Great Experiments in Psychology
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Module 1
Lecture No 2
Establishing Psychology as a Science

Hello everybody, welcome again to this next session of Great experiments in Psychology. In today's class we will discuss about how psychology was established as a science. In the previous classes we have talked about how philosophy had psychology had its roots in philosophy and how the philosophical changes in the world brought about a movement in developing psychology, establishing psychology as a science.

In today's class we will talk about the famous biologists, physiologists and medical practitioners, who an actually involved psychological counterpart in their work; and that is how, brought about the new science of psychology. The beginnings of experimental psychology started with empirical philosophy. We discussed that in the previous session and we saw that there was a (())(01:15) called an intellectual movement that was taking place all across the world especially in Europe.

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Now what was happening in Europe was there is a scientific revolution going on and this revolution were presented the beginning of enlightening thought and during the 17th and 18th centuries people started having more confidence in human reason and experience instead of faith in religion and traditional authority. So they were asking questions, they were asking

questions about the natural phenomenon, they were asking questions about why there were different behaviours in human kind, why people behave in a certain way, why certain physical and physiological experiences came about.

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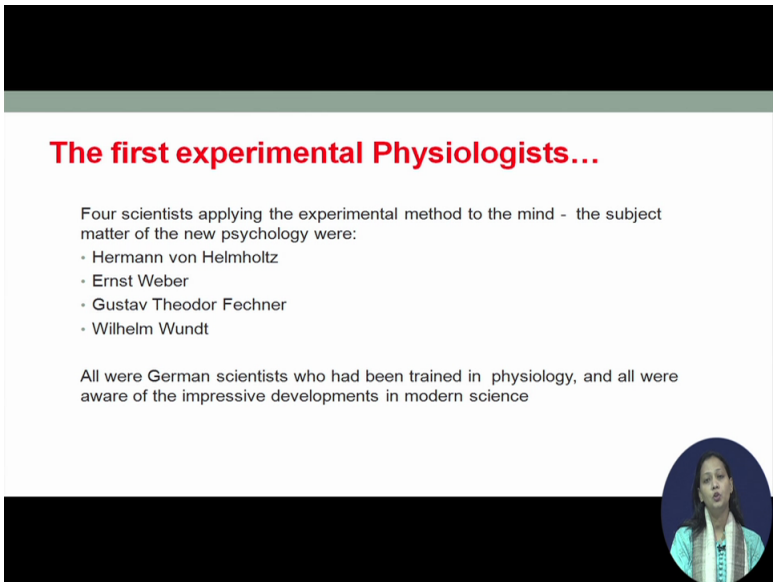

And this made these questions brought about various changes in the world of science. The first experimental psychologists were primarily psychologists from physiologists from Germany; we talked about physiology having a major role in the development of psychology. In the last class, we also saw how physics had an importance in developing psychology as a science. Today, we are going to discuss the four major people who had influenced the development of psychology as a science. And they are Hermann Von Helmholtz, Ernst Weber, Gustav Theodor Fechner and Wilhelm Wundt.

Most of us know of Wundt as the father of modern psychology, in our following classes today in the next class we will discuss as to why is it important to understand the role of Helmholtz, Weber and Fechner in the development of psychology and how and why is Wundt called the father of modern psychology. Mind you, I am specifying on the term modern psychology primarily because psychology as we know existed from long back and there is a history of psychology even in the Indian religious texts. Now we are not going to discuss about philosophy and the role of psychology and its role in religion and practice and also in the other religious pictures, but we are talking in here we are talking about experimental psychology.

Now this was it was seen that all of these 4 people that is Helmholtz, Weber, Fechner and Wundt all were Germans scientists and who were either trained in physiology or Wernicke's practices and all were aware of the impressive developments in modern science. Now, what is important to see is they are all from Germany. Now why Germany, why was Germany taking such an important part in the development of modern psychology. One of the major reasons being that Germany was a country that encouraged different biological sciences has or considered the biological sciences as a scientific discipline and encouraged this experimentation. France and England and especially other European countries were however, more keen on studying physical matters.

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So to them the sciences primarily meant studying the physical sciences and biological sciences had not yet opened up so much in the other countries and Germany on the other hand, also expressed interest in aesthetics in archaeology in several other fields and considered them phonetics and considered them as a part of science. Now most of these physiologists as you will see who would generally who would become either practise mathematics or physics along with medical science or physiology. Now that probably Germany that is why was the seed ground to develop psychology. It was a new discipline, it involved lot of physiology and questions that could be answered by physiology and so probably Germany was the ideal place to encourage this science.

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Now coming to the first person who had a influence in the development of psychology as a science experimental science is Hermann Von Helmholtz, Helmholtz strangely had no idea that he would be so popular and so well known in the field of psychology. Helmholtz was a medical practitioner and he had served the army for more than 7 years, he was a researcher in physics as well as physiology.

Psychology ranked third in his area of scientific contribution, yet he has been instrumental in the beginning of the new psychology. Helmholtz emphasized a mechanistic and deterministic approach and he assumed that the human sense organs functions like machines. Now look at this, there this is influence of physics and other scientific disciplines in these researches and you can actually see that psychology also had its other influences from physics. So Helmholtz preferred using technological technical analogies like comparing the transmission of nerve impulses to the operation of a telegraphic.

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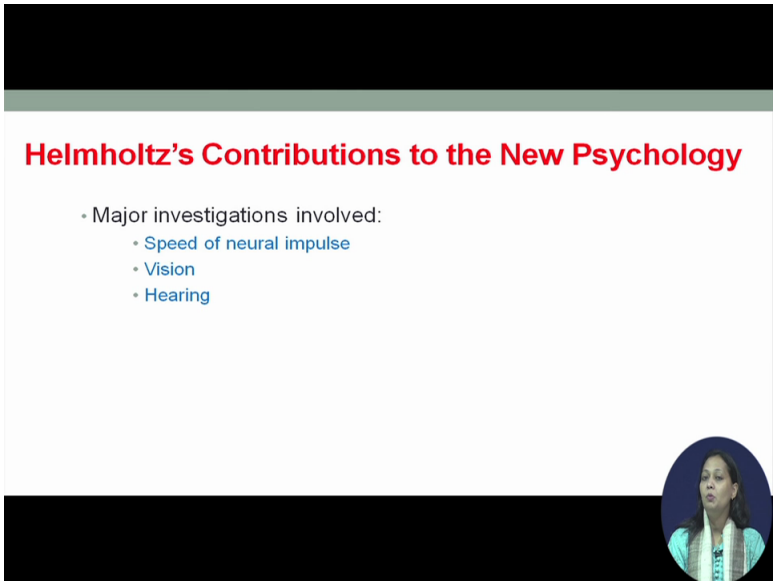

So it is strange that at those points in times, work was more interdisciplinary then isolated and segregated into specific disciplines. Now Helmholtz's contributions had majorly involved investigations in Speed of neural impulse, Vision and Hearing. Considering the speed of neural impulse, before Helmholtz people believed that the nerve impulse was instantaneous that is it travels too fast to be measured.

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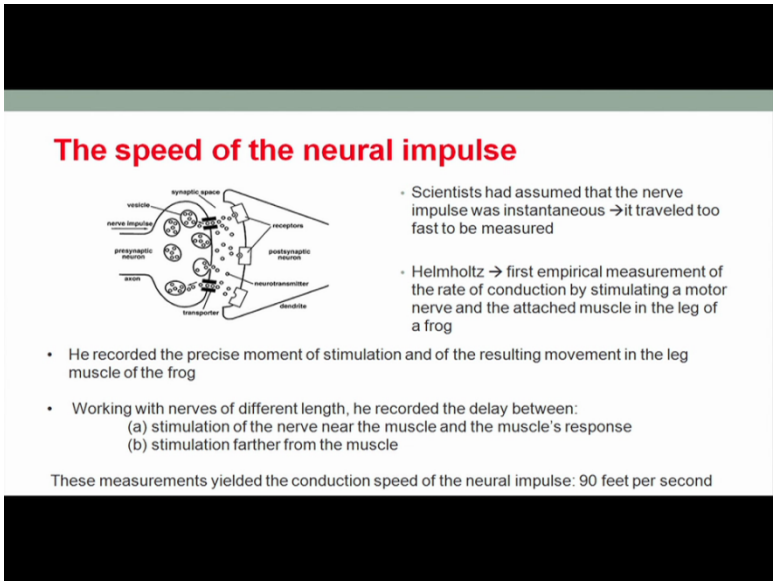

Now Helmholtz through his experimentation showed that the rate of conduction could be done by stimulating a motor nerve and what he did was he attached the nerve to a muscle in the leg of a frog and he recorded the precise movement of stimulation and of the resulting movement on the leg muscle of the frog. So this lag between the stimulation and the resultant

response actually gave him an idea about the time taken for that nerve impulse to travel. So he found that he recorded the delay between the stimulation of the nerve near the muscle and the muscle response and stimulation from the muscle and these measurements yielded the conduction speed of the neural impulse to 90 feet per second.

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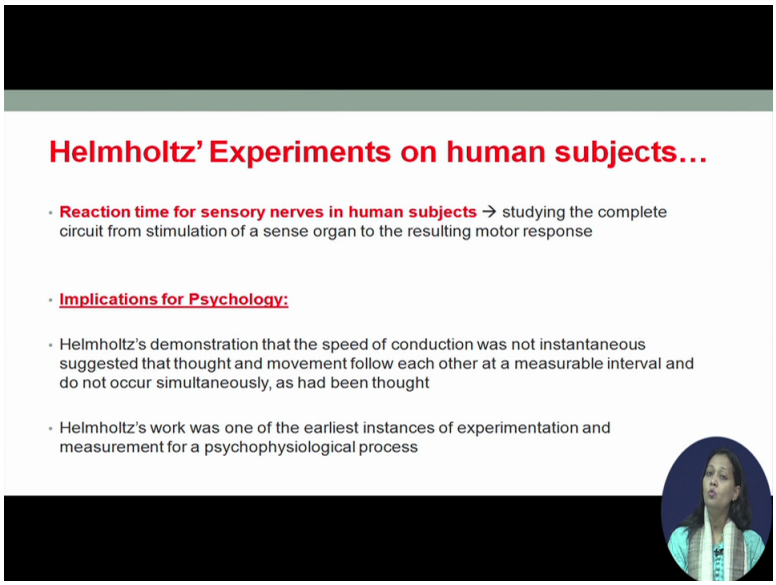

So Helmholtz not only experimented on the frogs but he also tried out on the human subjects and what he did was he tried to find out the reaction time for sensory nerve in human subjects, so he studied the complete circuit for stimulation of a sense organ to a resulting motor response and this is the first experiments recorded experiments on reaction time that have been done. So students of psychology today, you must be well aware of Helmholtz theories of vision and audition which will we come to later, but he was also you must be very familiar with reaction time experiments but this is probably the first reaction time experiment recorded of the time and this is way back in the 1800 where reaction time of sensory nerves were on/off human subjects were recorded by Helmholtz.

Now, what was its implication for psychology, seen that Helmholtz's demonstration that is speed of conduction was not instantaneous that is it did not happen immediately. There was a delay suggested that thought and movement follow each other at a measurable interval and do not occur simultaneously as has been thought. Helmholtz work was one of the early instances of experimentation and measurement for a psycho physiological process. So as we said right now that the very idea that thought and movement may be involves before a stimulus before a response. This is probably the first experiment of his time that encouraged this theory, so

Helmholtz's experiments though he conducted it from a physiologists point of view it has major implications in psychology.

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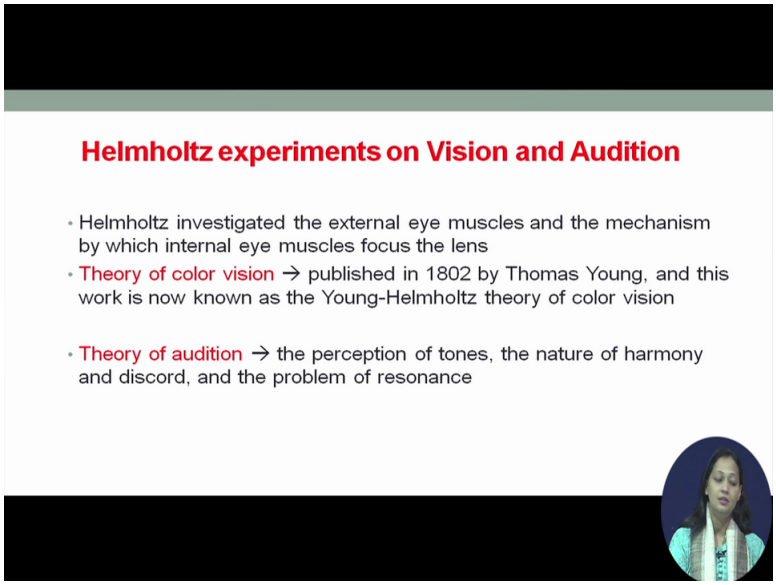

Now, as I was mentioning right now Helmholtz investigated the external eye muscles and mechanisms by which internal eye muscles focus on the lens and many of us are well aware of young Helmholtz's theories of vision and this was because it was published in 1802 by Thomas Young and that is how we know it as. The theories of audition include the perception of tones, the nature of harmony discord and the problem of resonance and again Helmholtz is famous in the theories of vision as well as understanding the theories of auditions. Now, how we have seen that his major investigations in understanding the neural impulse vision and hearing, contributed to the new psychology.

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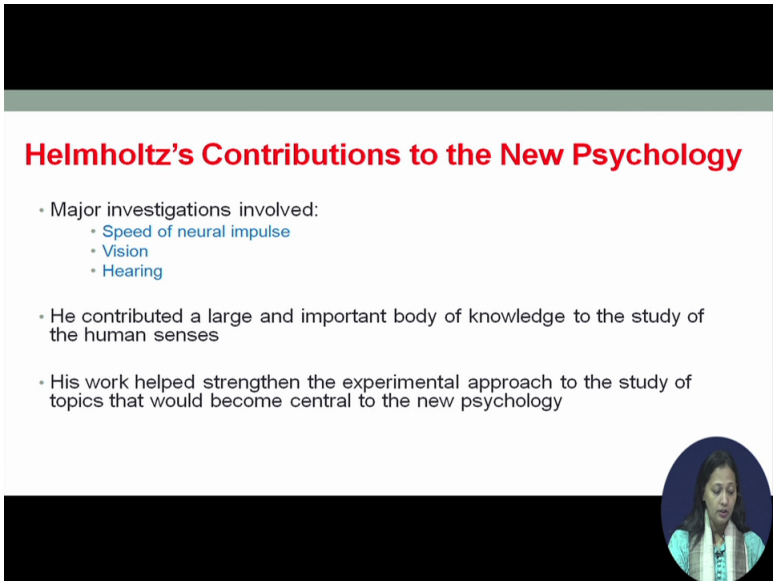

How he contributed a large important body of knowledge to study the human senses, so before this, we were studying the physiology in a more what should I say in a more structured manner where the human organism was not taken into account, this is the first time first of its kind besides his work helped strengthen the experimental approach to the study of topics that became central to the new psychology movement.

In fact even today if you consider the text books of psychology, you will see that young Helmholtz theory of vision and audition are still part of our subjects matter, also the reaction time experiments though most of us do not know that Helmholtz has been responsible for carrying a conducting a first reaction time experiment. We still conduct the reaction time experiments till date in psychology courses that brings us to the next famous physiologist Ernst Webber who has a huge role in building up psychology, the mew psychology movement.

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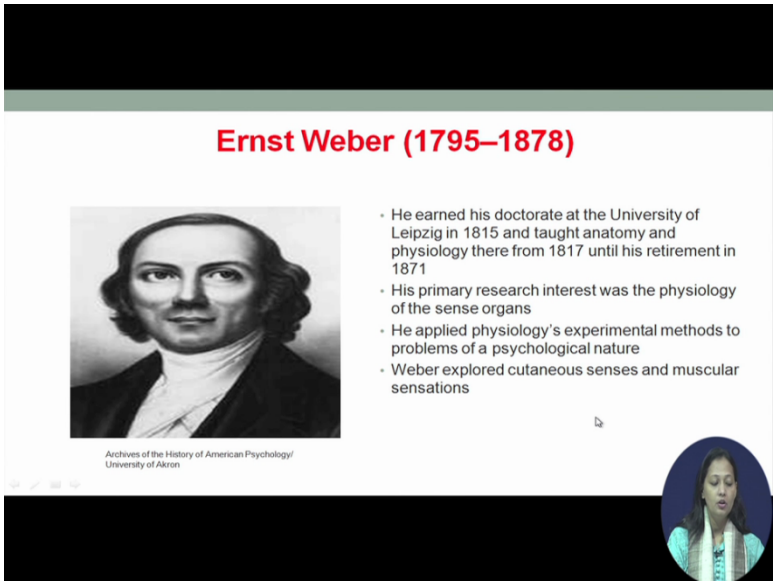

Weber earned his doctorate at the university of Leipzig in the 1850 and taught anatomy and physiology there from 1870 till 1871. His primary interest again like Helmholtz was physiology of the sense organs and he applied physiologists experimenting methods in problems of psychological nature, so you see how that drifts is coming on. So earlier we were just studying physiology, the different structure of the human body and now it has shifted to understanding the psychological mechanisms. So there is a blend between as we study from empirical philosophers that there is a blend between the psychology as well as the physiological method, use of physiological methods to understand the psychology. Now Webber explored Teutonic senses and muscular sensations, Webbers experiments are very very interesting until date we also carry it out in most of the psychology graduate classes.

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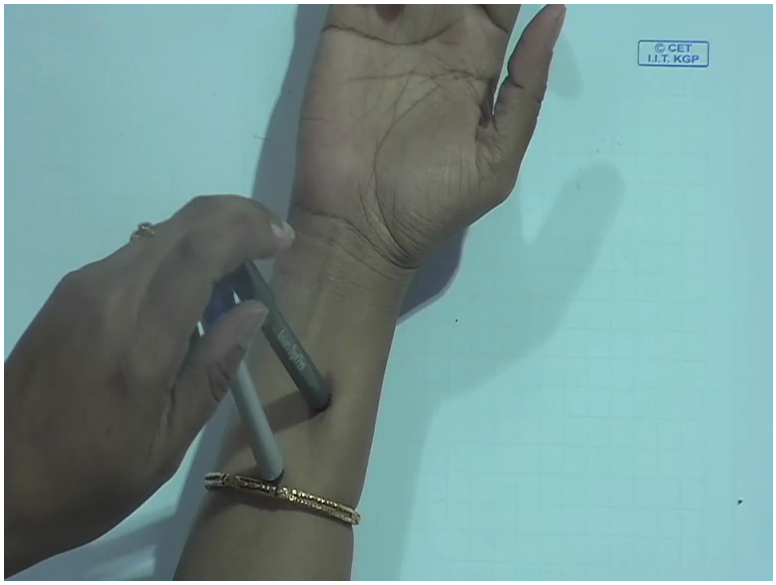

Now, one of the major questions that are answered that were answered by Webbers experimental were, what should be the difference between two points for us to be able to distinguish it as sensations. Say, if I tell you that there are two points and I put it on my hand so what should be the distance, if I put it together on my hand like this. So what should be the distance between the two points for me to understand that these are two sensations? So Webber was the first one to identify that there is a distance beyond which only we can understand two sensations.

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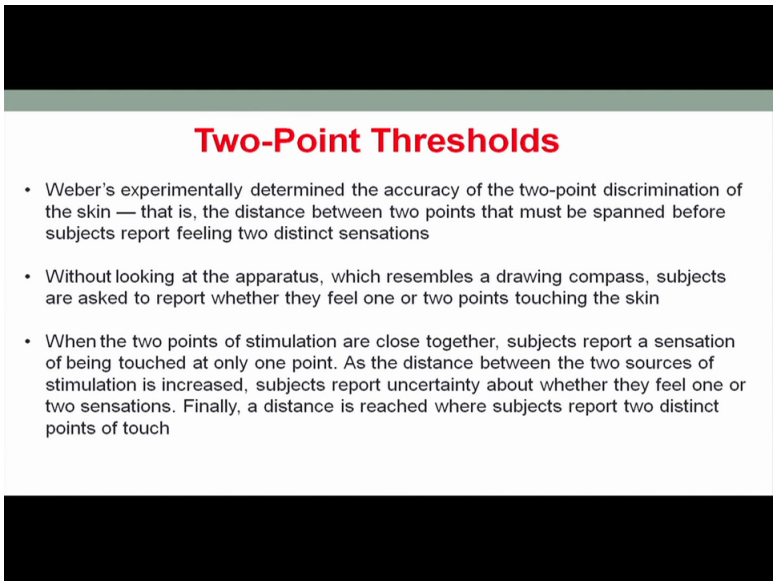

So there is threshold point beyond which we can discriminate two sensations otherwise, if it is close together and if these are considered as points, then these are just single points then it

will be considered as one sensation instead of two. So Webber experimentally determined the accuracy of the two point discrimination of the skin that is the distance between the two points that must be spanned before subjects report feelings of two distinct sensations.

So without looking at the apparatus which resembles like a drawing compass basically this is the apparatus most of the psychology students must have seen this, this is like a compass or a divided and there are two points and it touches the skin at the same time, so basically the subjects are asked to report whether they feel a one point sensation on the skin or a two point sensation. So when I am actually putting this on the skin like this so are you understanding this, is this a one point that is touching your skin or is it two points.

You can try this experiment on yourself at home. You can use a divider or a geometric compass and you please see that it does not hurt you that the points are a little more blunt. I generally put cello tape on it and it is very easily done and you can put it together on a point, just draw a straight line on your arm and see just whether if it is very close, do you actually understand a two point sensation or a one point sensation, then gradually start increasing the distance between the two points.

And Webber showed that as the distance between the two sources of stimulation is increased, subject reports are uncertain, so they are not really sure whether it is a one point or a two point and after that a point is reached where they can clearly feel that there are two distinguishing stimulus present on their arm. So we can see, there is a point where its expressed as one sensation then there is a point where it is expressed as a zone of uncertainty and then there is a point beyond which two sensations are can be discriminated or we can understand it as two sensations.

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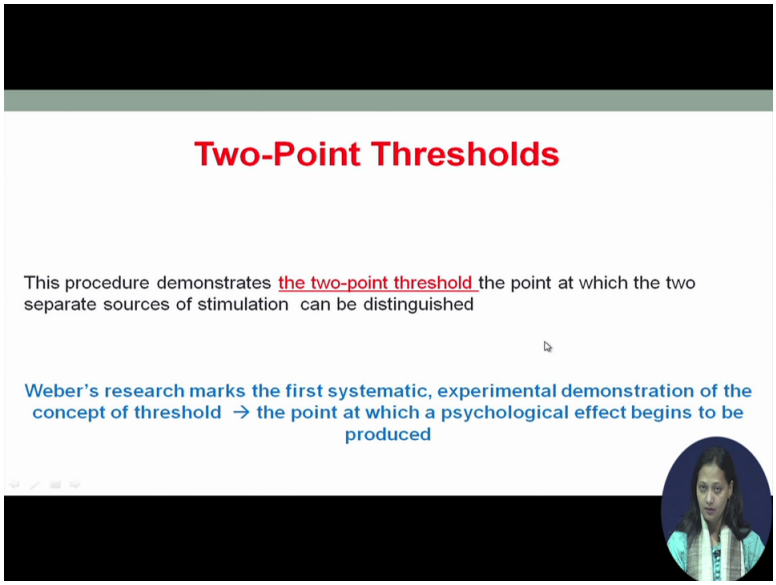

So basically, Weber says that this is a threshold point from where you can understand that there exists more than one sensation. Webber's research marks the first systematic experimental demonstration of the concept of threshold, so what is a threshold, it is a point at which a psychological effect begins to be produced. So this is where human sensations come into being, so this is where an individual may differ from another where his threshold may be longer or more than another or may be shorter than another.

So he can be more sensitive to two point sensation, so this threshold can be shorter for somebody else it can be longer. So that is where the individual difference starts and that is where the psychological effect begins to be produced. So now, that brings us this was on distance next Webber wanted to answer one more question, and here he went on to discuss how do we know one weight is heavier than another and this question brought in the first psychologies first quantitative law.

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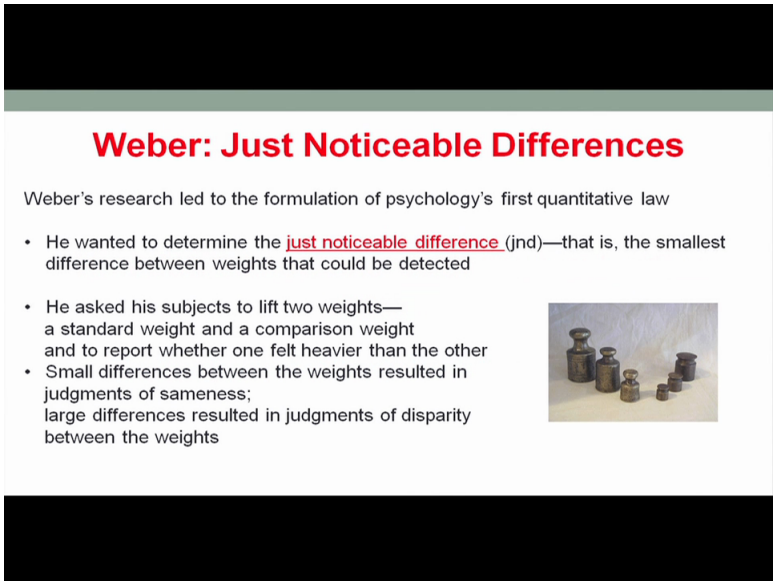

So here what Webber studied was the just noticeable differences and here I had a 100 grams weight and 200 grams weight, so how do I know that one is heavier than the other. What Webber did was he asked his subject to lift two weights, this is a standard weight and this is a comparison weight so you this is what you are going to this is the standard weight as compared to this you will see whether this is heavier or lighter or equal.

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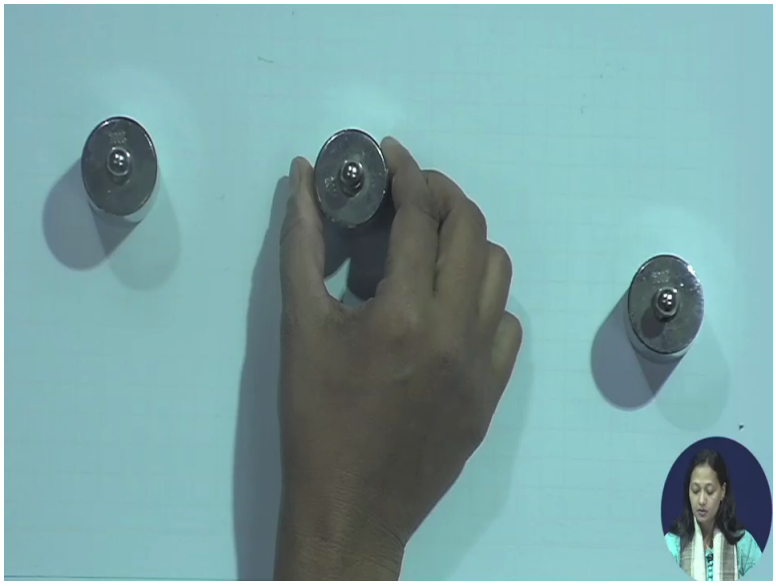

So I have another weight of 100 grams, this is 100 and this is 200 so the standard weight is 100 grams, so I pick up the 100 grams then I pick up the 200 grams and then I say oh this is heavy. Similarly, I pick up the 100 grams and then I this is the standard and then I pick up

another 100 grams and I say this is equal. Now, Webber wanted to answer this question why or how do we actually understand the difference in weights.

So here he saw that if there was a small difference between the weights it resulted in the judging of judging of sameness judgement of sameness, but when there were large differences in weight then the disparity between the weights could be understood. So if the standard weight is 100 and this is 101, then it will not be possible for me to understand the difference, so there has to be a certain difference in weights for me to understand that one is heavier than the other or one is lighter than the other.

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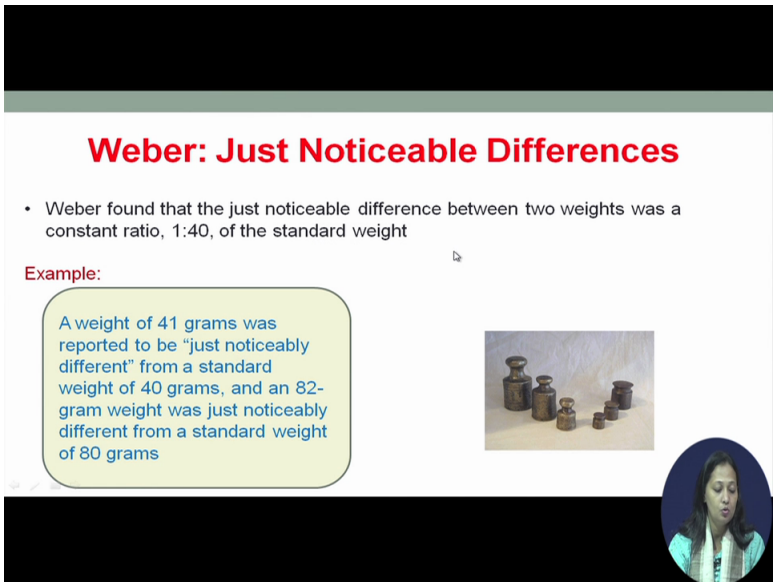

So Webber found that this just noticeable difference between two weights was a constant ratio of 1is to 40 of the standard weight, so if this is a standard weight then there has to be a difference of 1is to 40, so I will understand this only when there is a difference in ratio in this weight as compared to this of 1is to 40 otherwise I will not be able to say, so now let us just see an example.

So if there is 41 grams reported to be just noticeable from a standard weight of 40 grams and an 82 grams just noticeable from a standard weight of 80 grams. So say for if this was 40 grams then I could perhaps notice a difference in 40 gram, but if this was 80 grams then I would not be able to notice the difference in 81 grams, so it would probably need to be 82 grams for me to understand the difference ok so if this was 120 grams then probably this had to be 123 for me to understand the difference between the two. So if this was 121, 122 then both these weights would seem similar to me.

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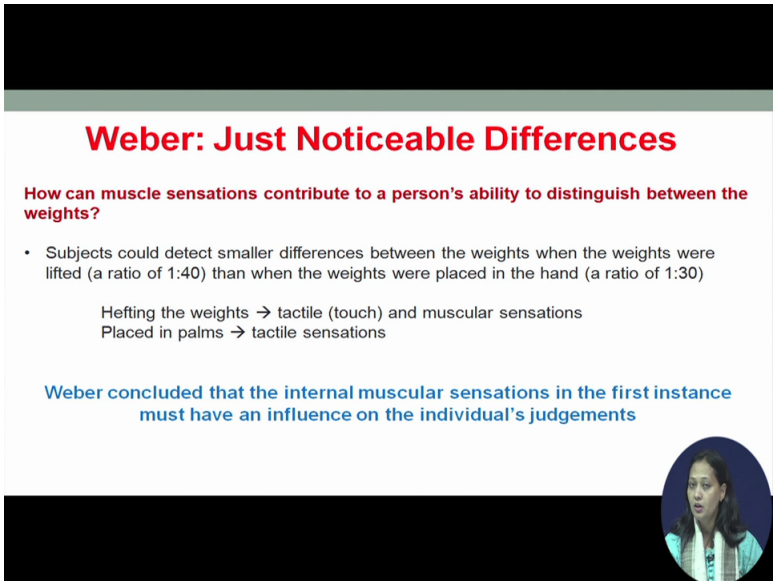

Now Webber realised with his experimentation with weights, Webber realised that muscle sensation also contribute to a person's ability to distinguish between the weights. Now how does that happen, Webber saw that if you actually gave the weight to the individually by hand, if you just put the weight in his hand and then this is a standard weight and then this is a comparison weight, the errors would be more, so he would not be able to understand the differences so well as compared to if the individual was asked to pick up the weight and then pick up the next weight, so then he would be able to understand the difference better. Now, here Webber said that the tactile or the touch sensation and the muscular sensations would actually contribute understanding would add on to the sensations and that would contribute to understanding the just noticeable differences in weight.

So when it is put on your arm, it is only the tactile stimulation and in fact, little bit of pressure also, but when you are picking up the weight so there is this change there is this tactile stimulation also you can understand the pressure once you picking it up the muscular sensations are also send as input with the brain and that input is resulted as a feed back to the system telling us that well this is this is heavier perhaps than this is heavier, this is heavier than this.

So Webber concluded that the internal muscular sensations in the first instance must have an influence on the individual's judgements. So now what do we see that we are talking of physical sensations or physiological sensations, but we see that this is a first time again that when physiologists are saying that the sensations are contributing to our understanding.

Before this Webber spoke of our psychological features also psychological phenomenon can be understood is a contributed in actually assessing things or perceiving things.

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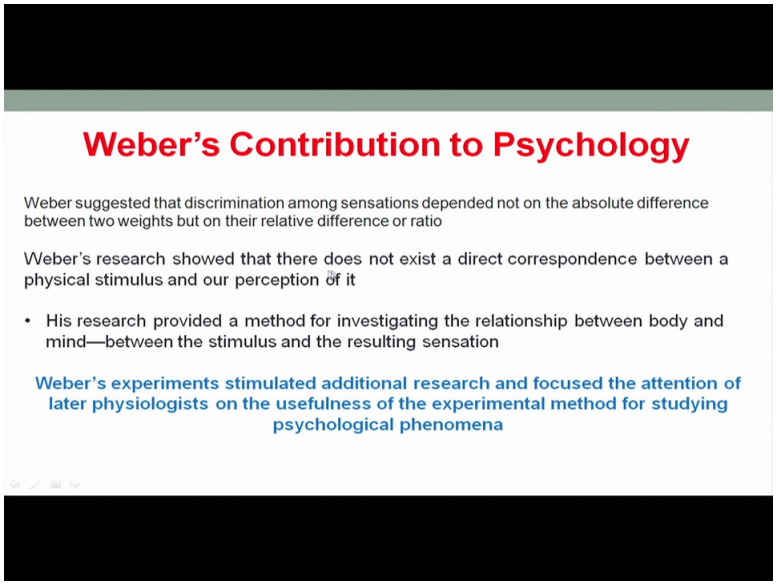

So the next so what is Webbers contribution to psychology, we see that Webber suggested than discrimination amongst sensation dependant not on the absolute difference between the two weights, but on their relative difference or ratio. So what Webber suggested was the difference in weights is not because this is 100 grams and this is 101 grams, but how do we understand the difference between the weights, it is by the difference in what is the ratio between the their difference now that is a constant. So Webbers research showed that they does not exists the direct correspondence between a physical stimulus and our perception of it. His research provided a method for investigating the relationship between body and mind and between the stimulus and the resulting sensation.

So spoke about the mind-body relationship in our previous class and we see that the mind-body relationship is extended beyond just the philosophy books, but has come to experimentation and this is after this we will see Fechner work that actually establishment of psychophysics, so we are using stimulus and we are trying to interpret the stimulus and the sensation that it creates through psychological explanations. So Webbers experiment stimulated additional research and focused the attention of later physiologies on the usefulness of the experimental method for studying psychological phenomenon. So, as you can see that we move into the science of explaining psychological phenomenon through experimentation.

So our course this course on Great Experiments in Psychology is to understand the different experiments that make psychology a science and to start with, in the previous class we studied about how philosophy and physiology empirical philosophy and the positive in the physiology is they brought about this new movement in psychology.

Today, we have discussed about Helmholtz and Webber and their contributions to this new science of psychology especially, Germany's contribution primarily in the role of development of psychology, hence in the next class we will move on to Fechner and his role in developing the science of psychophysics and after that we will come to Wilhelm Von's role and Fechner's role in developing psychology as a science. So I end today's lecture with the understanding that we have discussed about primarily two major forces, major experimental researchers who have helped to build psychology as a science, Thank you.