keyboard or mouse routine thinking operation, waiting for this respond I am not giving any time clicking a link, drop down, date picker, cut and paste, scrolling, typing testing, text field type, email type, password type, username type, web page address, 30 key strokes these are some of the things which are extensive.

Because now, it is hardly you know people start have been so familiar with mobile screens and touch screens that these operators have changed if you refer to more recent papers you will realize how new operators have been defined and those average performance or execution times have been calculated. With this we have come to the end of KLM model.

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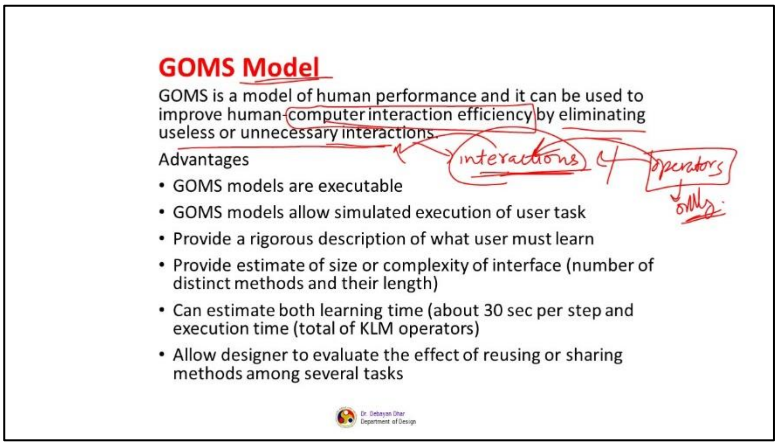

Now, the second model that we are going to discuss is the GOMS the GOMS model. So, the GOMS is a model of human performance and it can be used to improve human computer interaction efficiency by eliminating useless or unnecessary interactions. Now here the focus of this model is to ensure that efficiency of interaction can be optimized by the elimination of useless and unnecessary interactions.

So, here the focus is on interactions rather than on operators which we have seen only in KLM. Though you will realize that in these interactions' operators play a role, but then it has much more to operators then only operators while KLM is only about operators GOMS is about interactions that include operators and much more.

So, what are the advantages of GOMS? So, GOMS models are executable GOMS models allow simulated execution of user task it provides a rigorous description of what user must learn, it provides estimate of size or complexity of interface number of distinct methods and their length, sequence, how long the sequence is.

It can estimate both learning time about 30 second per step and execution time total of you know the KLM operators and it allow designer to evaluate the effect of reusing or sharing methods among several tasks.

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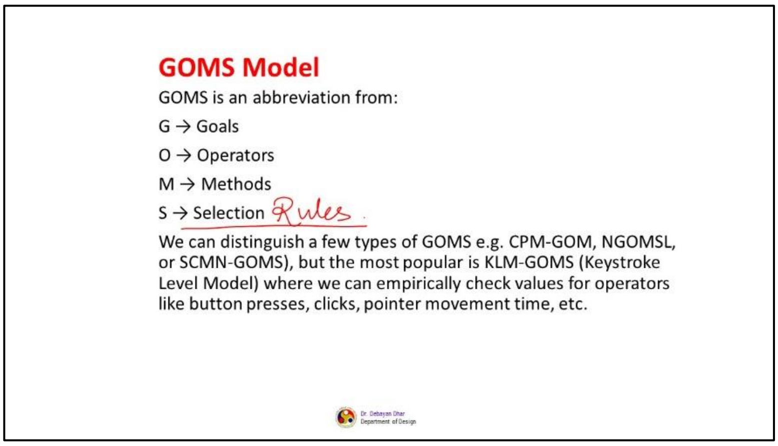

Now, GOMS is an abbreviation, it is an acronym each word in GOMS stands for G stands for goals, O for operators, M for methods and S for selection rules ok S for selection rules. So, we can distinguish a few types of GOMS there are some few types of GOMS in the literature you know that there are CPM GOMS NGOMSL or SCMN GOMS, but the most popular is the KLM GOMS which is called the Keystroke Level Model GOMS where we can empirically check values of operators like button press, clicks, pointer movement, time etcetera ok.

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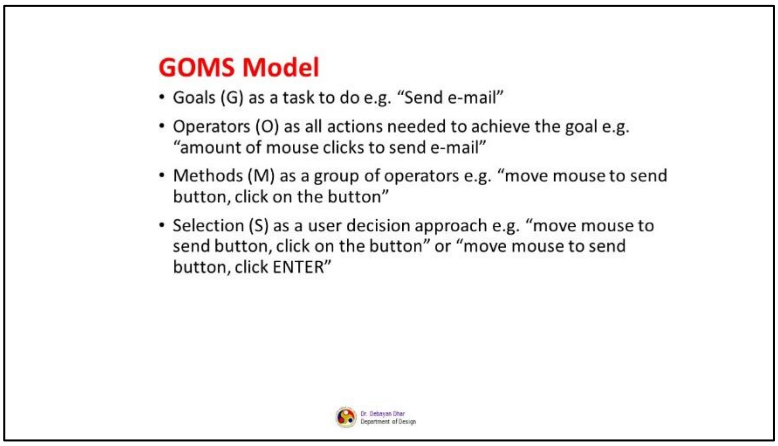

Now, let us understand how do we analyze GOMS for a particular task. Goals as a task to do goals means goals of the what is the goal of the activity. So, the goal of the activity example sending an email that is a goal. So, what are the operators that would be required to complete the task? So, operators O as all actions needed to achieve the goal. So, amount of mouse clicks to send email.

So, you we will have the KLM model operators the KLM operators listed down to complete the task. Methods M as a group of operators move mouse to send button click on button and then we have the selection rules as a user decision approach move mouse to send button click on button or move mouse to send button click enter. Selection rules means you have multiple scenarios when to choose which one it is being it is defined by particular rules that is what we called as selection rules.

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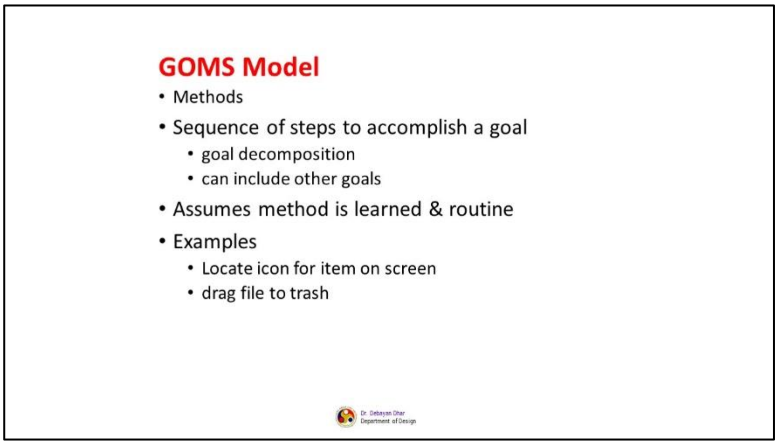

Now, when we talk about methods we know we have understood goals; goals mean the objective for the task by O we means video leads list down we will break down the task into its basic level of operators. Methods means sequence of steps to accomplish a goal right. So, goal decomposition it can include many other goals.

For example, if you consider during discussion of your customer journey mapping we talked about the journey of buying a mobile and that journey of buying a mobile is a composition of many sub goals. So, you go and study the existing mobiles that is one sub goal, you go and study what your immediate social networks or your social dream your friends your family members has you will go and talk from an expert you will then see feasibility in terms of your purchasing power and the amount of price that the products have and then probably you will go for buying a product based on your requirement.

Each of those activity can be considered as a sub goal. So, goal decomposition it includes other goals it assumes method is learned and routine examples locate icon for item on screen drag file to trash something are routine tasks.

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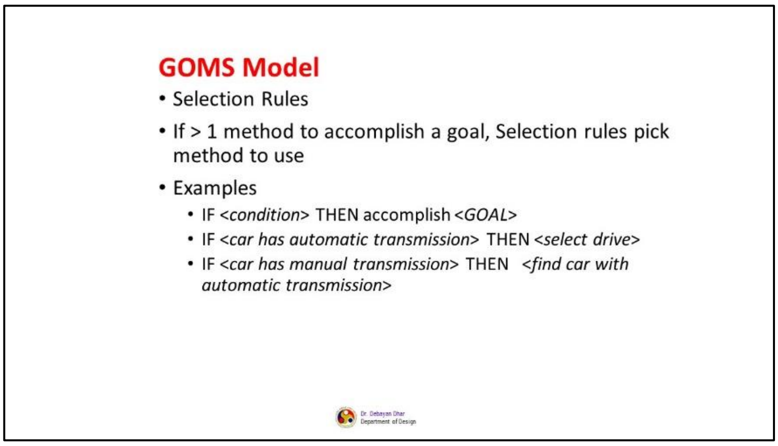

And then comes selection rules. So, if there is a rule that if greater than one method to accomplish a goal selection rules pick method to use. Examples; if this condition then accomplish this goal. If car has automatic transmission, then select drive if car has manual transmission then find car with automatic transmission right.

So, see understand this, when we talk about goal? We talk about the overall objective and to reach that overall objective you have a list of operators ok. And these operators using these operators you can take a particular method and the method can be composed of various sub methods small tasks associated in order to ensure that you reach the goal.

And then inside these if you have more than one method to reach the same goal there is a selection rule that comes. That if this is the condition then go for this method or else go for that method that is what GOMS allows us. GOMS allows us to see whether we are addressing the concerns of novice versus expert. Expert people look for much quicker way to complete a task while your novice are first time users they will look for step by step they will not jump on steps, they will go for a long stepwise way to complete a task.

So, GOMS provide you with the idea is that how many ways a task can be completed. Is your solution does your solution provide only a single window to complete a task then it is not considered an ideal way. Because you must give freedom to your user, he will migrate from being a novice to being an expert and while he migrates if your interface does not provide him with the opportunity to optimize his performance then he would not like that interaction.

GOMS allows you to understand these interactions. How these interactions pan over in order for your user to achieve the goal and you use the concept of a KLM operators to compare between these goals these selection rules and see which one is better, which one is not, which one can be dedicatedly given for your novice can be dedicatedly sponsored for your experts; that is the idea of GOMS model.

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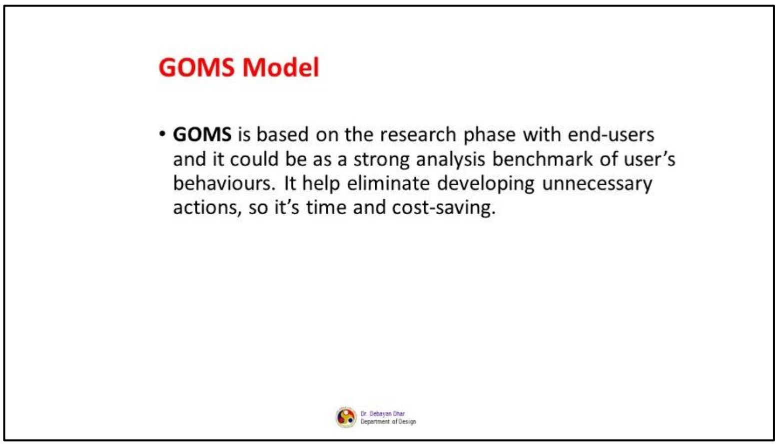

So, GOMS is based on the research phase with end users and it could be as a strong analysis benchmark of user's behaviors. It helps eliminate developing unnecessary actions; so its time and cost saving. So, you ensure that by doing this analysis unnecessary ways unnecessary ways through which a task can be completed through goals and selection rules can be eliminated and required amount of support should be given to the specific user's types; that means, the novice and the experts.

With this we come to an end of our module 7; we will next start module 8.