Language, Culture and Cognition: An Introduction

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Module - 07
Part - 1
Lecture - 15
Language and attention

Hello and welcome back. Today we will start with the 7th module of the course and this module is dedicated to the various language processing techniques, various aspects of language processing with respect to attention. Attention is a very important fundamental mental process, fundamental cognitive apparatus and how language interacts with this process through various stages of engagement is what we will focus on in this particular module.

So, let us start with the part 1 of the module. This is how we will progress. This is the roadmap for this module. This we will start with what is attention. So, slight background information about what is attention, how attention came to be in the forefront of research in psychology and various models and so on and so forth.

Then we will move on to the role of attention in cognition and gradually, from there we will build up the story about how attention and language are interconnected and then the various kinds different types of attentional mechanism, that is specific to language processing. This is how the road map will work.

Now, the moment we say attention, all of us seem to understand what attention is. Attention is not something that is considered a technical jargon for that matter. It is something that is part of our everyday language use. Attention is something that we always all the time use as a word; pay attention to what your teacher says, be attentive to you know what is happening around you and so on and so forth.

So, this is a part of part and parcel of everyday language use. However, technical attention to attention as a as a domain of research actually goes back very long a long way, other long way to the 19th century at least. In fact, it is very interesting to note that even though attention today is a very important domain of research within psychology; in fact, within

cognitive psychology and within cognitive science, within psycholinguistics and so on and so forth.

Actually, researching attention or let us say scholarly work on attention began much before psychology as a discipline came into being, technically speaking. Psychology as a discipline came into being much later in time in chronologically speaking in 1950s, when we look at cognitive psychology, experimental psychology and so on and so forth, taking firm rooting in academia actually note in the work on attention precedes that by a few decades 50/60 years at the list.

So, the most important and the oldest reference point for this we will go back to Wilhelm Wundt, a German psychologist who is in fact, considered the father of modern experimental psychology. So, Wundt is considered to belong to the school of thought that is called structuralism. At that time structuralism was kind of more important way of looking at how mental processes work.

So, structuralism fundamental understanding was to look at any concept look at any aspect of human nature, human consciousness, human language or whatever into in terms of its components, how it is built up. So, in terms of language, we look at how words and sentences and so on and so forth are formed, what are the processes thereof, what are the sound structures and so on and so forth.

So, basically bringing down a particular concept into its components, into its parts; similarly, when Wundt talked about talked about attention or he talked about consciousness in fact, more to be more precise. He talked about consciousness, there he talked about how what are the parts, what are the components of consciousness.

So, experimental psychology in fact is understood to begin with him, when he established the institute for experimental psychology in Leipzig, Germany in the year 1879. So, that is how far back it goes and of course, Wundt was one of the one of the most prolific authors or one of the most prolific researches of his time, even today even in today's parlance, he wrote close to 500 papers, guided close to 200 students and many of them went on to become towering figures within psychology, within various domains of psychology and so on.

So, one of his one of his work also dealt with the domain of attention; specifically, attention control of naming and reading, for both typical as well as disordered language.

He proposed a model for attention in the year 1902 that assigns important role to top down inhibition. Top down and bottom up are the 2 types of processing that human beings engage all the time. This is something we have been referring to, we will refer to more of we will refer more to these later on as well as we look at experimental work.

What does top-down refer to? Top down refers to the goal oriented behavior of an organism. So, if I want to learn about this course, I will pay attention to what the teacher is saying, this is top down attention. I modulate my attentional mechanism with respect to or gearing towards my goal at this given point of time.

Similarly, if somebody is trying to get a good picture, let us say a photographer is trying to look at a, wildlife photographer for that matter, is trying to get a good shot of the tiger cubs. So, what he will do is he will focus his attention to the only to that particular aspect of the scene and he will not attend to other. So, this is called top down attention, top down mechanism and this is relevant for various mental processes.

On the other hand there is something called bottom-up processing. Bottom-up processing is entirely stimulus driven. So, even if you have not decided, even if there is no goal at hand right at this moment, but as I am speaking if there is a loud noise somewhere on that side or this side or behind me or somewhere in the corner of the room, my attention will immediately shift to that particular location, where the sound comes from, I will try to locate.

So, this is a bottom up attentional mechanism, where your attention is drawn by the stimulus that is outside in the environment, it is not dependent upon my goal as to I did not really want to look at it. So, Wundt actually talked about top down inhibition, top down attentional mechanism and in terms of attentional mechanism he also gave a lot of importance to top down inhibition, which is relevant even today.

Even today the latest models of attentional mechanism and the engagement and disengagement and so on, does find it very relevant does find Wundt's ideas very very relevant. This control mechanism is responsible for selective processing for one task over

another. So, we need to pay attention to something that is more relevant for our current goal or sometimes even to inhibit interferences.

For example, in a cocktail party; cocktail party conversation has been a very interesting domain of research within psychology. So, this is in a party when we meet different kinds of people, there are simultaneously many conversations going on. So, the at any given point of time, the conversation we are part of we try to pay attention to what the other person is saying to us and try to inhibit the other incoming stimulus, other incoming conversational input from around us, even though it is perfectly audible.

So, this is something this needs a control mechanism at a higher level of processing within the human mind. So, this is what we refer to as inhibiting interference that can be not only auditory signal that can also be visual signal, there can be various other kinds of signals, which we try to inhibit in order to pay closer attention to whatever is relevant for to for us at that given point of time.

This particular idea has actually remained relevant even today. In fact, it has been incorporated in a new model which is called the WEAVER-plus model for the neurocognitive version of attention which is applied to impairments. This is a model proposed by Roelofs in 2003.

So, this is Wundt, he is credited with he is credited to be the first person among psychologists experimental psychologist to talk about attention, to give a model of attention and more specifically, to talk about top down inhibition inhibitory mechanism and it has it is relevant even today.

Talking about attention we must also look at William James, who was a contemporary, he worked around his book ‘principles of psychology’ in 1980 was very very well known and he is famously quoted as saying everyone knows what attention is. So, attention was getting a lot of attention at that time; on the one hand Wundt gives his gives his models, on the other hand, William James says this is nothing very unusual everyone knows what attention is.

And then he goes on to define what attention is and he says attention is taking possession of the mind, in clear and vivid form, one out of what seems several simultaneous possible objects or trends of thought. At any given point of time, all of us are having simultaneously

many trains of thought running in our mind. It is impossible not to think of too many things at the same time.

All of us if you just close your eyes and you notice that is what a mindfulness and meditation is all about, to shut off all the incoming noises, but that noise is always there, that is a talking head inside of our head that talks. So, attention basically refers to as far as William James is concerned, is selecting only one particular object or train of thought and shutting out the other and this includes focalization, concentration of consciousness and etcetera.

So, these are the primary essence of what attention is all about. He also goes on to say that it entails withdrawal of withdrawal from some things in order to deal effectively with others. So, one has to withdraw, this is what later on later on has been called the inhibition or suppression of various kinds of irrelevant cues.

So, this is as you can see these are these things also are they do make sense today and things have not really changed much. However, it has not really been that simple even though Wundt talks about attention, even though William James talks about attention as if it is something very well known it is, in fact, that is where the paradox about attention is, it is because all of us think that we know what attention is.

We probably have not been giving enough attention to various aspects of it and that becomes very clear when Harold Pashler later on says ‘nobody knows what attention is’.

We really do not know what it is. This that is that is slightly because, we all seem to know that is exactly where the problem is: we do not really know what it is and then in Neisser in 1976 talks about attention in terms of allocation of resources and processing to a particular region or object.

So, we know what it does, basically. All of us all the researchers as well as common lay people will be able to tell us what attention ‘does’ rather than what attention ‘is’. And in fact, it is where that is part that is where the theoretical problems are, do we all know what attention is or do we not know what attention is.

In today’s terminology, things have not changed only the terminology has changed and also of course, we have better understanding about various mechanisms of attention in

finer details. So, in today's terminology, attention is a cognitive process that picks an important aspect of the world, either internal or external to focus on, this is how we can simplify and define what attention is in today's term.

So, it is a cognitive process. It focuses on one particular aspect, that aspect can either belong to the our external world, that is something that is happening around us, in the world in the social domain, in the cultural domain, in the visual domain and so on and so forth. Or it can depend on it can refer to some particular idea or a thought or something that is happening inside of our mind at any given point of time.

So, there are two kinds of world. We can actually pick and choose any particular aspect of that world and then focus our energies; we can realign or align our resources mental resources to look at it closely. This is roughly what attention means. It is also now understood to be associated very closely with goal directed behavior.

So, when we talk about top down attention, we talk about goal directed behavior. So, we have a goal in mind at any given point of time, we are doing something. So, to do something we have to attend to that thing or at least attend to getting prepared for doing that particular thing. So, there is a goal in mind and accordingly our attentional mechanism is geared towards.

So, very often more often than not attention is associated with a goal directed behavior and it is often a precursor to action. Obviously, if there is a goal to do something then there will be an action after the attention has moved to that particular area, so ok.

Then what is attention again then? we have seen that everybody understands what attention is, but it is not that easy to define, define in terms of very concrete words as to as to what it is. It is easier to say what attention does than what it is. So, it what it what does attention do, it does a lot of things it does a lot of things.

In fact, the list is getting increased, list is getting longer day by day and however, it is roughly at the very basic level it is understood to be sort of a glue, that aids in object perception. So, when we need to perceive an object properly, in a proper way, we object perception that is the particular goal of our mind at a particular given point of time attention aids that.

So, if I need to look closer so, there is a bottle in front of me, I need to look closer whether it is a water bottle or it is a bottle of sanitizer that that object perception will need my visual attention to be employed to that particular object at that location. So, this is what we mean by object perception. Perception is very closely attached to attention.

So, attention helps in object perception. A biasing mechanism that helps in task relevant target selection, again if it is not just perception, but also there is a there is a task to be done. So, if I want to sanitize my hands that is the task at hand.

So, if I have to then I will look around find an object that will match my task at that given point of time. So, this is a biasing mechanism. This will even though there might be more salient objects in the environment, there might be good book lying in the table or something or the other, but at that moment my goal is my task is to sanitize my hands.

So, I will be biasing my attention towards that object. It is related to action system, as a result and then it is also a contributing agent to consciousness. In fact, this is where how it began; in to understand consciousness and what are the real elements of consciousness is how attention research actually began.

And today of course, we have added a lot of other modules to that. So, basically it is a network of several distinct functions like alerting, orienting and executive control, this is where we are today. So, it is not just a one particular thing, it is a network and deployment of attention is goal directed or stimulus driven. It is goal directed when it is top-down mechanism, it is stimulus driven when it is bottom-up.

So, that brings us to a little bit nuanced picture of what attention is. So, these are various kinds of attention. Attention is connected to vision, attention is also connected to language, attention is also has a role in perception, object perception and various different kinds of perception mechanisms. It also has a role in feature integration, visual search, spatial attention, executive function, neurological basis neurological connections and so on and so forth.

This list is by no means exhaustive. Attentional mechanism is found to be a relevant part, an important aspect of so many different mental mechanism. These are just some of them.

As a result of which as we have more and more evidence of more and more different types of you know task specific attentional mechanism, with different kinds of human actions that are really relevant to attention, that are dependent on attention and so on and so forth.

Now, the there is a new there is a there is an agreement that attention as a mechanism if we look at it as at as an unitary system it will not really work. So, the way attention as a mechanism has been conceptualized till very recently has led researchers to propose a rethink on this matter. Till now, till very recently it was similar it was simply just called attention.

So, attention is responsible for perception, attention is responsible for a proper language use and so on and so forth. Social cognition as well has attention as one important component. We have seen it already in language learning how joint attention plays a very very important role in learning language in the initial stages of a child's language development.

So, language that is therefore, the attention has been understood to be a kind of an unitary system, but this kind of different findings have led researchers to propose that it should be rethought, it should be reconceptualized not as a unitary system, but as something else, as something that is a mega process, a big process, a super imposed process which has many modules within it.

So, that is why many of late many influential scholars have proposed that attention should be and I quote Hommel here Hommel et al, 2019 'the attention should be reconceptualized to focus on the subjects of the processes and mechanisms that lead to task specific performance'.

There are two things here, two main things here that there are subsets of processes. Attention is not just one single process, there are many sub-sets there are many modules within the larger process and one must look at those subsets and the task specific performance.

So, what is the task at hand; is it a language specific task, is it a perception specific task, is it an executive control related task, is it an inhibition related task, is it a visual search related task, depending on the kind of task we have and the kind of performance that the

human agent gives us and accordingly we must connect it to the subset of that attentional mechanism rather than looking at attention as a kind of a unitary system.

So, attention basically what it says is that attention must be brought down to or broken down to various sub modules to in order to have a holistic a thorough understanding of the process. So, most researchers in the domain that is why now refer to ‘attentional network’ rather than simply saying ‘attention’.

We now call it ‘attentional network’. So, that we can take into account the fact that it is not a standalone process, as I just mentioned there are so many different kinds of tasks. So, many different kinds of outcomes of those tasks and the way those tasks employ various aspects, they engage various aspects of attentional mechanism within a network; therefore we must call it a network rather than attention per se.

So, it is an interviewed one working together with many other functions. Decision making again is a very important what kind of decision you will take does not only depend on what your goal is, but also various other factors at a particular scenario. So, in one scenario one your you remain the same person, but the scenario changes your decision is of one type, scenario changes your decision might be of another type.

So, depending on what kind of decision you arrive at, we have actually paid attention to differential aspects of the scene and so on. So, results are the results are the studies are task dependent, as we have already seen and it refers to particular type of engagements within that.

So, this is roughly what attention has been. How attention was looked at in the earlier days and how attention is when we say attention today, we do not just say attention as a as some kind of a homogenous entity, but we talk about attention in terms of these facets. In terms of the task, in terms of the task specific result, and also in terms of the specific engagement of those task specific conditions, with various parts or with various aspects facets of that attentional network.

Now, with that kind of an introduction, let us move on to certain aspects of attention that has been studied so far in psychology and then we will move on to linguistics. So, these are some of the fundamental notions within the concept of attention, one is called orienting

and then comes cueing and then selective attention. These have been studied for a very long time now and there are many theories to it, we will go over them briefly.

What is orienting of attention? Orienting, as the word as the as the name suggests, it basically refers to the way we channelize, channelize attention to a particular object or an event or anything. An important and initial part of attentional engagement, orientation happens in the towards the beginning of the attentional engagement.

So, before we engage we have to orient our attention. Before we really look at look closely at a particular object, we must orient towards looking that thing. So, it refers to aligning attention with the sensory input the source often sensory input. So, it can be visual, it can be auditory and so on.

So, we align and gear it towards channelizing it aligning it with an input. So, there are two types of orienting of attention, that is that have been proposed. One is the overt orienting, one is covert orienting. Overt orienting is a process as it is as it says that the process involves overtly an orienting attention to an object, often by moving our eyes to that object. So, if I want to look at if I want to attend to that door next to my right, I will simply move my eyes to the object and look.

However, attention moving of attention, orienting of attention to an object or even does not have to be automatically connected to movement of eyes. It can also happen without movement of eyes, I might orient my attention without even looking. In fact, this is where a very important finding in today's modern psychological theories is has been given by Michael Posner as we will shortly see.

So, that is called covert orienting. So, there are two kinds: orienting can happen with movement of eyes, it can happen without movement of eyes, depending on which you can call it either overt orienting or you can call it covert orienting.

Again orienting is connected to what you call 'cueing'. So, with the help of a cue we can orient attention; sometimes it is goal directed, but sometimes it is stimulus driven. When it is stimulus driven we use a cue to orient one's attention. So, there is something that happens a cue can be anything, a cue can be a sound, it can be a light, it can be anything. So, that might attract our attention, what we call attracting attention is the cue.

So, that cueing and its role in orienting attention in covert attention, these are what Posner has looked at detail we will see this in a while.

Here another domain of area of research within attention is what we call selective attention. Selective attention is a very very important notion. This refers to selectively attending to one particular stimulus among many. This is fundamental for us to perceive anything clearly, to for us to take a decision about our action for anything. At any given point of time we are bombarded humans are bombarded with enormous amount of sensory input.

Imagine yourself going to a mall; in today's world people often go to malls to [ghumne jaane ke liye]. So, you would just go out and you go to a mall. Imagine yourself in the mall in any mall in any city. The amount of light, sound, various kinds of visual displays, various kinds of auditory input, it can be actually quite mind boggling, if we did not have a very very sophisticated system of selective attention in our mind.

In fact, that is where one of the one of the indicators of disordered cognitive disorders are; in many cases of what in for children in the autism spectrum disorder, this is exactly one of those areas where the problem lies. All those surrounding information clamor for attention at the same time and the filtering mechanism is not working very well.

So, they find it they find it is overwhelming and not able to tackle it very very well. So, selective attention actually is somehow impaired in those population. This is something we have also seen in terms of language learning, because joint attention is also missing. So, it seems that attentional mechanism is one of the very key factors in functioning normally in the environment.

So, selective attention therefore, is very very crucial. Experimental work on selective attention started way back in 1950s in the domain of psychology of course, and the very first types of experimental work on selective attention had used what we called what is famously known as dichotic listening paradigm. It looked at the auditory input.

Dichotic listening refers to listening through both ears, where you hear two different kinds of things in two different ears. So, the selective attention fundamentally is the key to acquisition of robust information. Until and unless we play we pay close attention selective attention to a particular stimulus, we will not be able to get adequate amount of information.

If we are attending to everything at the same time, ironically we are not able to get anything out of it. This is what happens with information overload in today's time. In today's time internet is there is flooded with information even small children are addicted to internet. So, there is always so much out there and because, there is constant changing of channels, constant changing of windows we are looking at so many things at the same time.

As a result of which, selective attention is often found to be missing in many growing kids, because of this particular thing. So, selective attention is very very important in order to have robust information. We move our eyes and fix it on things we want to inspect more carefully similarly, auditorily it is not visible. In case of eyes we can see that we are looking at a particular object more carefully.

In terms of auditory attention, we do not really see it. So, that is where the research has looked at dichotic listening. In fact, selective attention is found not only in humans, but even in insects. So, this is a recent study where they have looked at this particular phenomena, I will include this all these in the reference section for you to look at.

So, selective attention could mean several processes. It is again not a simple process, it can include various smaller subsets, like staying focused on something, ability to ignore irrelevant distracters and to monitor the ongoing activities for better goal directed behavior, these are aspects of it.

So, one needs to stay focused, selective attention does not just mean you look at it carefully and then you move away. You need to stay focused on that particular, this is something that is what we see when children play children or nowadays even adults play various kinds of video games. With playing various sort of this kind of games are actually found to be training the selective attention mechanism.

Because they are addicted, they are all they are playing this for hours together and this trains your brain to look at one particular object for a long period of time. So, this is what we mean by staying focused. Staying focused on something for a long time, this is a part of selective attention.

Similarly, at the same time you also have to ignore. So, in order to stay focused on one particular stimulus one has to also be able to ignore many other incoming information,

which is irrelevant at that point of time, at that point of time meaning that it is not relevant for your goal at that point of time.

So, ignoring irrelevant distractors is also a part of selective attention and then also to monitor the ongoing activities for goal directed behavior. So, this is what selective attention basically includes.

So, let us go back to the dichotic listening experiment that goes back to 1950s and there have been many versions of it of course. So, this is experimental work on selective attention and in humans started with dichotic listening experiments. What basically it entails is that there are two different messages played to two different ears of the person and the subject then is asked what he heard.

There are many versions of it, the in case of an dichotic listening without any overt task, let us say something like this. So, this is let us say this is some kind of an earphone and this let us just consider this is a human head and so, if there is a message here and there is a different message here.

So, the famous example was of 'Abraham Lincoln liked to read under the in the light of fire' and then there was something else played here. So, when you hear two different things in two different ears and then the subject is asked what did they hear, it is very difficult to selectively be aware of what actually happened. So, in most of the cases it the subject were finding it subjects found it difficult to separate the messages in terms of meaning.

However, when dichotic listening happens with overt attention, in the sense that in this experiment the listener is asked to repeat what they hear in the left ear. So, there are again two different messages played to two different ears, but the subject is asked to overtly repeat after what they are listening in that particular ear, this is also called a shadowing effect.

Because as they are talking about it, they are they are paying attention to what is happening in the left ear and as a result of which they are shadowing what is coming in through the right ear. So, basically the message that is coming to the right ear is unattended, because if you have to repeat what you hear you must pay attention to it.

So, they were basically overtly paying attention to the message coming in to the left ear and they were not paying attention to what was coming through the right ear. The results showed that they could not detect meaning or you know change of participants or even when there was a reverse setting of the speech in the ear that was not attended to. They were basically sometimes they did not did notice some of the physical properties like change of tonality and pitch and so on.

However, language aspect of it, the meaning the change of various things so on and so forth did not get noticed.

So, this is about what is what you call dichotic listening. Of course, there are finer nuances to it, but this is roughly what it is at this point of time. We will take it up later when we talk about in terms of language. So, basically humans notice very little about unattended message.

So, basically attention is important for us to look at meaning, in order for us to understand. So, this is how selective attention was looked at that time at that time, in the beginning years of experimental work on selective attention.

Therefore, there have been many models of selective attention as well. The first model was the Broadbent's early filter model which talks about. So, basically all these models talk about when the filtering mechanism happens. We get a stream of incoming stimulus and then we attend to them, we understand meaning of it we and then depending on what we understand we do something about it, there is a goal to it to it, but where exactly does the filtering happen, where do we start paying attention?.

So, depending on that there are very many models. There is one is Broadbent's famous 'early filter model'. Then there are some 'mid selection models', there will one is famously called 'Dear aunt Jane experiment' and then of course, Treisman's 'attenuation theory' and then there is yet another model 1973 Mackay's 'late selection model'.

We will not get into the details of this, because right at this moment it is not relevant for us; but the main difference between these different models are that early selection model says that we attend to a meaning in terms of language. We attend to a meaning later in the process, selection happens first.

So, we select the message that is important first and then we pay attention to it, but the late selection models talk about attention to meaning takes place much before the filtering process actually takes place. So, this is in terms of how the different kinds of models takes care of where exactly the filtering system happens.

Another important notion of within the understand within the domain of attention is the role of attention in perception. That is something we have been talking about and then in within the role of within perception, there is a particular understanding particular kind of phenomena which is called change blindness.

There is this game, we even now there we see those games, there are scenes. So, there is one particular picture and then there is a gap and then there is another picture. So, what do you notice? what kind of change do you notice in the second picture from the first picture, this is the this is the task. This is the test which is called the Flicker test, it also has many other names.

So, the change, what kind of change do you see from the first picture to the second picture this is the task. Often, a lot of people fail to find the change. Why it happens is because, visual system is designed in such a way that it needs continuous input. We do not see the our world in snapshots, we see it as a continuous kind of a stream of input.

So, this is the that is how the visual system is prepared for. So, it needs continuous input. So, now, in a Flicker test, what happens is that there is a blank screen; it will not work if there is no black screen. It works because, a blank screen kind of messes with that information power processing system.

So, it creates by creating this it makes it non continuous, the stream of visual input becomes non continuous by virtue of having a blank screen in between and that is where it creates a problem in understanding the change and this is what is famously called the change blindness in humans. This has been replicated in many studies across time, but this is a fundamental notice.

In fact, there is a very interesting study, interesting group of studies rather that looks at change blindness in real world not only in the laboratory setting, but also in the real world. One famous study was carried out by Simons and Levin in 1998, where which is called the pedestrian experiment.

What they do is a person the experimenter goes and talks to a pedestrian a random pedestrian and asks for some road, some direction or something. Just goes and starts talking to a random stranger and while they are talking, two people come and cross the path with a big board or something. While doing so they interrupt the conversation and they change the participant in the conversation.

So, the person who was talking to the pedestrian before, has now been changed to another person, actually this is a trick that those two people carrying a huge board is part of the experiment. So, one of them shifts changes into changes the inter the experimenter. However, in 50 percent of the cases the pedestrian, the stranger with whom the experiment is being conducted, they do not notice that the person they were talking to has changed.

So, this is something called a change blindness. So, you were talking to somebody and suddenly there is an interruption and then you are going back often you fail to notice. This has happened in at least 50 percent of the 50 percent of the subject.

So, this is a very important aspect of attention with respect to perception. Now, let us move on to one of the most prolific scholars of our time, in terms of attentional research Michael Posner. Michael Posner has given us a understanding of attentional network, where he says that there are many aspects to it.

Many aspects to attentional network, attentional mechanism and these include sustained attention, which means that allocating resources should have to be should be done over time, while maintaining a steady level of performance. So, for example, playing a video game, one has to continuously be engaged, continuously focus our attention to what has to be done while simultaneously doing what has to be done. So, the level of performance has to be also steady.

So, this is one aspect of attentional network and then there is orienting. Orienting as we have already seen, disengaging from one location to reorienting to a different spatial location. Selective attention we have already seen in this and then executive function. So, executive function is the sensory motor output, something that we have to do after we have attended to something, something that needs action, that is called executive action. Executive action actually includes both inhibition and action.

So, inhibition is stopping yourself from reacting or acting or this is something you see lack of inhibition is often leads to a lot of problems. In today's time you see that is a knee jerk, what you call knee jerk reaction to many stimulus. So, you see some inflammatory content on the social media, immediately we start reacting and you know so, forwarding the same message and so on and so forth without really verifying its content.

Often more often than not no matter where the source is many of them turn out to be incorrect, factually incorrect, but however. So, what is happening here is without thinking if we process it further, forward it or no comment on it or create a big noise about it, this is meaning that we have not put the inhibitory processes into action. So, that is only we are acting on it there is no inhibition.

So, executive control so, that is executive control part is missing here. So, executive function needs both control as well as action, as we will see in finer detail in the when we talk about the research findings.

Michael Posner's work first demonstrated that attention can orient in space without movement of eyes. This is something we talked about we said that covert orienting. So, covert orienting the most important landmark finding was by Posner's Michael Posner who actually experimentally showed it, that attention can really move even when you are not moving your eyes. So, attention can be summoned to a location using a peripheral cue.

So, that is why where cue is important this is called an exogenous cue. It exogenous cue as in this is something in the environment. It is a it is a bottom up process. So, there is a cue in the environment by using which we can actually orient a subject's attention to that location where we want him to be. So, similarly one can direct attention to a location voluntarily as well, which is called endogenous cue, which is a top down process.

So, this Posner showed this with a simple detection task. The detection task was like this: the subjects had to detect a target appearing in one of the two place holders that are equidistant from the central fixation cross.

So, this is the screen on which there were two placeholders, two boxes, one of which will they were they are actually similar size the they are same in every other way the and in one of those boxes a particular object will appear. So, the target that the object that the subject has to attend to will appear in either of these boxes.

The person who is taking part in the experiment does not know where it will appear. So, what happened after that? In some trials, one of the boxes only one of the boxes is flashed briefly, some light appears or the color gets brighter or whatever. At this moment the subject is looking at the participant in the experiment is looking at the fixation cross in the mid in the middle and as soon as the one of the boxes flashes briefly, his attention is moved to it involuntarily reflexively.

Even if you have not, even if you do not really look at it by overtly orienting your gaze your eyes you have still moved. How do we know that, how did it show that? In some other so, in cases the one of the box in some cases one of the boxes flashed, in other cases a central arrow head appeared. An arrow appeared in the middle, pointing towards the box. So, in both cases whether it is a flashing of one of the boxes or appearance of the arrow-head, attention will move.

So, the manipulation in the task was the percentage of trials where lighting of the boxes or the appearing or of the arrowhead predicts the appearance of the target. What is happening here? There are two boxes; the target will appear in one of the boxes. Before that either a box lights up or an arrow-head appears. In some cases none of this happen and, but the target still appears.

So, it is randomized and equally distributed. Now, what they find out is that, crucial finding is that when the target appears in the box where there has been attention has already moved, the detection is faster. Actually it is the other way round. What they see is that in those cases, where the one of the boxes has been already either flashed or pointed to by the arrow and the target appears in that box the person actually detects.

So, the task is detection task as soon as you see the object in that target object in the box you have to press a key. So, that the experimenter knows that you have seen. So, the time that you take, reaction time that you take after seeing after the target appears from the time the stimulus really appears and then you react that is faster.

So, the detection is faster, when the target appears in the same box, where there was a flashing of light or the arrow pointed towards it. This is what basically the finding is. So, let us say this box flashes briefly, very very briefly. All these experiments take place in terms of milliseconds. So, this box is flashed briefly very very briefly and soon after that flower or a picture of a flower appears.

So, the subject sees the flower and immediately presses a key. So, this let us say the reaction time is 400 millisecond in this particular in case of this. As opposed to this the target when the target appears here and this box has neither been flashed nor been pointed to by the arrow and in this case the object detection by the participant is, let us say, 600 milliseconds.

So, what this proves is what this proved for Posner and his group was that this is faster, because attention had already moved there. Why had the attension moved? Because there was a cue there. What was the cue? This flashing of the of the box or the arrow head here.

So, both of them are pointing to the box and because the subjects, because the person taking part in the experiment had detected the object appearing in this box faster, let us say the box B faster as opposed to the box A, which means his attention was already engaged there, he merely had to look.

So, attentional engagement, attentional orientation is possible even when you are not looking at it. This is the most remarkable finding by of Posner in terms of orienting, covertly covert orientation of attention with the help of a cue. These are exogenous cues, these are cues in the visual field.

So, in that is part of the stimulus part of the sensory input. So, this is why they are called exogenous. So, there are three stages of such movement of attention. He goes on to say there are three phases. First is orienting. So, attention moves towards a location without eye movement, either due to the cues as Posner showed in these experiments or in or some cases you want to look at it. So, that is a top down process.

And depending on the perceiver's goal in this experiment the goal was to detect the appearance of an object in that box. Depending on the perceivers goal attention can be either engaged at that location or disengaged from the object. So, if you have a goal to accomplish, if you have a task to do then you keep your attention engaged to that object, but if it is if it does not really merit your attention, you disengage.

And then so, basically this is this operates like a cycle, orienting, attention engagement, disengagement and get back. So, this goes like a cycle this is and this happens on an everyday basis at every given moment of time.

We are constantly upgrading information in our visual world and this is how we upgrade the information load. We are constantly orienting attention and deciding whether it requires us for requires us to engage our attention. If it does not, we disengage and we come back and again engage in another object and so on, it is a constant cyclic process. In this cycle there is a remarkable finding again, which is called the inhibition of return, IOR in short.

What is inhibition of return? Inhibition of return talks about that if a location or object has captured one's attention already then another object appearing in that process is likely in that location is likely to get priority processing, which we just saw in Posner's cueing experiment. This is called Posner's cueing task which has been replicated again and again in many different formats.

So, this is or this is something we already know. So, if attention has already moved to a location object detection in that location is faster. However, it has been found that attentional mechanism is reluctant to return to a place where it has been recently. If the attention is already there and something else comes in, we detect it immediately.

However, because it is a constant process of engagement and disengagement, if the disengagement has already happened, then the mechanism has some reluctance to go back there. This is famously called the inhibition of return; that means, we do not want to return which we have left right at some time back.

This is one of the most important findings in this recent times. This "disengagement hypothesis" with respect to IOR was first proposed by Posner as I just said Posner and Cohen in 1984; however, this has been further developed by Raymond Klein in later years. So, how this in IOR actually inhibition of return really works has been updated.

So, this happens when attention is disengaged as we just said that orienting, engagement, disengagement and coming back. So, this is how it goes. So, if it if the disengagement has already happened, then it is very difficult to re-engage in the same location. If the second cue follows the first in rapid succession, this facilitates processing.

So, when how do we know it has disengaged, how long is the engagement, how long does it take for the eyes or any the entire attentional network to disengage, that seems that there

is a time window, there is a time window. So, if there is a gap of 250 to 300 milliseconds, then IOR effect is seen.

Before that so, if your attention has been captured at a location and then the target object appears there within 250 milliseconds, then the detection is very very quick. However, if there is a gap of 250 to 300 milliseconds between your engagement of the attention and the appearance of the target then, IOR has already set in. Why does this happen? 350 milli 300 millisecond is a remarkably small time, remarkably small time window.

This means that our system our mental mechanism, cognitive apparatus is basically geared towards optimizing. We cannot keep continuing to look at something that has nothing to give us. So, if we keep constantly looking at a particular object and then we do not really expect anything to happen there, then we cannot really waste the resources.

And knowing and ignore many other probable salient features in the environment. So, that disengagement is as important as engagement in terms of attentional network. So, that is why we see this effect.

So, disengagement happens and 250 to 300 millisecond is the time window after which we see this effect. However, the research findings are not entirely ah non controversial in this domain. So, this is not really certain if both endogenous and exogenous cues will give rise to IOR and if they do if whether they will be of the semi of similar nature.

It is widely believed that endogenous cues do not typically give rise to IOR. What is endogenous cue again? Endogenous cue is the cue that is part of the top down processing. So, we want to look at something we need to. So, there is a goal in mind.

So, when there is a goal in mind and we have with the goal in mind, we have geared our mechanism attentional mechanism to a particular location or a particular object or whatever, then we have already spent a lot of our resources mental resources. So, it is not very good idea to disengage quickly, right?

So, if we have for example, if we have you know prepared very hard for an exam and then the exam is you know on the day of the exam there is a there is a [bandh] or there is a you know heavy rain or something we would still try to go and sit down at the examination

hall and take the exam. However, if there is no such goal and we were just thinking ok, there is a new mall that has opened and this is a this is a stimulus in the environment.

So, we may want to go there, but if there is a problem we just do not go. This is something similar. So, if we if it is an endogenous process, we might not see the IOR effect, but if it is an exogenous cue that has engaged our attention, then the IOR cue is visible more clearly and more commonly.

So, that is why it is IOR is commonly observed when the cue is exogenous, because it was less effortful because, we have not really engaged much of our mental resources there.

So, most studies use an arrow for triggering endogenous attention shift. By definition, endogenous attention shift is under the control of the perceiver. So, when we see an arrow, we already know that we have to look at that, but then even there is a lot of controversy here.

So, even things that are considered endogenous cue like arrow in the in the Posner's cueing experiment. Even that is a learned behavior using an arrow for cueing our attention is a learnt behavior in the modern society. Imagine a society where this kind of things do not exist, road signs do not exist for example, left right this kind of words do not exist for example.

For all of us it is like an automatic behavior, when we see left in a road as in the road sign, we turn left, when you see right we see we turn right and so on. But this over a period of time this probably has become an endogenous cue, but at some point it was a learnt behavior. So, at that time it was an exogenous cue.

So, what really is exogenous and what is an endogenous cue? There is some amount of disagreement there. So, hence puts this attentional mechanism in the social domain. So, this is a learned behavior. So, every society has its own different ways, in spite of all the homogenization that we see today's in today's world, there are still societies that are different.

So, this is where differences might be seen and this is where actually we can have a lot of differences. So, directions direction words like up, down, shift attention reflexively and then it affects eye movement in today's world.

So, there are all these by now you see there is attention, when we say attention it is not a simple thing. It is not a very homogeneous simplistic small mechanism, it has many many facets to it has many aspects to it. So, we need to focus our attention on our attention again on a certain aspect of that.

So, this is this was an introduction given for the for that purpose to make it clear that attentional mechanism is actually a network of various interconnected aspects. We will be focusing on only a few of them with respect to language in this module. So, we will look at attentional network of language, vision and attention connection.

So, language in terms of language visual attention, primarily will look at so, language vision interaction with respect to attentional mechanism and what are the contributing factors that lie within.

So, you this is actually a small part of the entire attentional network mechanism and even within that we will look at what are the factors that help modulate this particular connection, this particular network. What are the mechanisms that work and how are they modified, modulated, changed and so on and the results of this function in various linguistic processing domains.

So, even when we say language processing it is not again a unitary thing. Language processing includes speech processing, signal sentence processing, word processing, phonological processing semantic processing and so on and so forth. So, when we say language, vision and attention interaction, we are again looking at a huge network of finer, smaller domains.

So, we will look at may, some of these if not all the nuances may not be possible to cover for brevity of time, but we will look at various linguistic processing domains with respect to attention and vision interaction. This how we will take this is what we will take up from part 2 in detail.

So, let just give us very brief overview on the of the language vision interact language and attention interaction. Previously till by Chomsky famously said that language as far as language is concerned it is an unitary, it is a module in itself. It is insulated from other mental mechanisms and hence it is unaffected by other mental processes.

Language processing is sacrosanct. In fact, he even he gave a higher status to syntactic processing within language processing and says that it is the most important part of it and it does not depend on any other mental process. Language processing is more like reflexes.

So, as a result of which we have what we call famously, what is the famously called the modularity of language view and there are some very important researchers who have looked at it more thoroughly. Fodor's work is one of the earliest and then of course, there are many followers. So, that is the modularity view, where language is considered unaffected by any other mental mechanism.

However, in recent times, an increasing number of studies show that language processing in many many domains do indeed involve the attentional mechanism, for one. There are many others, but attentional mechanism yes. So, in case of picture naming, that is word processing and then sentence generation and so on. So, there are these areas that we will start with respect to language and attention connection from the next part.

Thank you.