Other Senses, Integration and Cognition
Professor Doctor Sebastian Moller
Quality and Usability Lab
Technische Universitat Berlin
Haptics

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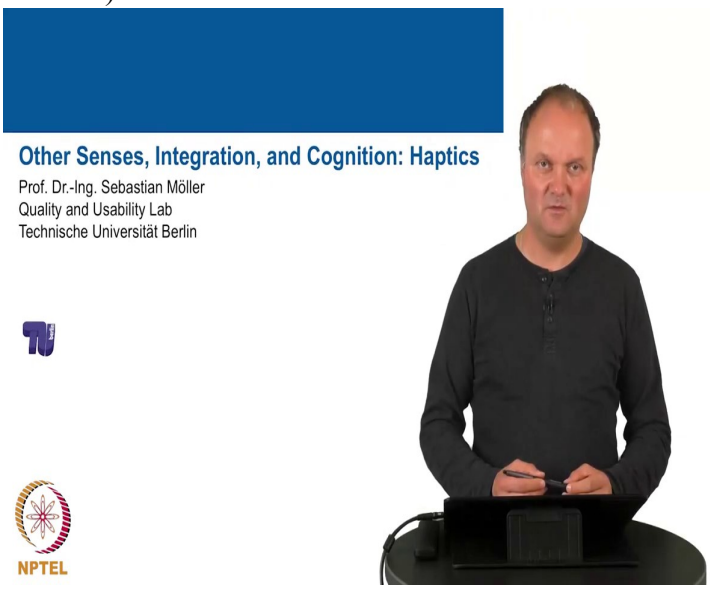

In this video we will report on the skin that is the haptic system

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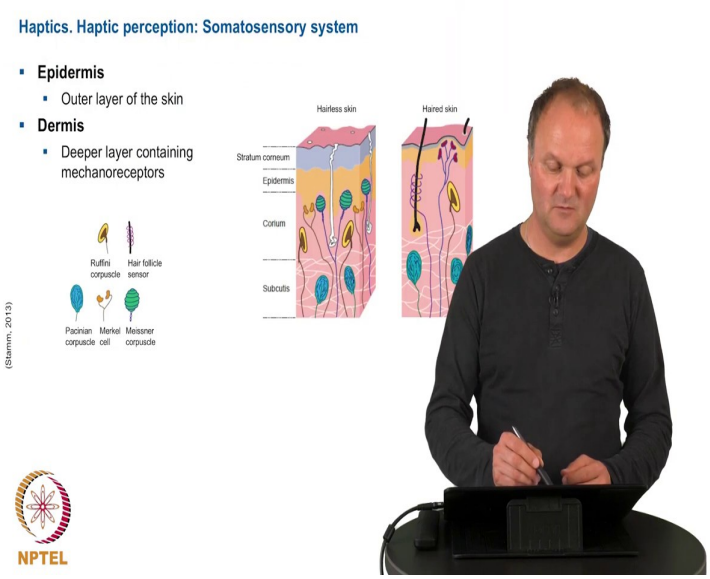

which is actually part of our somatosensory system.

The skin

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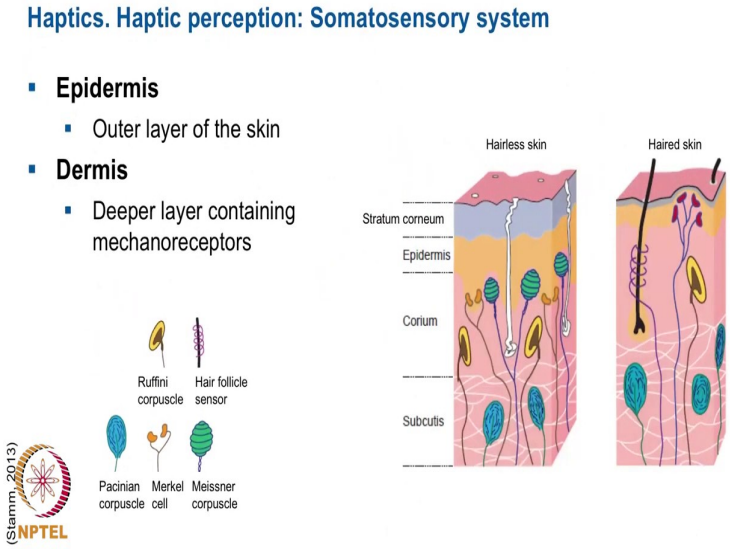

actually consists of two layers, the so-called epidermis, the outer layer of the skin and the dermis. Specially in the dermis but also close to the epidermis there are different receptor cells which are able to distinguish between signals and to perceive haptic signals through our skin.

You see some of them in the lower left part of this picture behind me. And I will go through the functions of the cells

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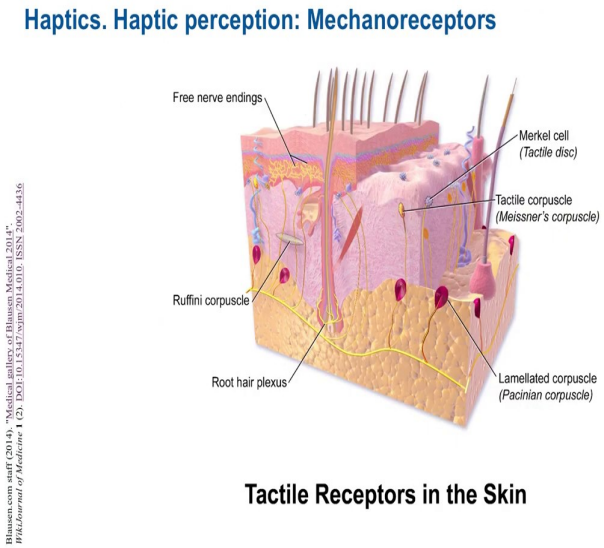

now. The first two are ones which are located very close to the epidermis so on the outer side of the skin and these are the so-called Merkel receptors and the Meissner corpuscles.

Merkel receptors fire according to continuous pressure. So if there is continuous pressure, they continuously fire. On the other side, the Meissner corpuscles only fire when you apply or de-apply certain pressure that is, they fire in on and off mode.

Merkel receptors are important for fine detailed perception where as the Meissner corpuscles are important for hand-grip control. In parallel to these two receptors

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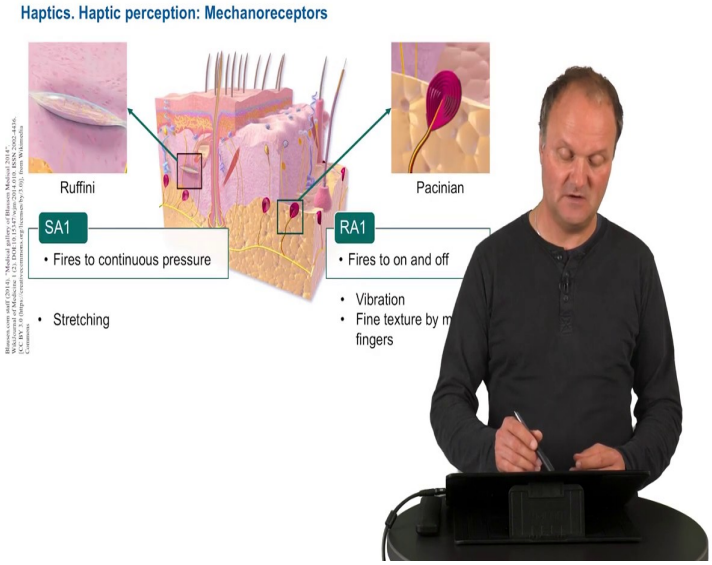

which are located closer to the outer side of the skin, there are two types of receptors more, located inside.

These are called the Ruffini cylinders and the Pacinian corpuscles.

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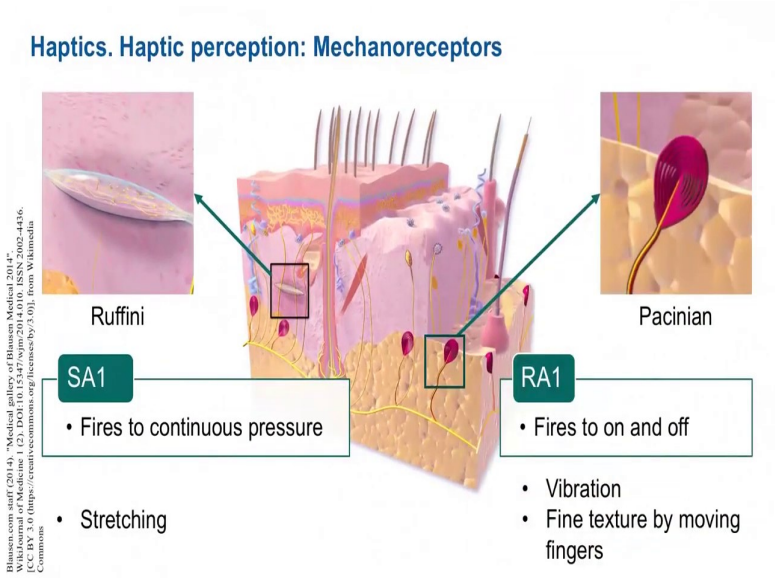

Once again Ruffini cylinder fires continuously when there is a pressure and the Pacinian corpuscle fires only in an off and on mode that is when you apply the pressure or when you relieve the pressure.

The Ruffini cylinders are important for the perception of stretching. This is why they are located more inside the skin. And Pacinian corpuscles are important for the perception of vibration and of fine texture by moving

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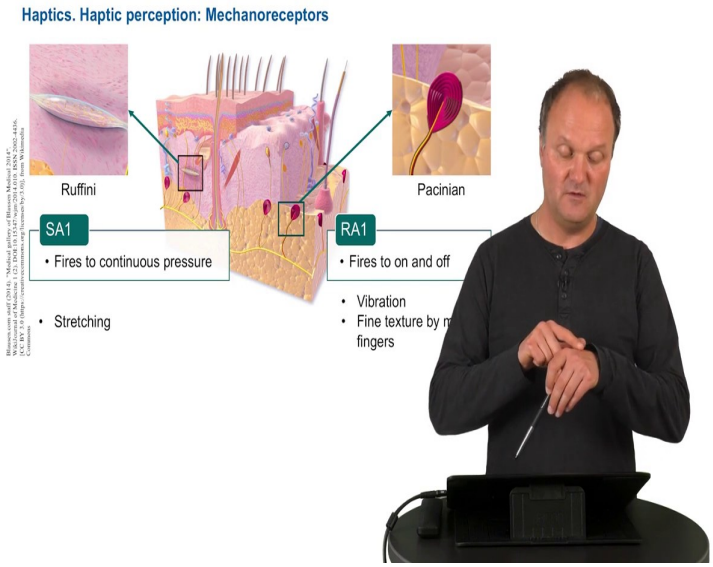

with your finger across something which has a certain texture.

These four types

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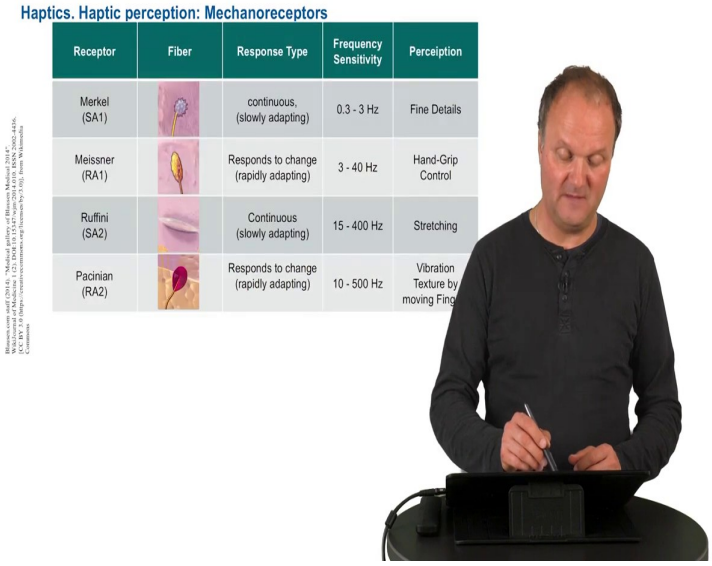

of receptors respond in different frequencies; that is they are sensitive to different perception on off pressure appliance frequencies as you see in the list behind me.

So they are two so-called slowly adapting receptors, Merkel and Ruffini SA1 and SA2 in this picture, and they are two rapidly adapting, the Meissner and the Paccinian, RA1 and RA2. And you see also for what details of perception they are necessary.

The information which comes from these mechanoreceptors is then fed to the brain. But it is not equally processed in the brain.

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Actually there is a so-called somatosensory cortex which is the part of the cortex which is responsible for dealing with the information coming from the skin.

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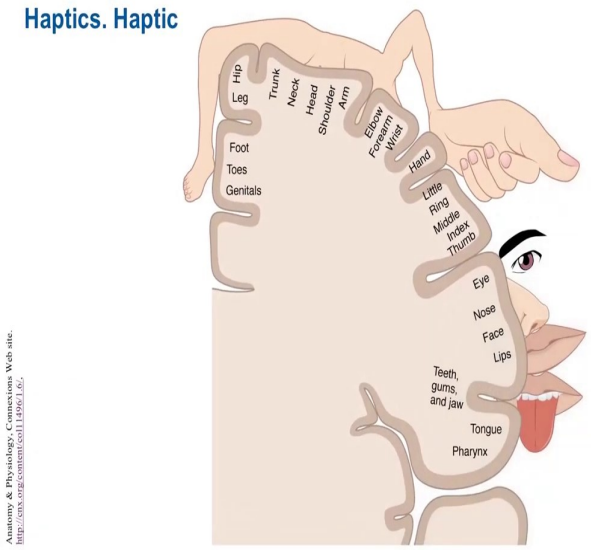

And in this very nice illustration which is a kind of cross-section which you see in the lower right half of this picture, you see also the sizes of the area of the cortex which are related to different limbs and different organs where the skin is active.

You will see, for example that the fingers and the hand occupy far more space on the cortex than for example, your arm or your leg does. And there are other parts like your lips where there is lots of space are located in the cortex meaning that there is lot of fine grained processing of the haptic information in those areas and there is less processing of information in other areas.

Even within one particular part of the body, there are differences

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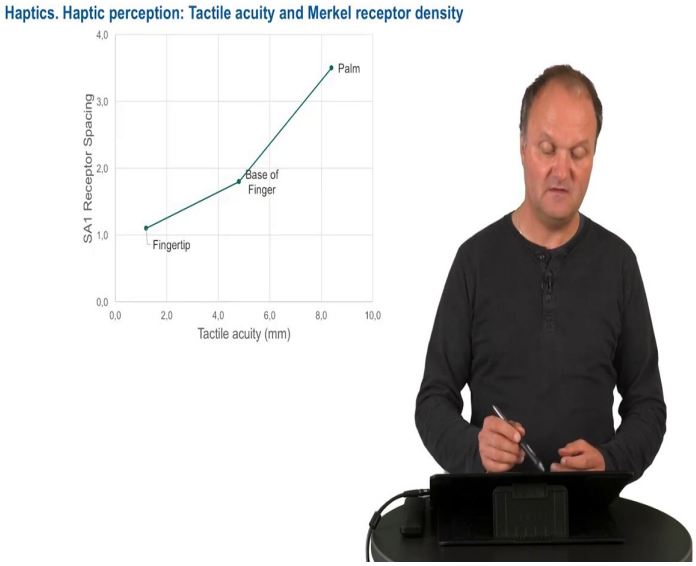

in sensitivity which you see here. And this picture illustrates the tactile acuity that is the difference between the application of two different stimuli on one part of the skin which needs to be necessary in order to be perceived as two distinct stimuli.

And you see that this difference is very small for the finger tip but it is much larger for the base of the finger or the palm which means that we are

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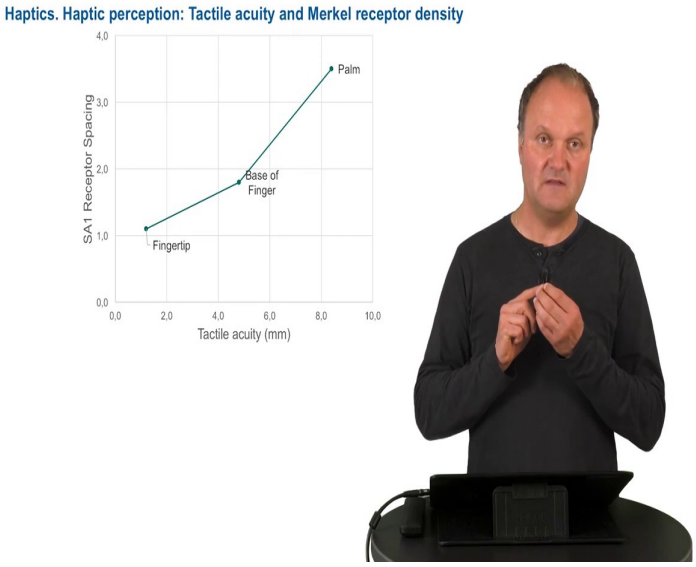

very sensitive to fine grain depliance of information at the fingertips but we are

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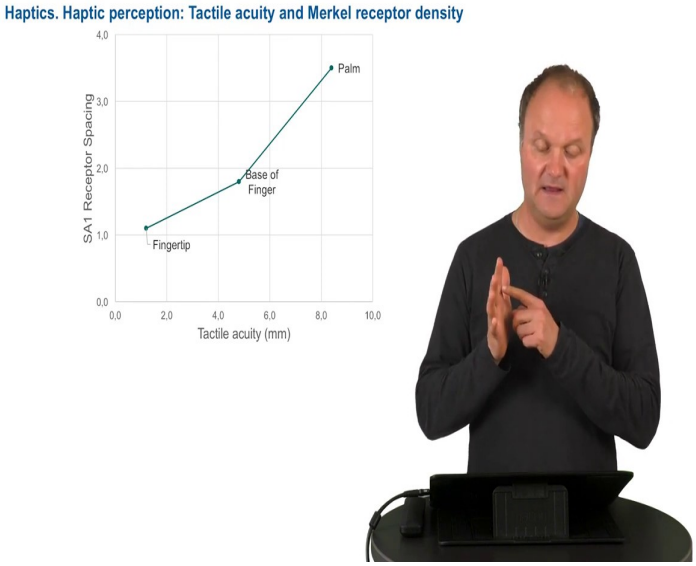

less so on the base of the finger on the palm.

And this of course refers also to the other

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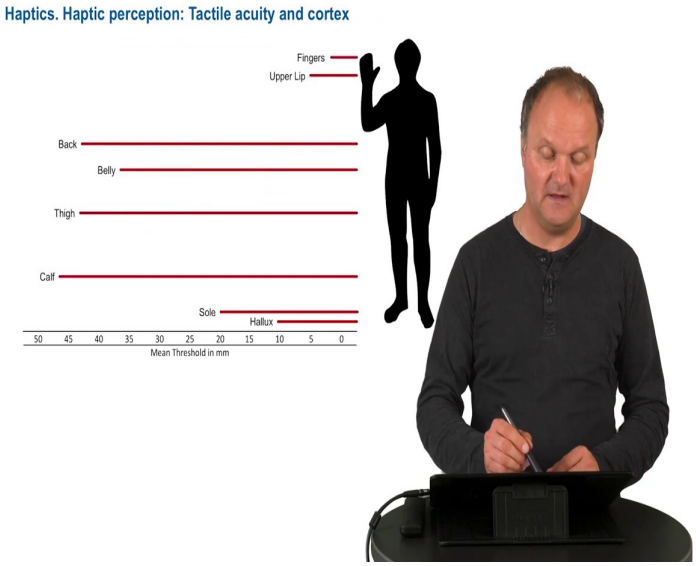

parts of the body. So here for example, you see the tactile acuity and the relevant areas of the cortex for the different parts of the, of the body.

You see, for example that you have a relatively high threshold for very unsensitive parts like here at your leg, but you have other parts like your fingers especially and also parts of your face where you have very low threshold meaning that you are very accurate that you do not need to apply much force in order to be sensitive.

And this of course is in agreement with our common sense. We have, we are far more sensitive at the fingers than we have at other places on our body skin.

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