Direct and Mediated Touch –
From finger, to hand, to tool, to machine— and back!

Note by Edith K. Ackermann

How to get “a feel for” things we cannot grab? How to get “a handle” on things beyond our reach? — in this case because they exist at a micro or nano scale. More generally, how do we make sense of things we cannot experience directly (be in touch with or act upon). This note addresses the relations between direct and mediated touch: from finger, to hand, to tool (or probe), to instrument; as well as between visual and tactile exploration: from eye to hand—and back! and between perceiving (or sensing) and measuring (or probing).

Direct touch – Give the head a hand ! Give the hand a form/texture/tool !

“If the head and the hand act separately they conclude nothing: if they work together they can accomplish something, but much more can be done when head and hand work together with a tool”.
Francis Bacon

Giving the head a hand suggests that much knowledge that we held is knowledge-in-action (we think and act at the same time). Giving the hand a texture (or tool) further suggests that the materials we explore, and the tools we use—and become familiar with—both prolong and mediate our action in the world. Said otherwise, our minds are grounded in our bodies, bodies in actions, actions in contexts—and all the above are expanded through tool use. We both project ourselves into the tools we use and we “incorporate” them.

Haptics – Grab it to “see” it! (extracted from website: enactive.network²)

*Touch is the only sense that involves the presence of the body that we touch and our body at once. Touch is close, sight is far*

Ortega y Gasset³

The intrinsic connection between perception and movement makes touch an unique case of “active perception” (Merleau-Ponty, 1945, 1964). When seeking to recognize a solid triangular shape, a blindfolded person has to move her fingers around the outline in a specific sequence. And if the figure is small, and detachable from its ground, the perceiver often uses hands (and sometimes mouth) to explore its contour, shape, and material qualities. The concept of triangularity is in this case closely linked to - and co-defined by - the sequence of responses in the act of exploring the outline of the triangle (MacKay, 1952, 114)⁴.

According to Katz, movement plays a complex role in tactile perception: 1. it intensifies the action of static stimuli and prevents the habituation of the captors; 2. it connects the subjective and objective poles of touch (the sensation of the external, distal object which causes the experience as contrasted to the subjective sensation of the local stimulation); 3. it allows for the perception of qualities such as texture and elasticity that are not available through static touch alone: “Every ongoing tactual activity represents a production, a creation in the true sense of the word. When we touch, we move our sensory areas voluntarily, we must move [because…] we are constantly reminded that the tactile properties of objects remain mute until we make them speak.” (Katz, 1989. Original work published 1925, p. 242)

More recently, Klatzky, Lederman, & Metzger, (1985) and Lederman & Katsky (1987, 1993)⁵ fleshe out further connections between hand movements and the properties extracted by touch. They describe a set of exploratory procedures: stereotyped and recursive patterns of movement that blindfolded subjects perform (often unconsciously) when exploring different types of objects and surfaces with their hands. Each of these patterns is associated with the extraction of particular properties by touch. For example, lateral motions are associated with the extraction of texture; pressure with hardness; contour following with shape. When freely exploring different properties of an object, perceivers tend to perform the corresponding exploratory procedures and, what’s more, the relative speed and accuracy in the recognition of certain properties are greater when the corresponding exploratory procedure is performed.

¹http://www.enactivenetwork.org/index.php?lexpid=lexiconDefinition&entryId=595&definitionId=0
² In Montagu, *Touching, The Human Significance of the Skin*, pp.100-101
Mediated or indirect touch — “hand-held” utensils / probes / tools

To be deprived of the sensibility and flexibility of the hand is frustrating, as we realize when we drive a car wearing heavy gloves or try to tie a shoelace with frozen fingers. On the other hand, using a tool, such as a kitchen utensil (to avoid burns), a paint brush (instead of finger paints) or the pointy or smooth sides of a “screw-driver” (cf. Teo Enlund’s assignment, Nanoform laborations) holds the potential to expand, and in some cases augment, our haptic or tactile experience.

Each tool channels / mediates our tactile experience in specific ways

Tools as extention and part of the body — extension / incorporation

Merleau-Ponty described the use of a cane by a blind person as exemplary of perception in general. By virtue of using the cane, the person acquires new motor and perceptual skills, which in turn brings about new knowledge. Both the world and the body schema are enlarged to encompass the cane as an extension of the body. The cane and what “it” touches are ‘incorporated’ (Merleau-Ponty, 1945, 1964).

Indeed, when we rely on a tool or probe, these are not handled as external objects. Instead, “we pour ourselves out into them and assimilate them as parts of our own existence. We accept them existentially by dwelling into them” (Polanyi, 1952, p.59). In Maurice Merleau Ponty own words: “To get used to a hat, a car, or a stick is to be transplanted into them, or conversely, to incorporate them into the bulk of our own body” (Merleau Ponty, 1962, 143).

Both Polanyi and Merleau-Ponty illustrate what Heidegger calls the ‘readiness-to-hand’ of equipment (Heidegger 1962). The point here is that even though there may be a de-facto demarcation between body and tool, in using the tool —in becoming a fluent user over time—the demarcation fades away: the tool-at-hand becomes an extension and hence part of us. We are cyborgs in-principle!

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Tool to machine — The splitting of agencies, The division of work

In Gesture and Speech, Leroi-Gourhan became fascinated with the “liberation” that happen in societies where “tool and gesture are now embodied in the machine, operational memory in automatic devices, and programming itself in electronic equipment (MIT Press, 1993).8

Our own research on Children and machines shows that even very young children, starting at age 6, establish a distinction between what they conceive of as being a tool or a machine. To make a long story short, in their eyes, a tool is something that prolongs and supports what “you” are doing (ex: scissors are a tool because “it’s you who cut”). A machine, by contrast, is something that takes your input and transforms it in ways that make a difference (ex: a push lawn mower is a machine because “you push and it cuts”). A machine, in other words, is an autonomous entity, or agent, capable of generating change from within. It has its own “powers”, or “motors”, or “smarts” (sometimes referred to as a “mechanism” or a “program” by older children).10

The take away here is the notion that whenever the instruments we use transform (translate) our inputs (what we do) in ways we perceive as different, or obscure, a phenomenological “spitting” occurs: We then cease to incorporate them and treat them as “external,” autonomous agents with a mind of their own.

8 Written in the mid-1960s, Gesture and Speech (MIT Press, 1993) describes the origins of gesture and graphism as cultural mutations that “rendered possible the externalization of memory and hence mythological narrative”. The author takes an integrated approach to human evolution: gesture (conceived of as ‘material action’) and speech are seen as twin products of an embodied mind that engendered our technical and social achievements. His explanation of the evolutionary association between hand and face provides a biological basis for cognitive as well as communicational aspects of gesture, with culture emerging as an extension of our zoological foundation. He asserts that the liberating of the hand from locomotion led to the liberating of the face from prehension, thus creating the duality of instrument and symbol whereby human beings physically and mentally grasp the world in which they live.


10 Other examples: a car is a machine because “it has a motor”. A bike is not a machine because “its you who pedal”. However, an aircraft with a bicycle mechanism (as exhibited at the Boston Science Museum) is a machine because “if you pedal and it flies...then it’s gotta be a machine”. Note that in the example of the bicycle, the transformation of a rotation into a translation (moving on the ground) is not perceived by the child as significant, whereas for the airplane, the transformation from rotation to taking off the ground is indeed significant. Yet, if the mechanism is the identifying feature of a machine it is usually treated as a black box. Only upon request do children refer to the mechanism as the ‘brain’, the ‘motor’, or the ‘power’. One important finding of this experiment is that the ideal of transparency, so important to many adults, seems to leave our children cold. Their spontaneous focus is less on how the mechanism works than it is on
To conclude

1. Visual and tactile exploration: opposites or complementary?

Merleau-Ponty [1945, 1964] stressed that all visual experience exists in the context of the movement of the eyes and gaze, thus vision too makes reference to touch. From a psychological perspective, it may be useful to think of "seeing" itself as a kind of grasping — moving between modalities.

2. Perceiving and measuring: a continuum

Perceiving and measuring are often opposed. The first is seen as qualitative and subjective and the second as quantitative and objective. And to a great extent this is the case. From a psychological perspective, however, it is useful to think of measuring as the capture of sensed data – regular gauging over time – and its translation into a traceable behavior, or language, that is reliable and understandable: from mechanical gauges to informational graphs, from natural traces of erosion or growth, to graded sticks that mark moments in a transformational process.

3. Analogical versus digital: what’s the trade-off?

Analogical output devices are often easier to grasp, at least for novices, than their digital counterparts (ex. analogical watches, oil-level gauges, barometers, voltmeters as used in Instrumentation laborations at Albanova). This is because analogical devices are better at helping crack the code of how they translate inputs into “readable” data. The translation feels transparent if the interface matches the ways we might convey what we sense (ex: higher is up, lower is down; ex: a knob makes you “feel” how much you turned it). Digital, on the other hand, offers many advantages in terms of flexibility and computational power.