



Haptics

Image <https://www.wallpaperflare.com/person-touching-body-of-water-person-touching-body-of-water-during-daytime-wallpaper-zthoe>



Learning Goals

- The somatosensory system
- Haptics
- Applications in HCI

Somatosensory System

- informs us about objects in our external environment through touch and about the position and movement of our body parts through the stimulation of muscle and joints.

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(content provided by Chieyeko Tsuchitani), <https://nba.uth.tmc.edu/neuroscience/m/s2/chapter02.html>



Touch

Image Source <https://www.flickr.com/photos/bpprice/14862350066> by brando



Proprioception: movement (kinesthetic)

Image Source https://de.wikipedia.org/wiki/Dater:Running_Man_Kyle_Cassidy.jpg by Kyle Cassidy




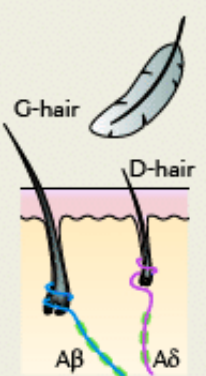
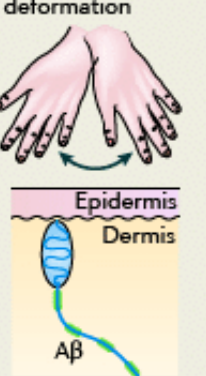

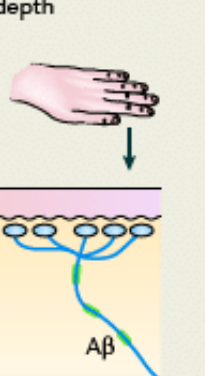
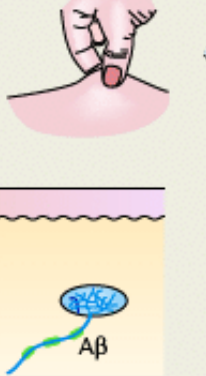

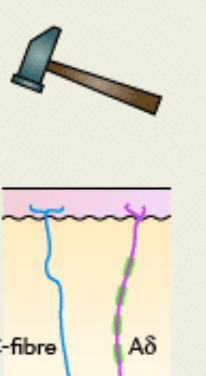

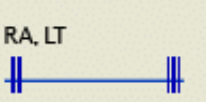




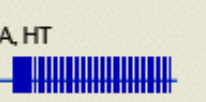
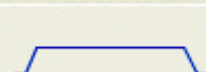
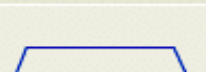
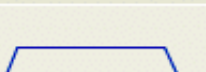
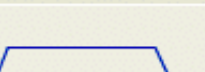
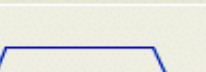
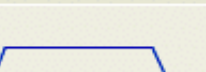
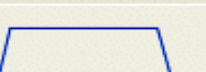







Proprioception: position

Image Source <https://pixabay.com/de/photos/yoga-pose-asana-2959233/> by andiP

Modality	Sub Modality	Sub-sub Modality
Pain	sharp cutting pain	
	dull burning pain	
	deep aching pain	
Temperature	warm/hot	
	cool/cold	
Touch	itch/tickle & crude touch	
	discriminative touch	touch
		pressure
		flutter
		vibration
Proprioception	position: static forces	muscle length
		muscle tension
		joint pressure
	movement: dynamic forces (kinesthetic)	muscle length
		muscle tension
		joint pressure
		joint angle

Haptics



	a	b	c	d	e	f	g
Receptor subtype	Hair follicles	Meissner corpuscle	Pacinian corpuscle	Merkel cell-neurite complex	Ruffini corpuscle	C-fibre LTM	Mechano-nociceptor Polymodal nociceptor
Skin stimulus	Light brush 	Dynamic deformation 	Vibration 	Indentation depth 	Stretch 	Touch 	Injurious forces 
Afferent response	RA, LT 	RA, LT 	RA, LT 	SA, LT 	SA, LT 	SA, LT 	SA, HT 
Stimulus							
Receptive field							
Perceptual functions	Skin movement	Skin motion; detecting slipping objects	Vibratory cues transmitted by body contact when grasping an object	Fine tactile discrimination; form and texture perception	Skin stretch; direction of object motion, hand shape and finger position	Pleasant contact; social interaction	Skin injury; pain

Mechanoreceptors

RA/SA rapidly/slowly adapting; LT/HT low/high threshold

Suslak, Thomas. (2015). There and back again: a stretch receptor's tale. Thesis, https://www.researchgate.net/publication/292449835_There_and_back_again_a_stretch_receptor's_tale

Somatosensory System

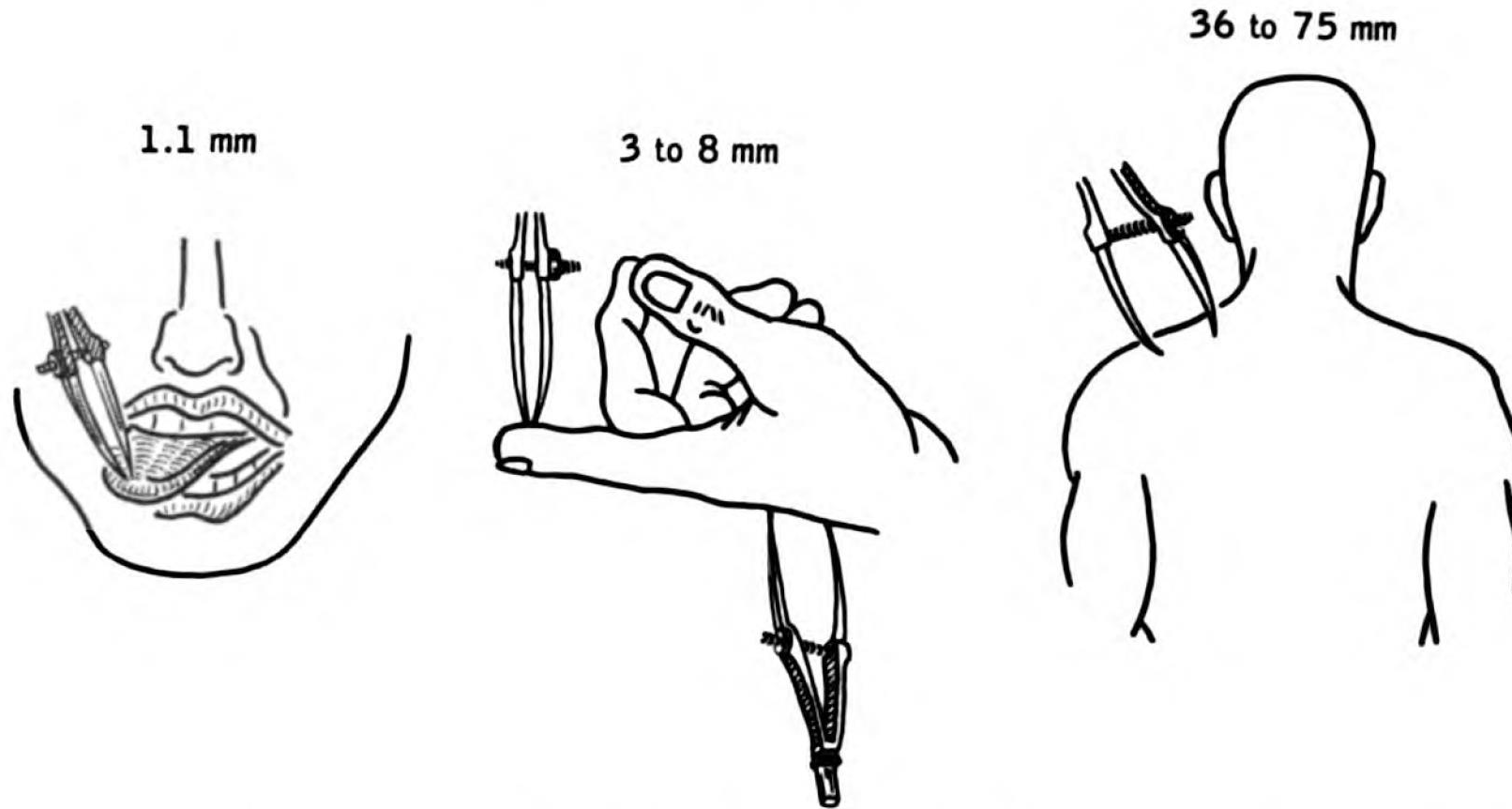


Image Source https://en.wikipedia.org/wiki/Two-point_discrimination#/media/File:Lawrence_1960_8.11.png by House, Earl Lawrence. Pansky, Ben. - A functional approach to neuroanatomy 1960

Somatosensory System

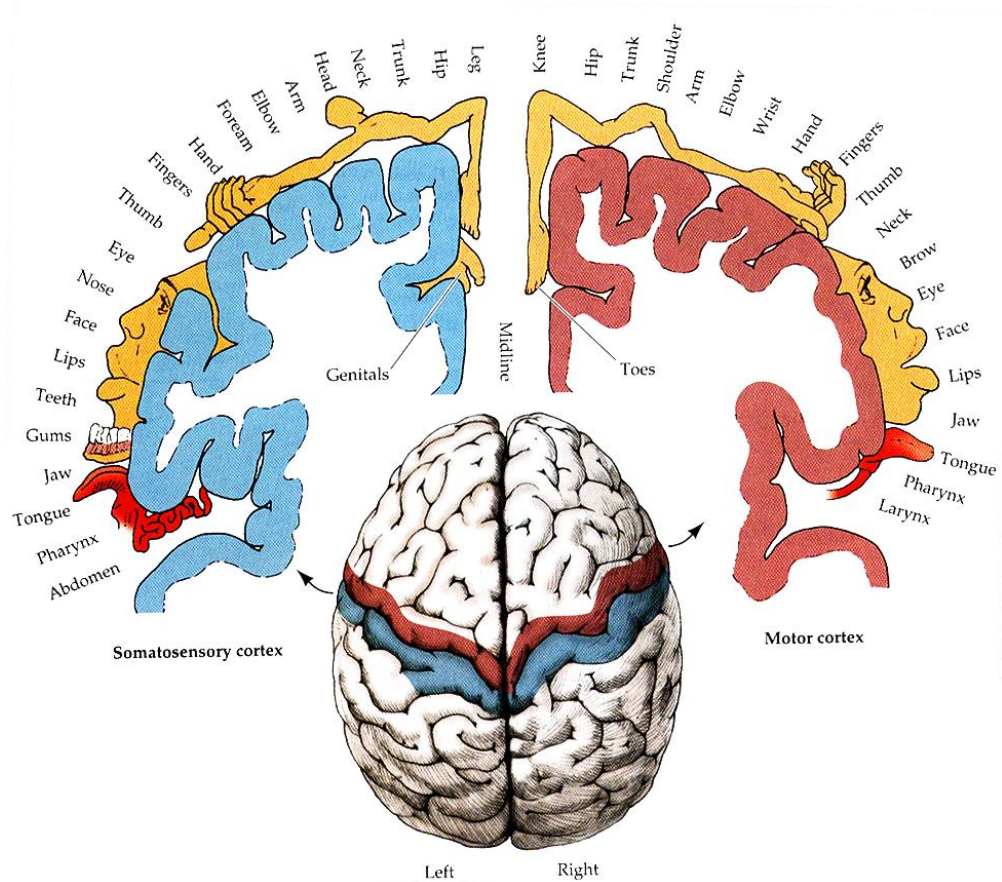


Image adapted from <https://www.flickr.com/photos/46006858@N05/8641421501> by Gary Kirwan & https://en.wikipedia.org/wiki/Cortical_homunculus#/media/File:Front_of_Sensory_Homunculus.gif by Mpj29

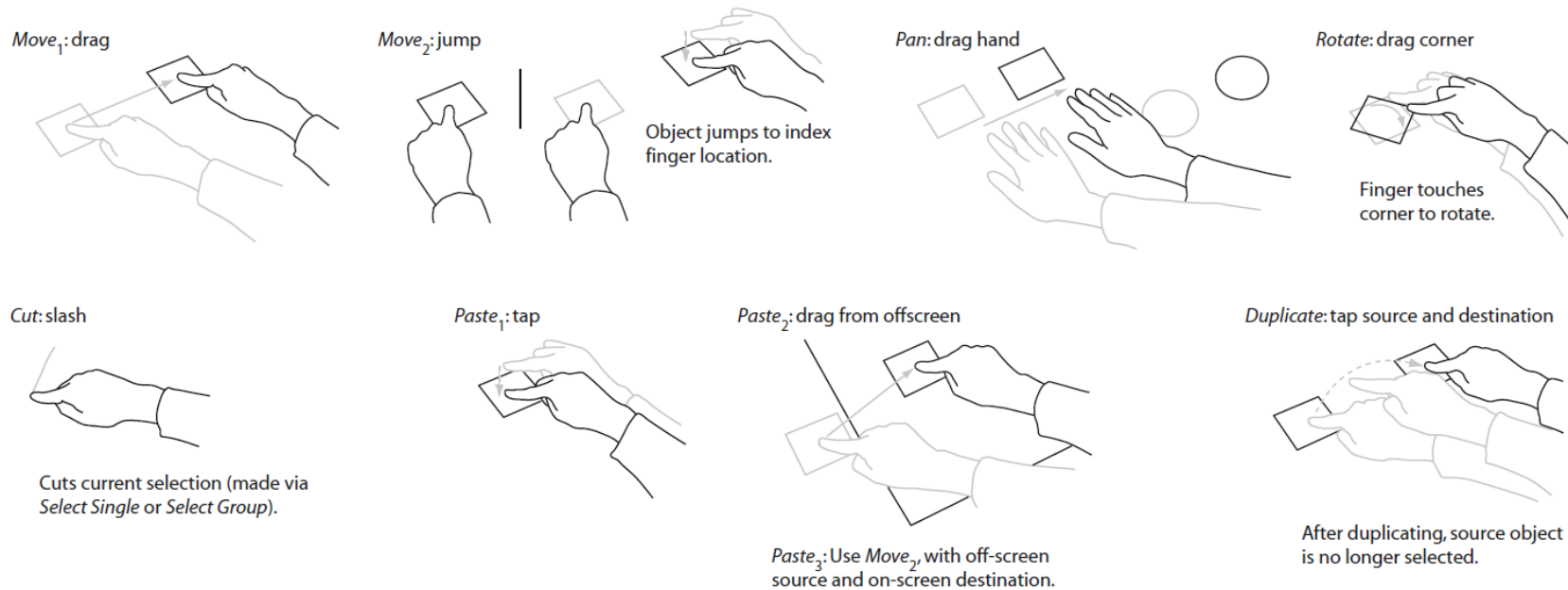
Slide adapted from Tonja Machulla

Haptics

- Haptic perception: active exploration of surfaces and objects by a moving subject, as opposed to passive contact by a static subject during *tactile perception*.¹
- Haptic technology: creates an experience of touch by applying forces, vibrations, or motions to the user.²

1 Weber, E. H. (1851). Die Lehre vom Tastsinne und Gemeingefühle auf Versuche gegründet. Friedrich Vieweg und Sohn | 2 Gabriel Robles-De-La-Torre. "International Society for Haptics: Haptic technology, an animated explanation". Isfh.org. Archived from the original on 2010-03-07

Haptics in HCI



Jacob O. Wobbrock, Meredith Ringel Morris, and Andrew D. Wilson. 2009. User-defined gestures for surface computing. CHI '09

Haptics in HCI



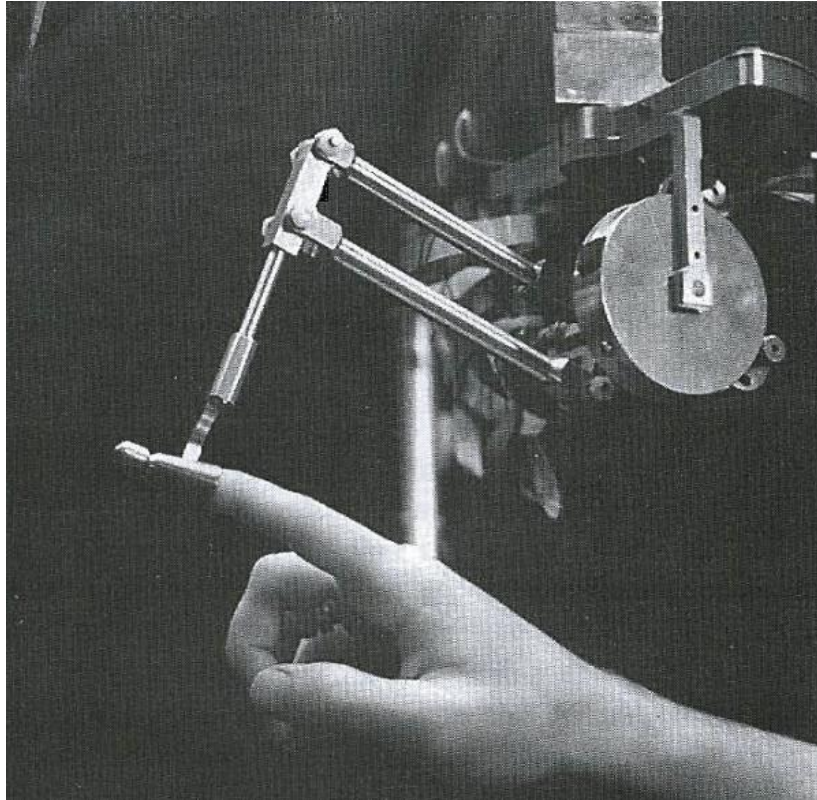
Image Source <https://www.needpix.com/photo/1005794/mobile-phone-smartphone-mobile-phone-phone-icon-to-call-screen-phone-call-call> by ElisaRiva

Haptics in HCI

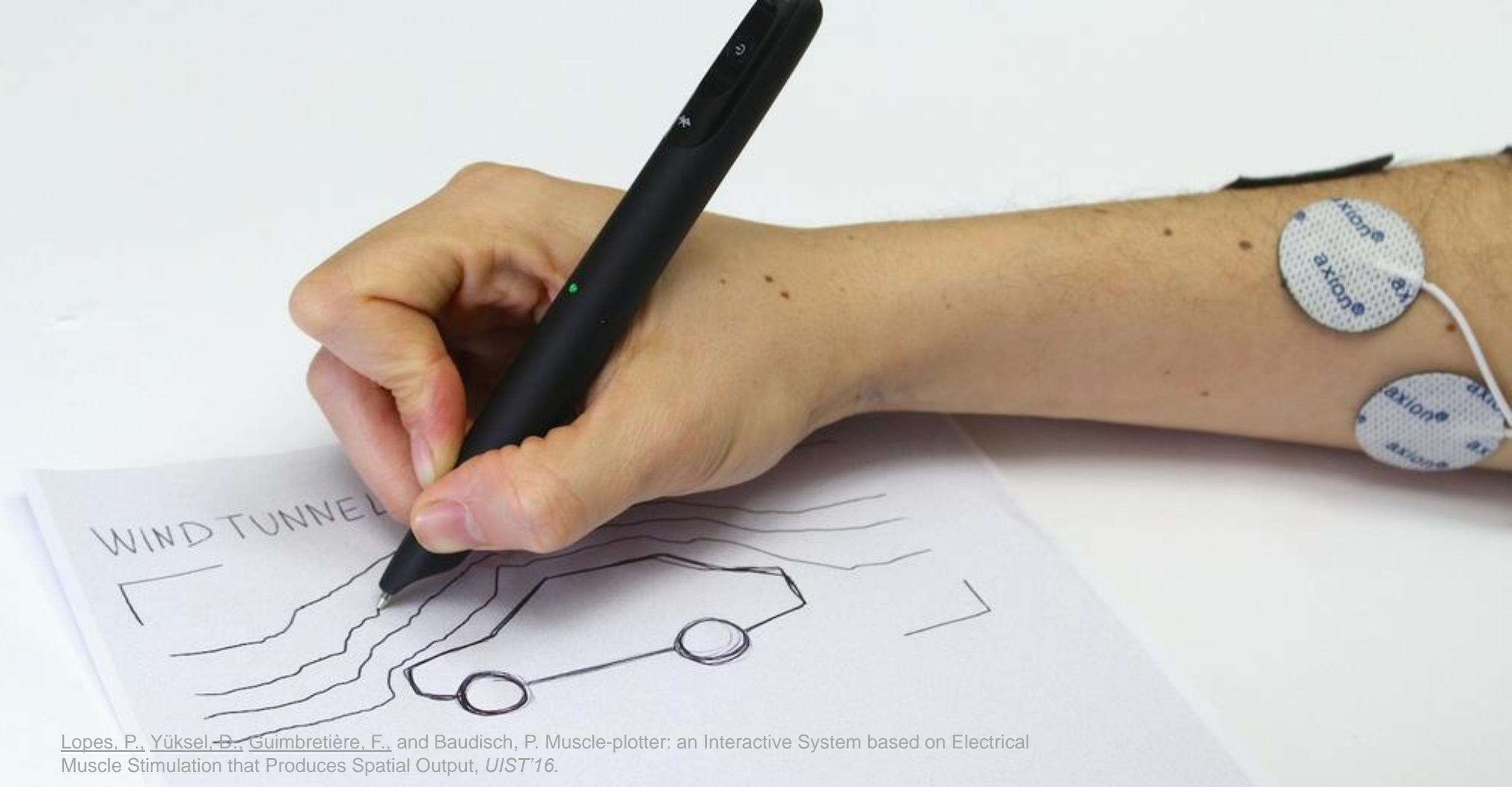


Image Source Raphael Wimmer and Sebastian Boring. 2009. HandSense: discriminating different ways of grasping and holding a tangible user interface. TEI '09

Haptics in HCI

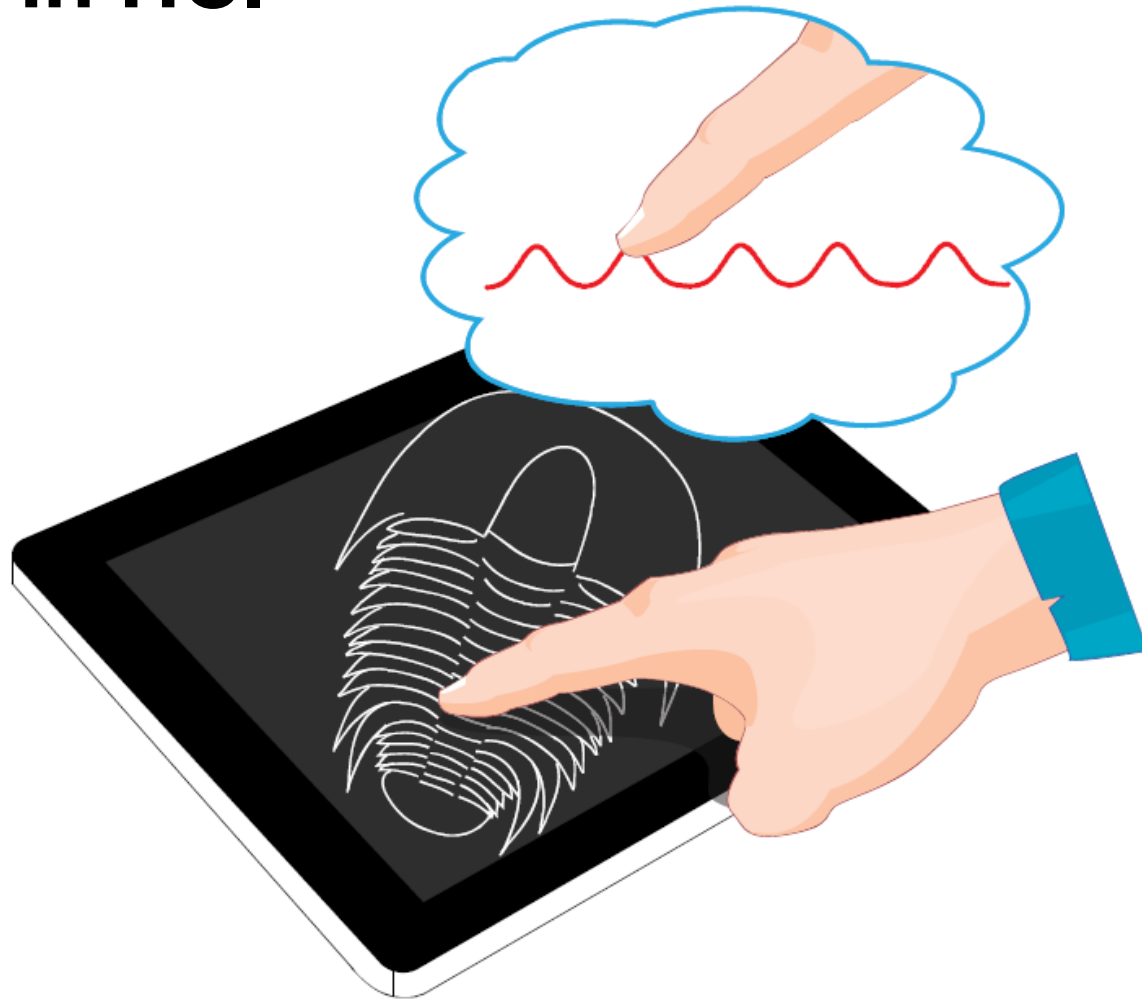


Massie, T. H., & Salisbury, J. K. (1994, November). The phantom haptic interface: A device for probing virtual objects. In *Proceedings of the ASME winter annual meeting, symposium on haptic interfaces for virtual environment and teleoperator systems* (Vol. 55, No. 1, pp. 295-300).



Lopes, P., Yüksel, D., Guimbretière, F., and Baudisch, P. Muscle-plotter: an Interactive System based on Electrical Muscle Stimulation that Produces Spatial Output, *UIST'16*.

Haptics in HCI



Seung-Chan Kim, Ali Israr, and Ivan Poupyrev. 2013. Tactile rendering of 3D features on touch surfaces. *UIST '13*

Slide adapted from Tonja Machulla



Katrin Wolf and Timm Bäder: Illusion of Surface Changes induced by Tactile and Visual Touch Feedback. In CHI Extended Abstracts (CHI EA) 2015

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