User-Centric Computing for Human-Computer Interaction
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Lecture – 13
Introduction to GOMS family of models

Hello and welcome to the 13th lecture in this course of User-Centric Computing for Human-Computer Interaction. So, let us recap what we have learned in the previous lectures.

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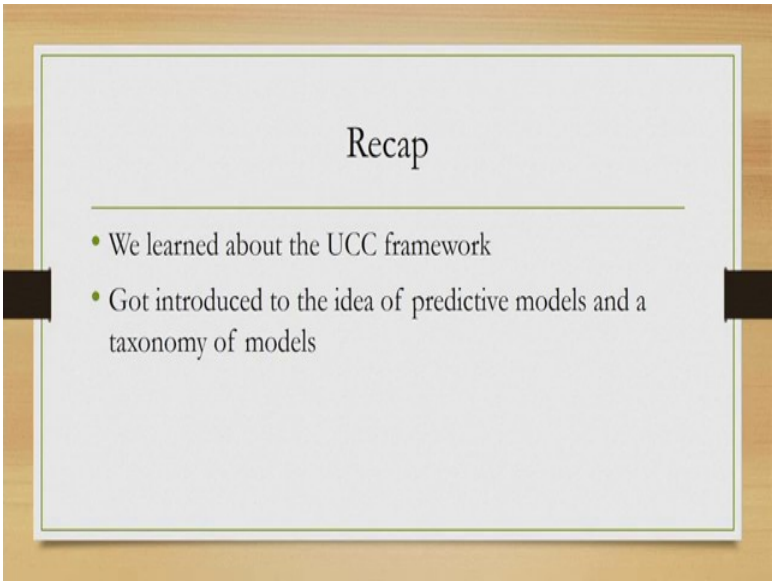

So, we started discussion on the idea of predictive models which are essentially equivalent to the user-centric computing models; we discussed different categories of such models. These models are useful for implementing the framework the user-centric computing framework that we have learnt earlier, in fact, these models from the backbone of the sub layer two in that framework that is the user state predictor layer.

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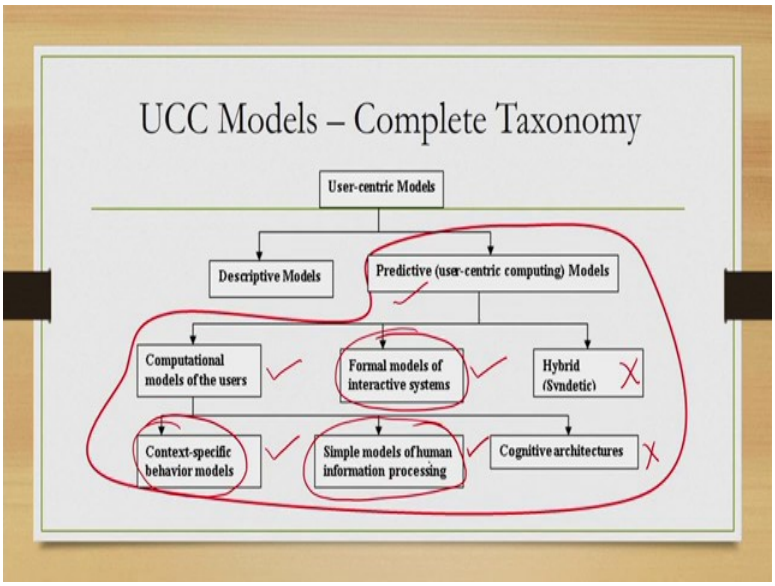

Now, let us have a look at the categories of these models, again two position today's discussion in the proper context. So, let us have a look at these categories. Earlier we said we are not going to consider descriptive models anymore. Our focus is predictive models. And in this there are three categories computational models of the users, formal models of interactive systems and synthetic models or hybrid models. However, we are not going to consider hybrid models any further.

Under computational user models, we have context specific behavioral models, simple models of human information processing and cognitive architecture, but we are not going to discuss cognitive architecture any further. Our main focus will be these three categories context specific behavioral models, simple models of human information processing and formal models of interactive systems.

Today, we will get introduction to a class of models that belongs to these category of simple models of human information processing. These models are very popular in this field of user-centric system design. These are known as the GOMS models, there are many models in this category or this group collectively known as the GOMS family.

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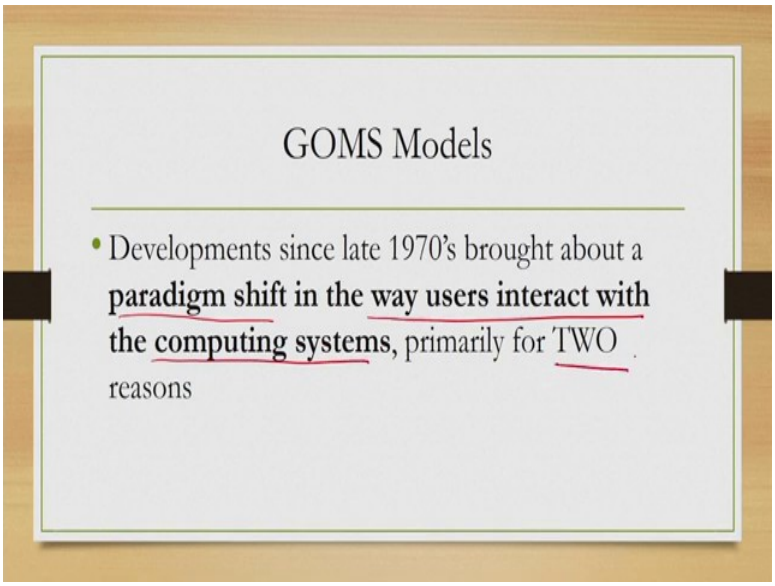

Now, from where these models came? So, let us have a brief look at the historical evolution of these models. Development since the late 1970s brought about a paradigm shift in the way users interact with computing systems, primarily for two reasons.

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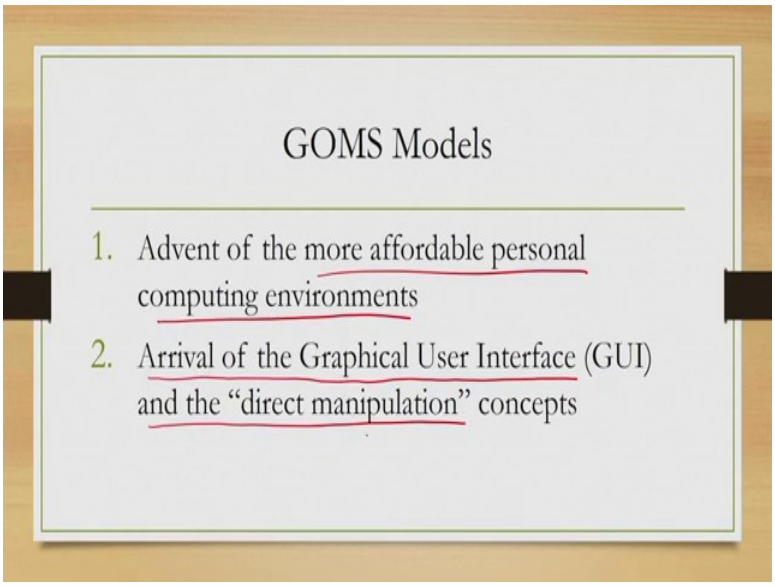

One is the advent of more affordable personal computing environments. If you can recollect from our first lecture on historical evolution said that around that time with the advent of microprocessor and technology, the computing systems started becoming affordable, and which eventually lead to the desktop computers or personal computers.

Along with that around the same time, another important thing happened that is the arrival of the graphical user interface concepts and the direct manipulation. Now, these things together made computers very popular. So, people started building systems for the general population rather than specialized group of people which was the case earlier.

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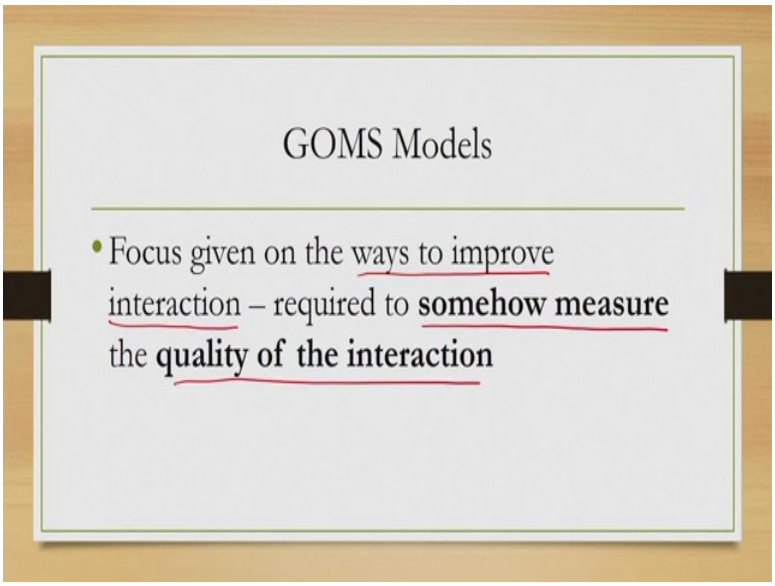

Now then the focus of these developments shifted towards ways to improve interaction, because these systems are likely to be used by non-expert users those who are not expert in computers. And so what was required is that they feel comfortable with this systems; in other words usable systems. Now, the development of usable systems required a way to measure the quality of interaction. Now, this measurement is important, how do we measure, how good the system is, how do you measure the quality of interaction.

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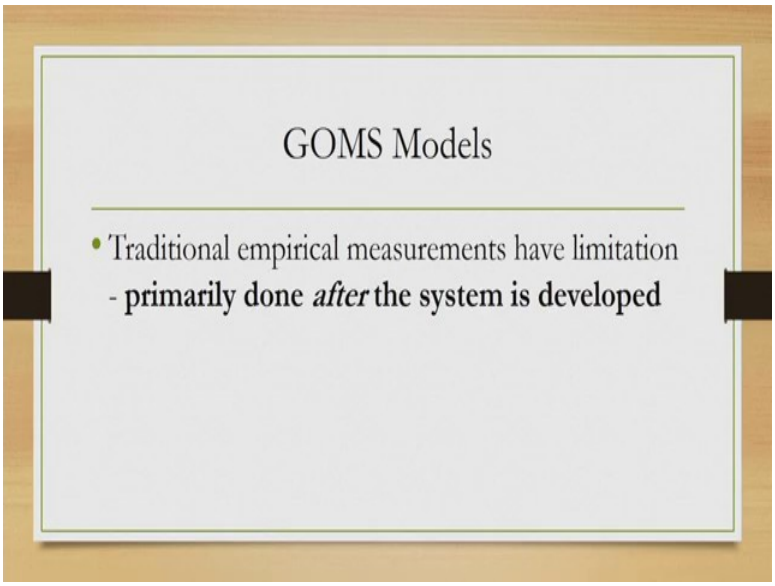

Of course, we can always go for traditional empirical evaluation, but then that requires you to first develop the system and then go for evaluation which is of course, costly. If you develop a system which you find later to be not very acceptable to the users, then you have to discard it, then the entire effort given to build the system including the manpower and the cost is wasted.

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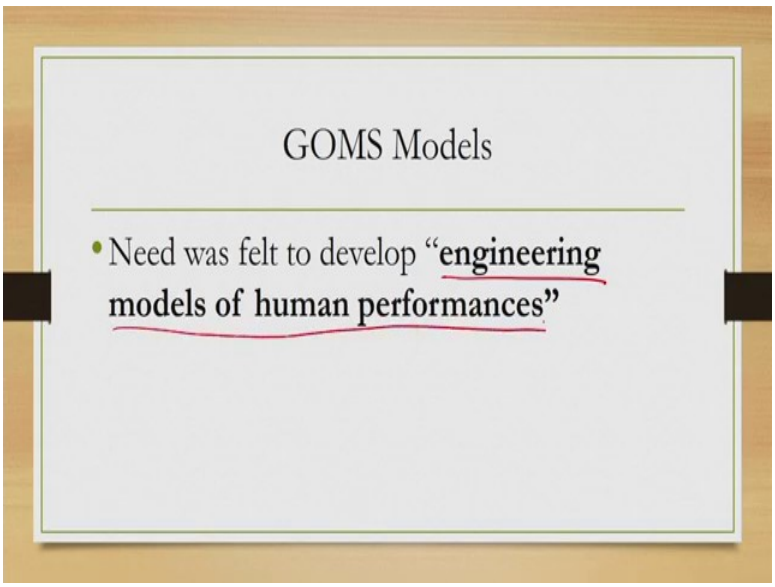

So, then we need something where we can test the system before it is actually developed. Now that led to the development of engineering models of human performance.

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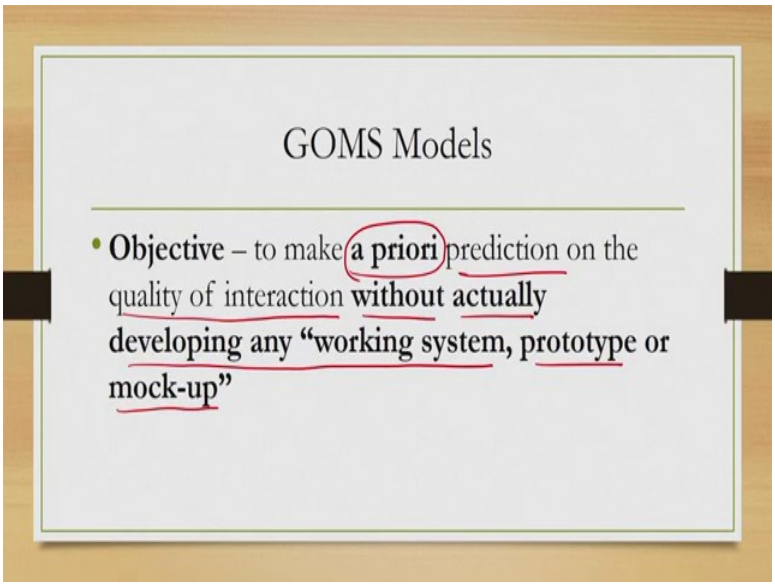

The objective of such models was to be able to make a priori prediction on the quality of interaction without actually developing any working system, prototype or mock-up. So, essentially we wanted to predict the quality of interaction without actually building any system, so that was the idea behind engineering models of human performance, in order to be able to predict the quality of interaction without building any system.

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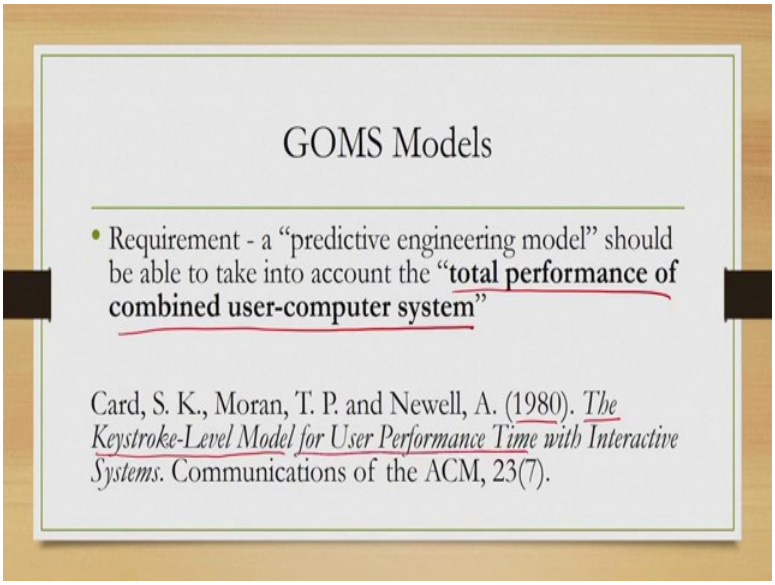

Such predictive engineering models should have the capability to take into account the total performance of the combined user computer system. So, recollect from our earlier

discussion we said that here when we talk of the term system, we are talking of both the user as well as the computer together.

And the predictive engineering models that were thought off at that time it was felt that such model should have the ability to take into account the total performance of this user computer system combined. Now, these ideas were elaborated in the seminal article that came up in 1980 by Card, Moran and Newell. So, they proposed one such model which is the keystroke level model for user performance time with interactive systems.

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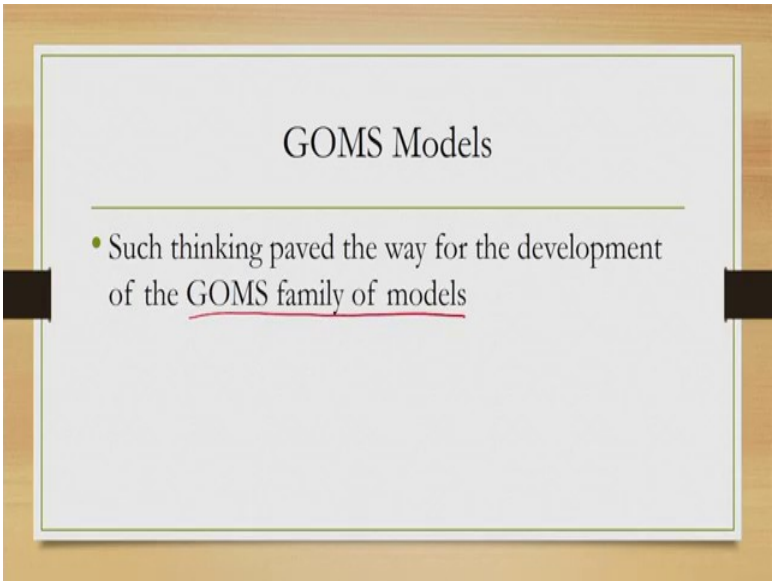

In fact, that was the first article in a series of articles which proposed family of models that is collectively known as the GOMS family. So, all the models belong to this family. So, these GOMS family of models will be our interest in this and the next lecture.

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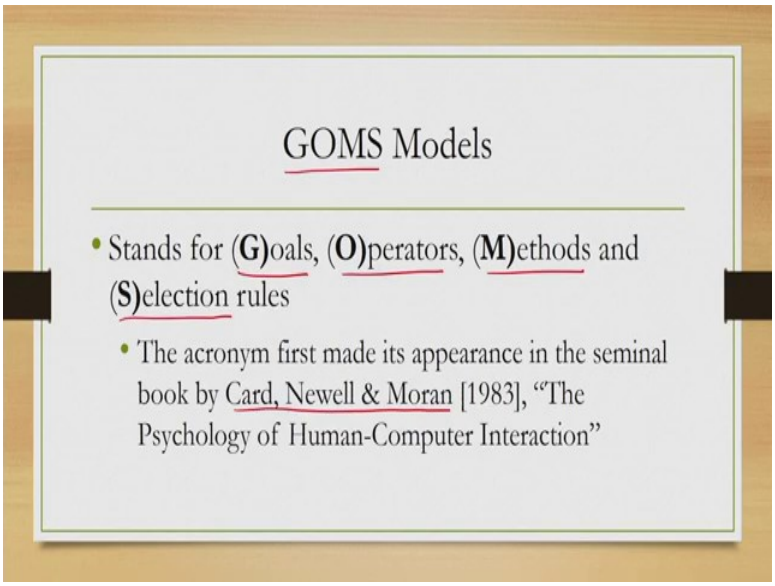

So, what this GOMS stands for? The acronym GOMS G O M S stands for Goals, Operators, Methods and Selection rules. This acronym was first proposed by Card, Newell and Moran in their book, The Psychology of Human-Computer Interaction, which is a seminal book and which gave us many new ideas on how to build predictive engineering models. The details of these concepts namely goals operators methods and selection rules will be discussed in subsequent lectures. Today we will just introduce this family.

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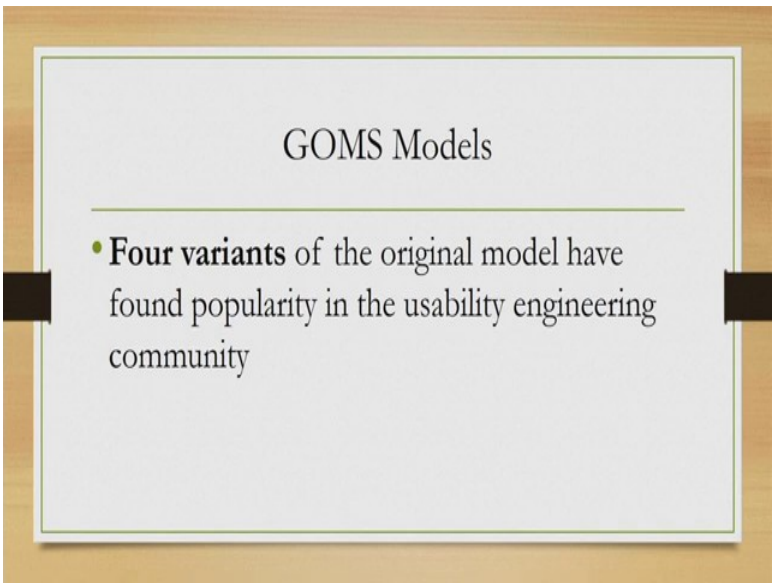

Now, in this family of models, there are actually four variants four models.

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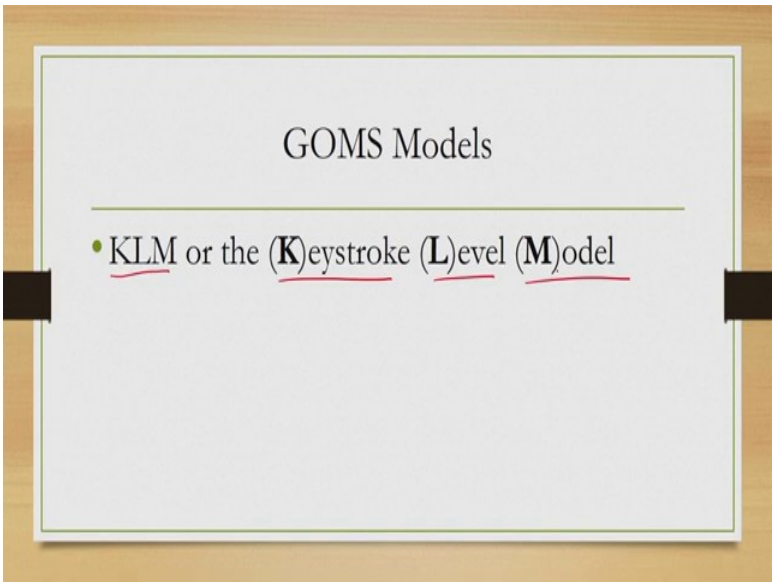

One is KLM, which is again an acronym which stands for keystroke level model or KLM.

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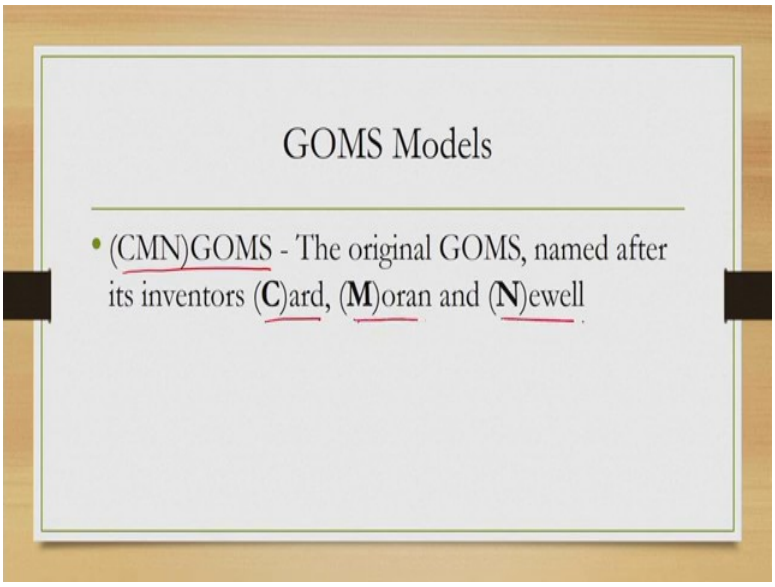

Then we have the CMN GOMS. This is the original GOMS model and it was named after the inventors of this model namely Card, Moran and Newell.

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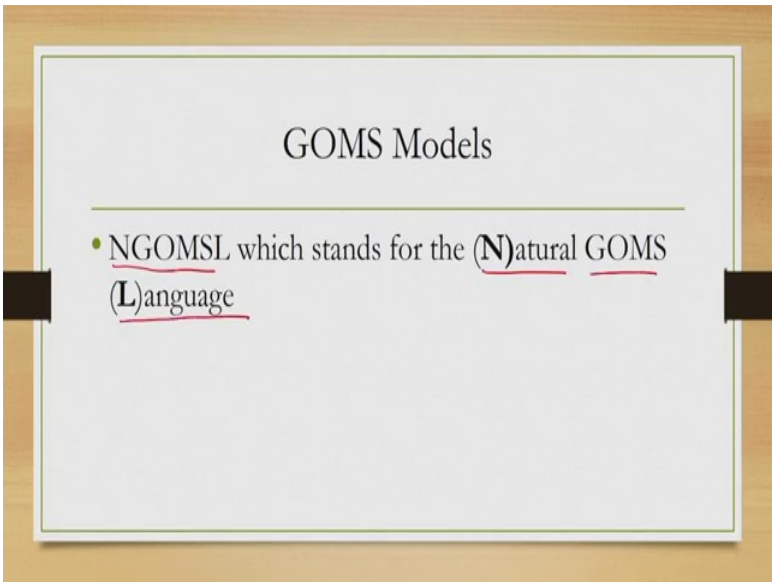

A third variant is NGOMSL, which stands for Natural GOMS Language or NGOMSL.

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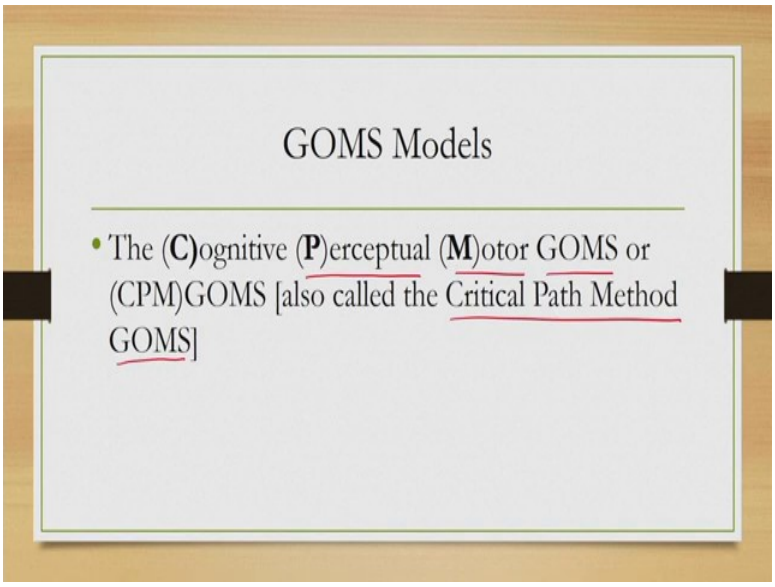

And finally we have the fourth variant that is cognitive perceptual motor GOMS or CPM GOMS. It is also sometime known as the critical path method GOMS. Thus the acronym CPM may represent cognitive perceptual motor or it may also represent Critical Path Method both are used.

So, to recollect, so in the GOMS family there are four models the KLM or keystroke level model, the CMN GOMS or the Card, Moran, Newell GOMS. The NGOMSL or

natural GOMS language and finally, the CPM GOMS or the critical path method GOMS also known as the cognitive perceptual motor GOMS.

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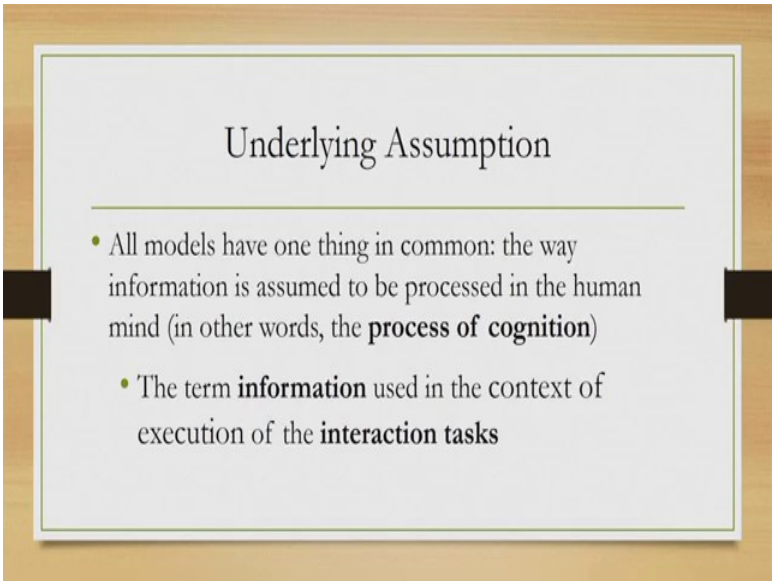

So, all these models why we are calling them as part of a family because all these models make some assumption about the process of cognition, how the information is processed in our mind during the process of cognition. Now, when we are talking of the term information, we are referring to information in the context of interaction with a computer.

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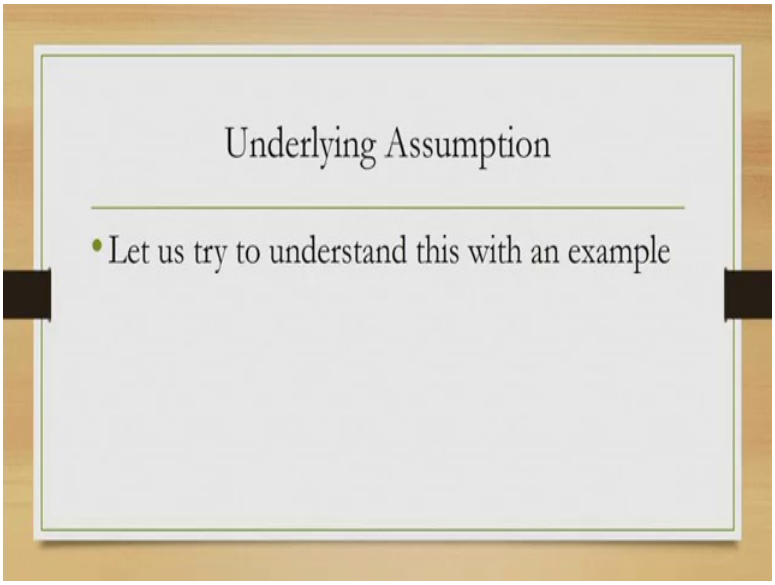

So, let us try to understand this information processing with an example.

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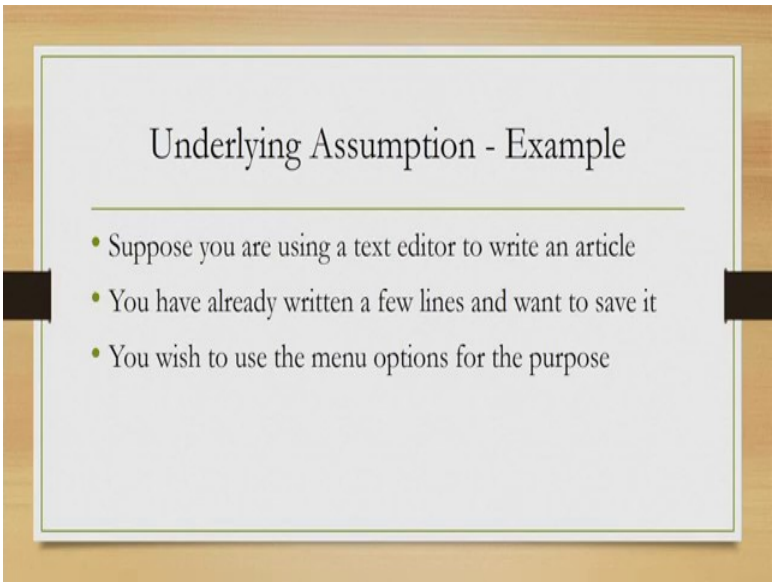

Suppose, you are using a text editor to write an article now you have already written few lines and now you want to save it. And you want to use the menu best saving options.

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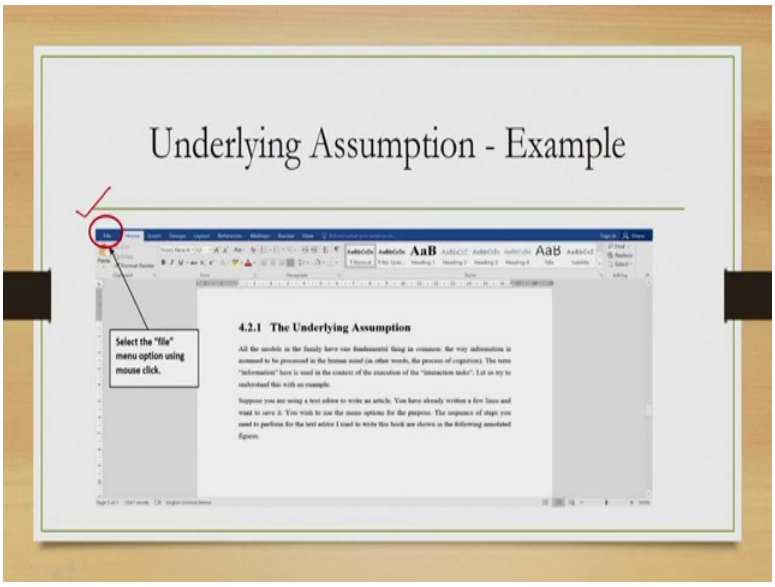

So, what we typically do suppose this is the interface. So, I am using this word processor MS word to type a document, and I want to save it. So, few lines are written. So, then I have to go to this save option here, I have to click on it which results in a drop down list.

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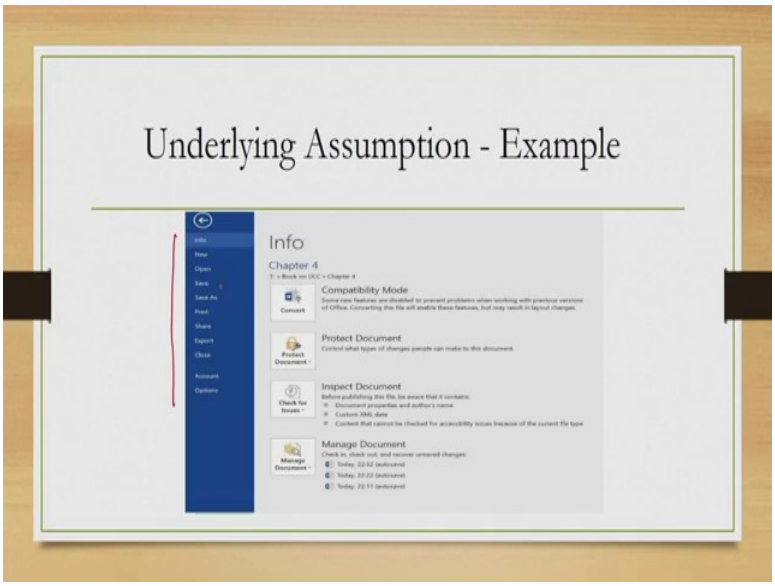

So, from this list I have to figure out where this actual save option is and then I have to select that option here.

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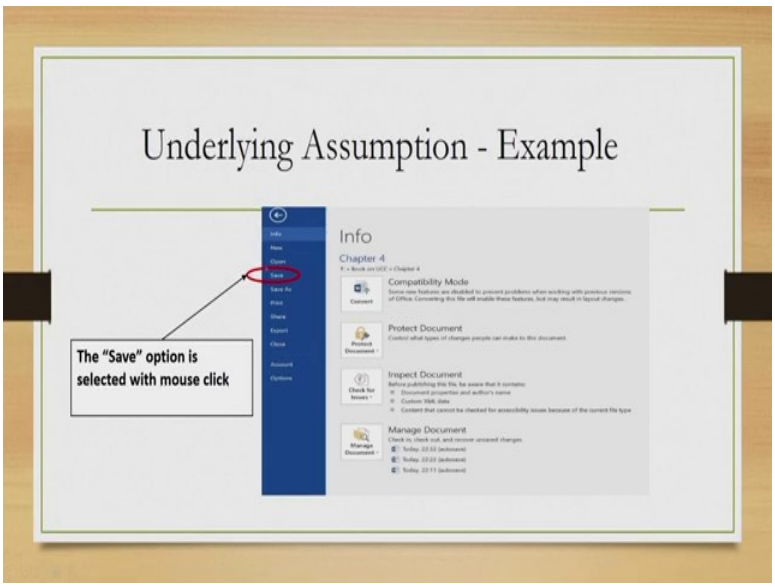

So, forth from the top, so I first select the file menu option, then get the drop down list, then find out the save option and I select it. These are informal descriptions of the activities that we perform and we can go you one step even further.

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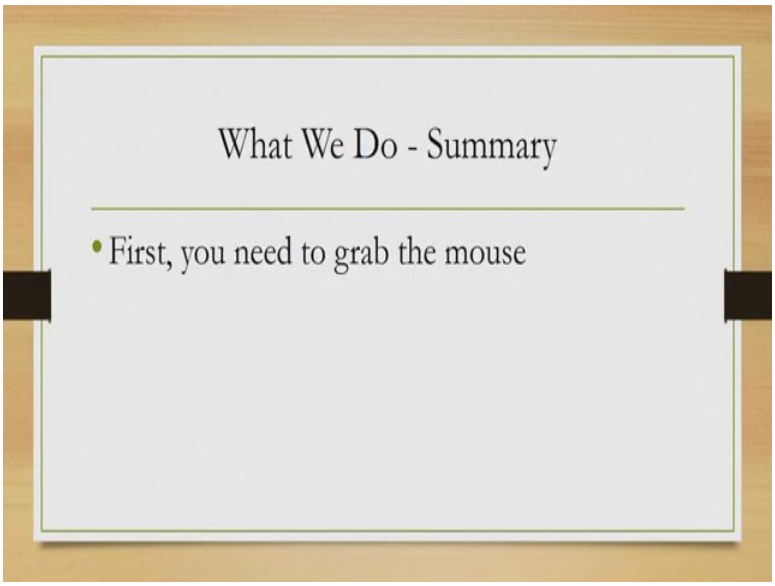

So, in order to save the file what are the tasks, the first thing is we have to grab the mouse.

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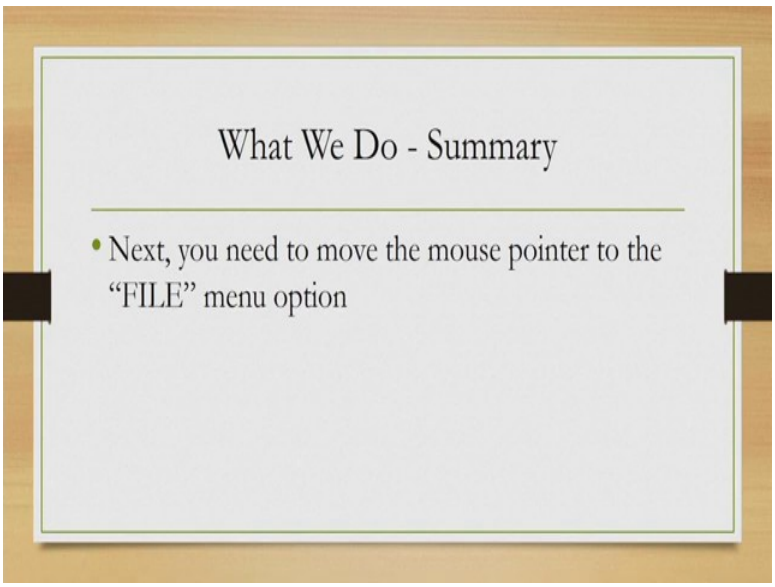

Then we have to move the mouse pointer to the file menu option.

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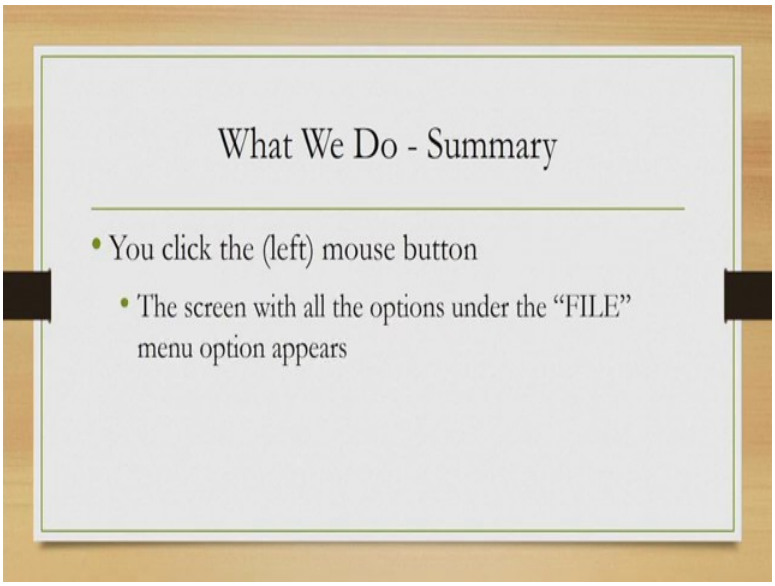

Then we have to click the left mouse button to select that option. This results in the appearance of the drop down list.

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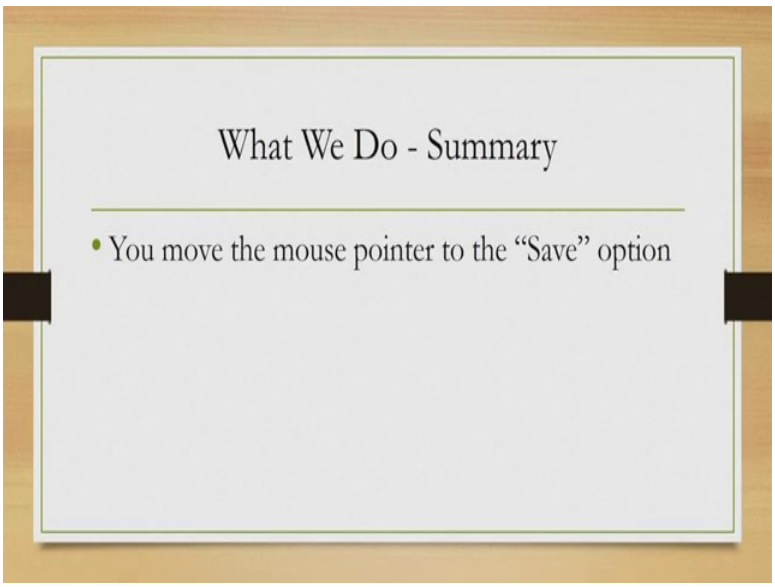

From the list, we have to first identify the save option, its location, and then move the mouse pointer towards this option.

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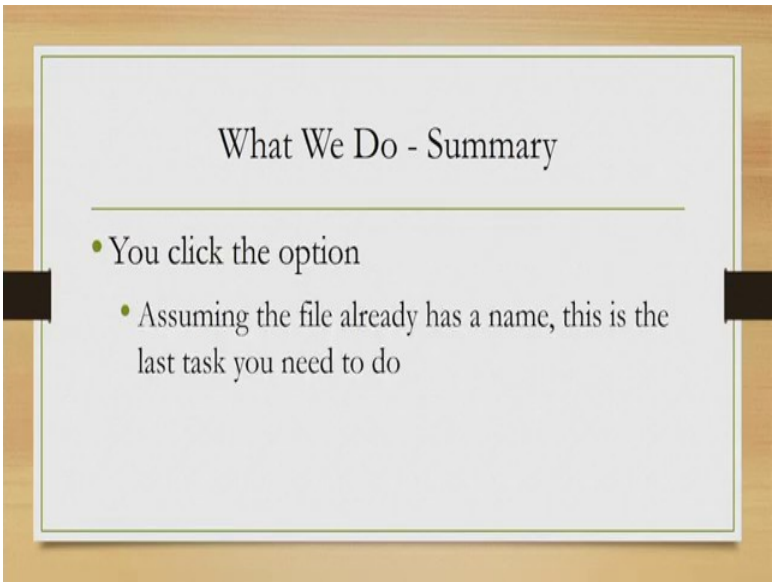

And then finally, we click on the option.

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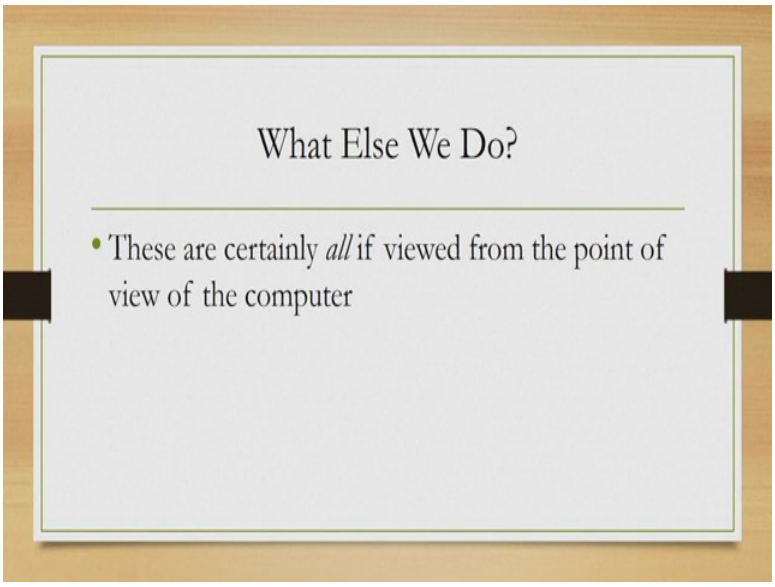

So, if you are a user, these setup activities may seem to be the all the things that you need to do to select the save option to save your editing activities.

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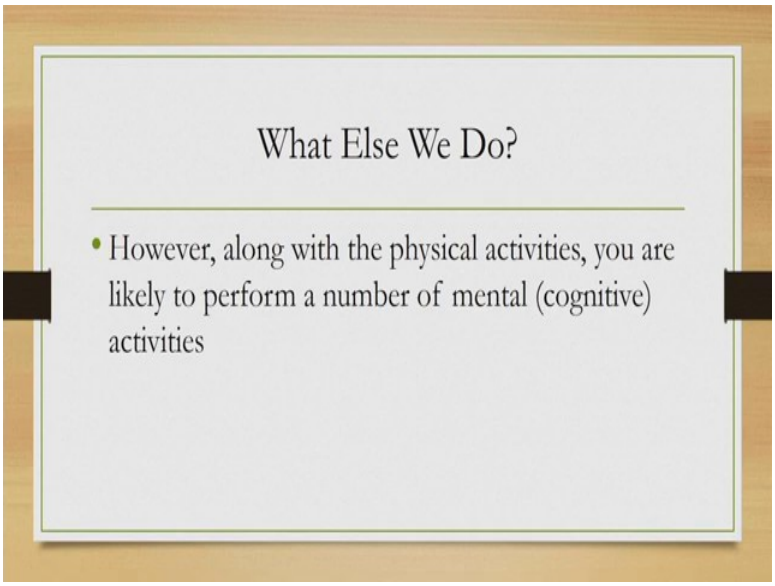

Now that need not be the only things that we do. Along with the physical activities, we also perform some mental activities. And in the previous listing of activities, we have not explicitly listed those mental activities?

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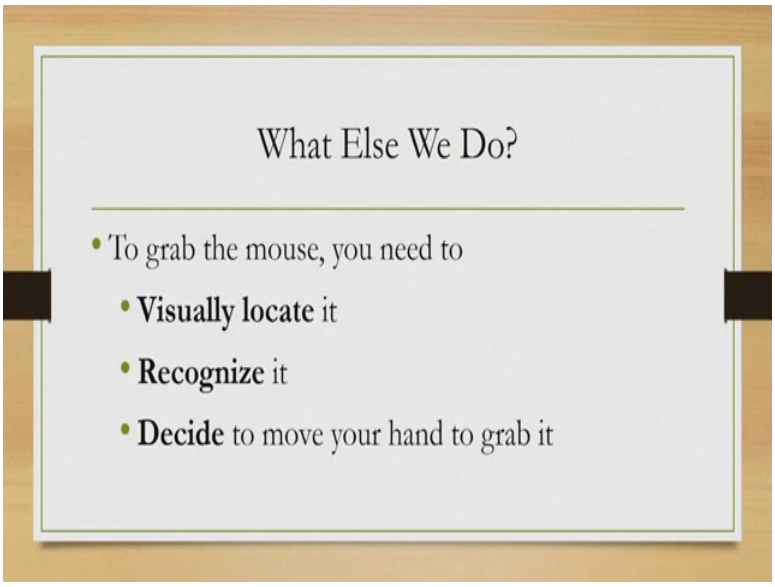

What are those mental activities let us start with the very first activity, grab the mouse. So, in order to grab it, what we need to do, we need to visually locate it or in other words we need to perceive the mouse. Then once the perception is done, we need to recognize the mouse that this is actually the mouse this is not something else.

But finally, once we recognize that this is a mouse which we have grabbed we need to decide to move our hand to grab it. So, first perception then interpretation then decision and all these things happen inside our mind, there is no physical activity involved.

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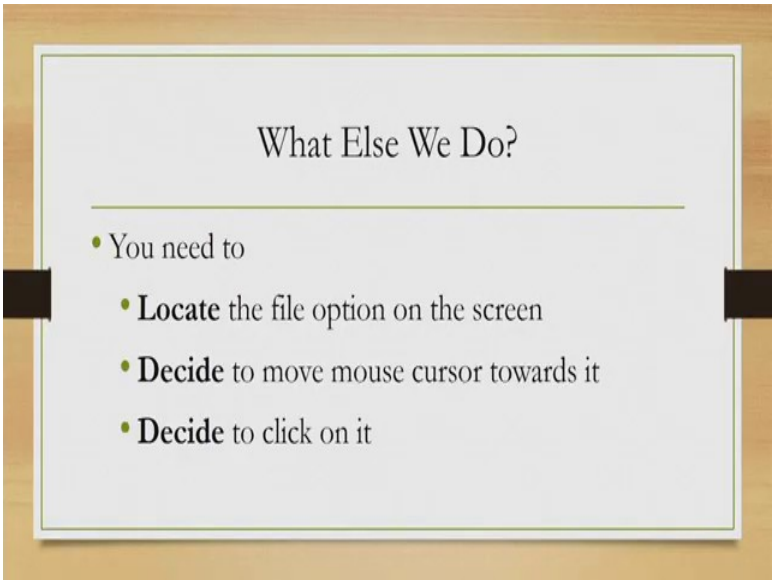

Similarly, in order to select the file menu option, we need to locate the menu option, we need to decide to move mouse cursor towards it, and we need to decide to click once the cursor reaches there. Of course, we have I have to identify when the cursor reaches there, so that involves perception and interpretation followed by this final decision when to click on it.

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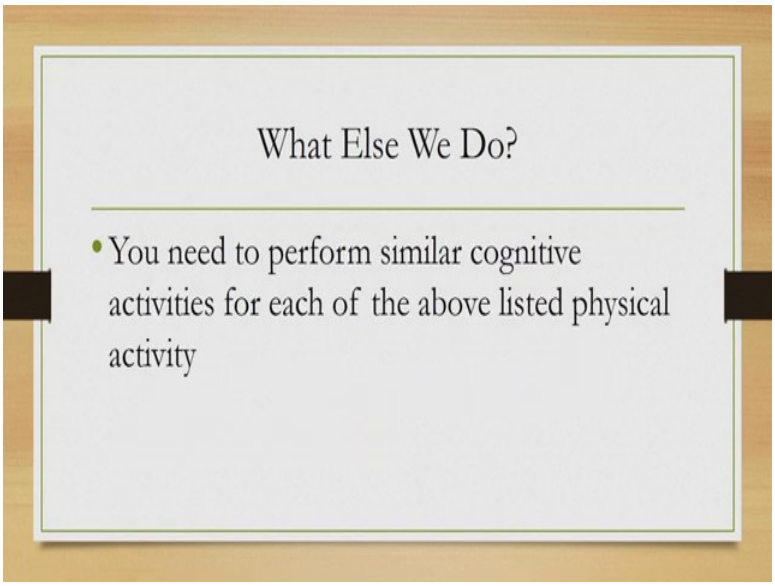

In fact, these activities are part of all the physical activities that we have listed before in order to save our file. So, whenever we are performing a physical activity along with that activity we are always performing a set of mental activities. And we need to take into account these activities in our overall concentration of the interaction.

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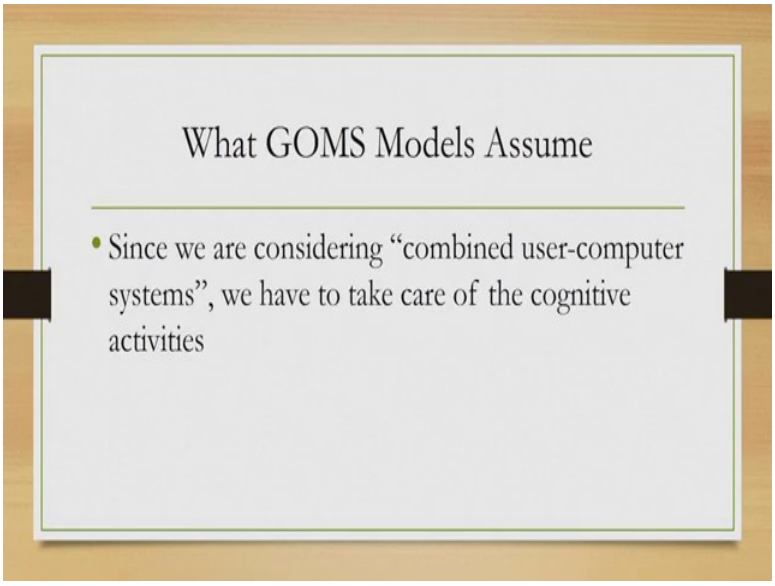

Because here we are considering combined user computer systems, so the consideration of those mental activities is essential.

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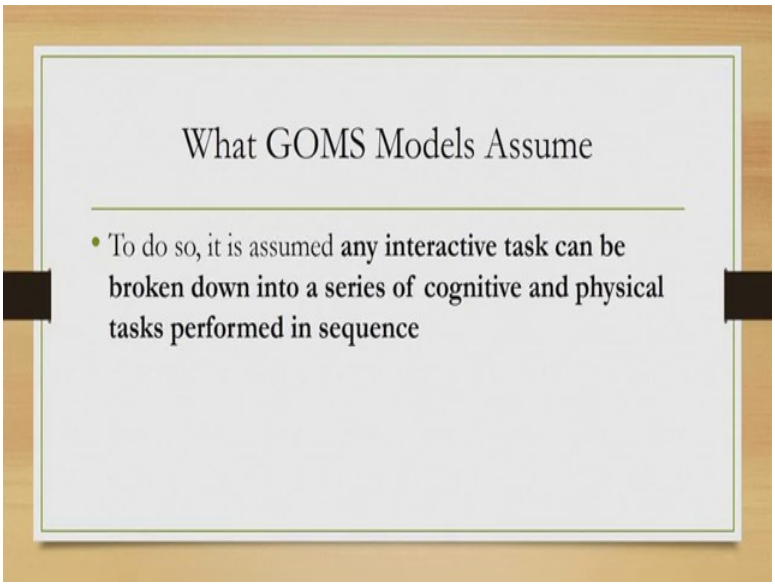

How we can consider the mental activities? Now, every time we are using the term mental it is the same as cognitive activities. So, we will use this terms interchangeable. So, whenever we are talking of these cognitive activities, how we can consider them in the overall interaction, so there is one simple assumption which this GOMS family of models make what is that assumption any interactive task can be broken down into a series of cognitive and physical tasks performed in sequence.

So, whenever we are thinking of an interaction task, we can break it down into a series of cognitive task and physical tasks which are performed in a sequence.

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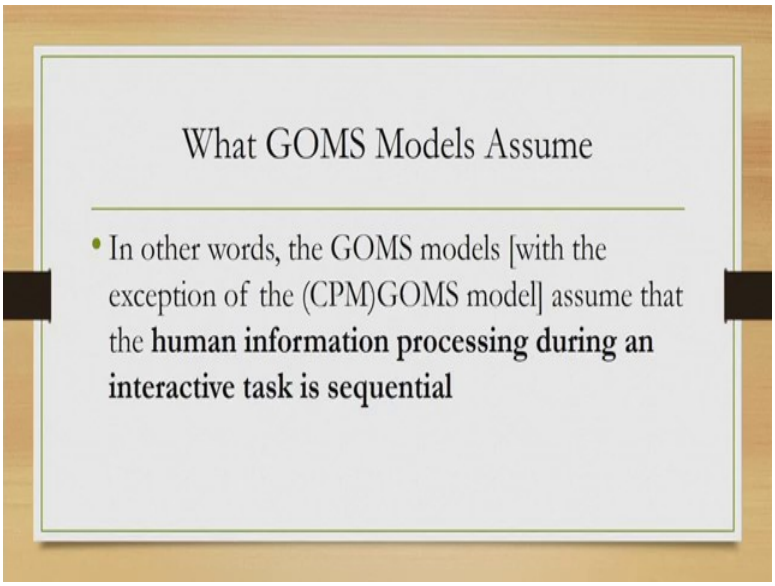

In other words, these GOMS family of models assume that human information processing during an interactive task is sequential. So, we think in a sequential manner in terms of sub tasks. Although I said all GOMS models, but among the four three of the models make the assumption, the fourth model critical path method GOMS or cognitive perceptual motor GOMS, this particular model does not make that assumption.

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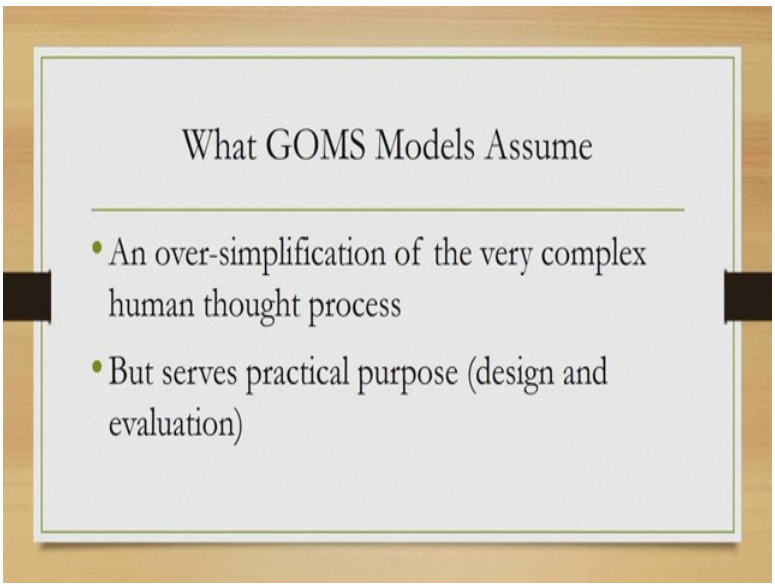

Clearly that is a very simplified assumption. We always make use of some parallel activities. For example, when you are talking to somebody at the same time you can

actually listen to surrounding sounds and make decisions or when you are reading something at the same time you can drink your tea. So, there are always some parallel activities involved.

It is not sequential that only one activity we are performing, but GOMS assumes that the human information processing during interaction task is sequential and can be represented as a sequence of activities physical and cognitive. So, this assumption simplifies many complex things that happens when we think when we perform cognition. However, although it is a very simplistic assumption it has its practical values.

Based on these assumptions many interfaces in particular graphical user interfaces can be designed and evaluated using the models which are based on this simplified assumption. So, GOMS models are based on simple assumptions, and we can use this models to design and evaluate GYs that are used in practice. So, even if the assumptions are simple even if it represents human cognition process in a very simple light we can make use of the models for many practical purposes.

In the next few lectures, we will talk about these models in details. However, there are two models that will be discussed we will not discuss NGOMSL and CPM GOMS our discussion will be on KLM and CMN GOMS.

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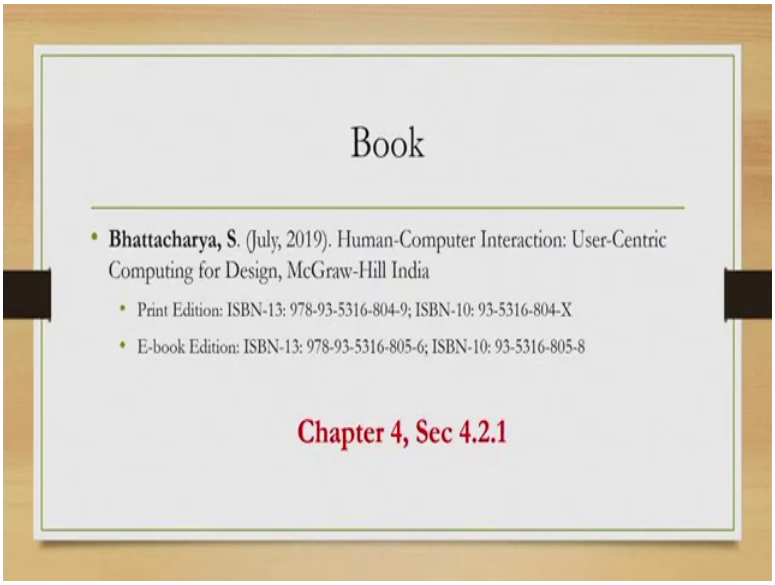

Now, this introductory idea of the GOMS family that we have discussed today can be found in this book including the relevant references. So, you are advised to refer to chapter 4, section 4.2.1 to get more details on these concepts that we have introduced today.

Thank you and goodbye.