Virtual Reality as embodied interactions

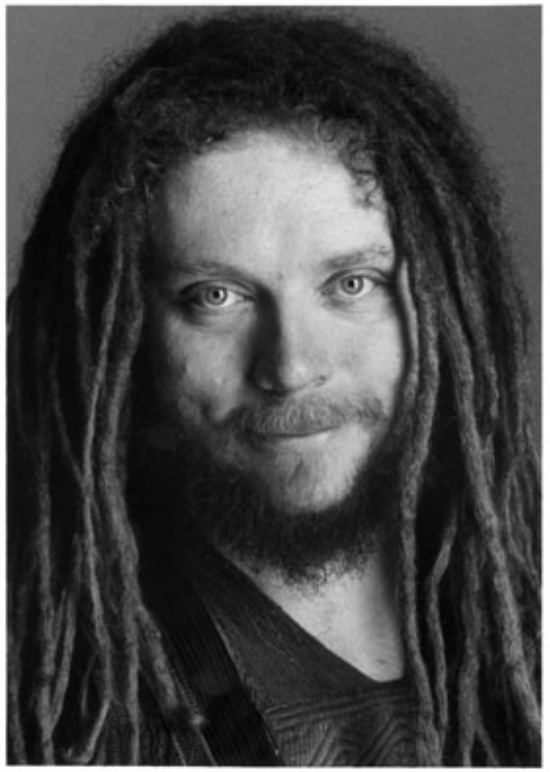
1. Terminology
2. What is Embodied Interaction ?
3. Conclusion

1. Terminology

Virtual Reality (Jaron Lanier [born 1960])

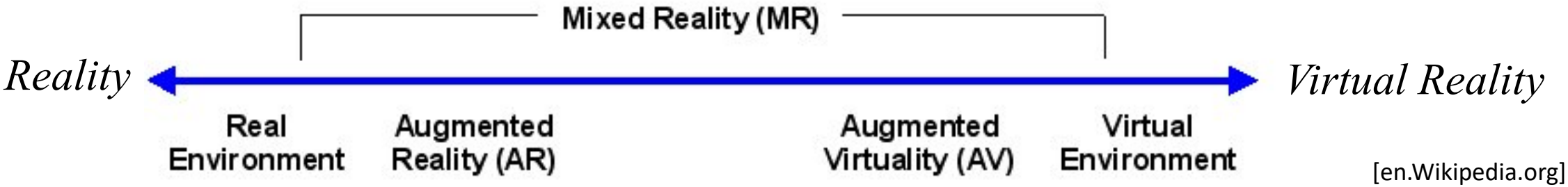
1. Being so in effect or in practice but not in name
2. Nearly so, almost but not quite
3. Computing & internet

actually or physically existing (~tangible), as opposed to imaginary.



[adapted from Chambers Dictionnary & Thesaurus 2008]

1.1 Milgram's Virtuality continuum [1995]



[en.Wikipedia.org]

See-through Head-Mounted Display e.g. Hololens 2

[Microsoft.com]

e.g. integrating real-time video within a Virtual Environment

[Oculus Quest]

Recently, the expression Extended Reality (XR) is also used as a synonymous to MR

2 What is embodied interaction ?

The contribution of Phenomenology

The study of real-world phenomena as they are experienced by human beings : how we perceive and understand phenomena.

- H. Bergson (1859-1941)
- E. Husserl (1859-1938)
- M. Merleau-Ponty (1908-1961)
- M. Heidegger (1889-1976)

-> Reject Cartesian dualism of mind and body
-> The mind cannot be considered without its integration with the body

Key concepts from Heidegger « Being & Time » 1927:

• complementarity of ***ready-to-hand*** & ***present-at-hand*** modes of performing everydays actions

2.1 ready-to-hand & present-at-hand

Heidegger distinguishes two modes of embodied interactions [D2001, O2008]:

Ready-to-hand ⟷ ***Present-at-hand***

Ready-to-hand (handiness): we develop ***skillful*** use of material of the world and in turn we develop ***tacit***, ***embodied*** knowledge or ***know-how*** that allows us to cope smoothly with the world around us.

Present-at-hand : is the ***reflective*** mode of ***thinking*** about the process we are engaged in. Rather ***mental*** and ***internal*** than physical and active. A second kind of knowledge: *know-that* rather than *know-how*.

2.1 ready-to-hand & present-at-hand (2)

Example [Dourish2001]

The hammer:

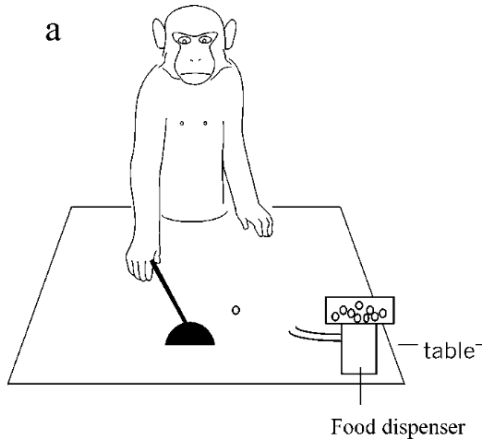
A hammer can be **ready-to-hand** when used in a standard task by a skilled person; in such a case it *recedes from awareness* as if it became *part of the user's body*.

The hammer becomes **present-at-hand** when it appears to be unusable and has to be examined to be fixed.

2.1 ready-to-hand & present-at-hand (3)

Most of human activities are spent according to the readiness-to-hand mode (i.e. tool use) similar to a subconscious autopilot mode.

Supported by findings about brain adaption to the use of tools, perceived as body extensions [O2001]

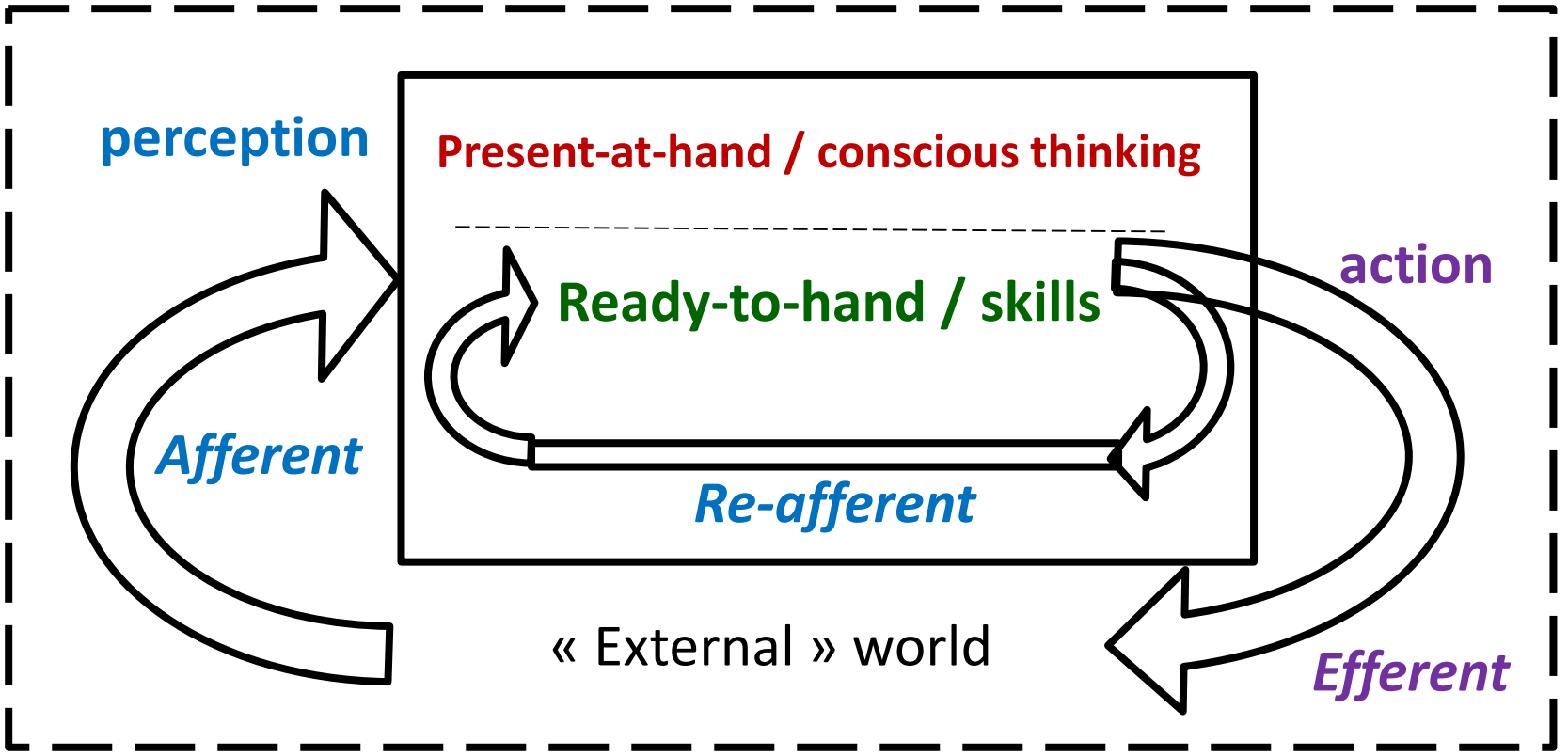


The use of a tool modifies the "body image" in the brain [O2001] [F2007]

On the other hand, human creativity emerges through the periods in present-at-hand mode where problems have to be faced and solved.

2.2 Embodied interactions in VR

VR heavily relies on body involvement, hence taking advantage of both modes, with the potential advantage of the intuitive nature of the ready-to-hand mode.



Key advantage: VR leverage on the fast «skill» loop

What types of activities is VR best for ?

- **Learning / Training / Rehabilitation**
  - Coordinated (full-body) movement = **skills**
  - Complex protocols in 3D space = **procedural knowledge**

- **Entertainment**
  - Leisure with active body involment
  - Social activities
  - Health care (attention distraction)

2.3 VR initial niche market : training

The first VR application were motivated by the high risks and costs of training military/civil pilots.

It is critical to master low-level sensory-motor coordinated skills in addition to high-level symbolic thinking.

Initial core business: flight & driving simulators (plane, tank, train, truck, car, bus, helicopter, etc..)

The Link trainer for training pilots in pre-computers era

Over time, flight simulators scaled to fit more and more complex systems.

Notice the combination of :

- Tangible control board replicating the real one
- Large projected screen in front of the cockpit or one screen per window

This setup allows multi-users interactions

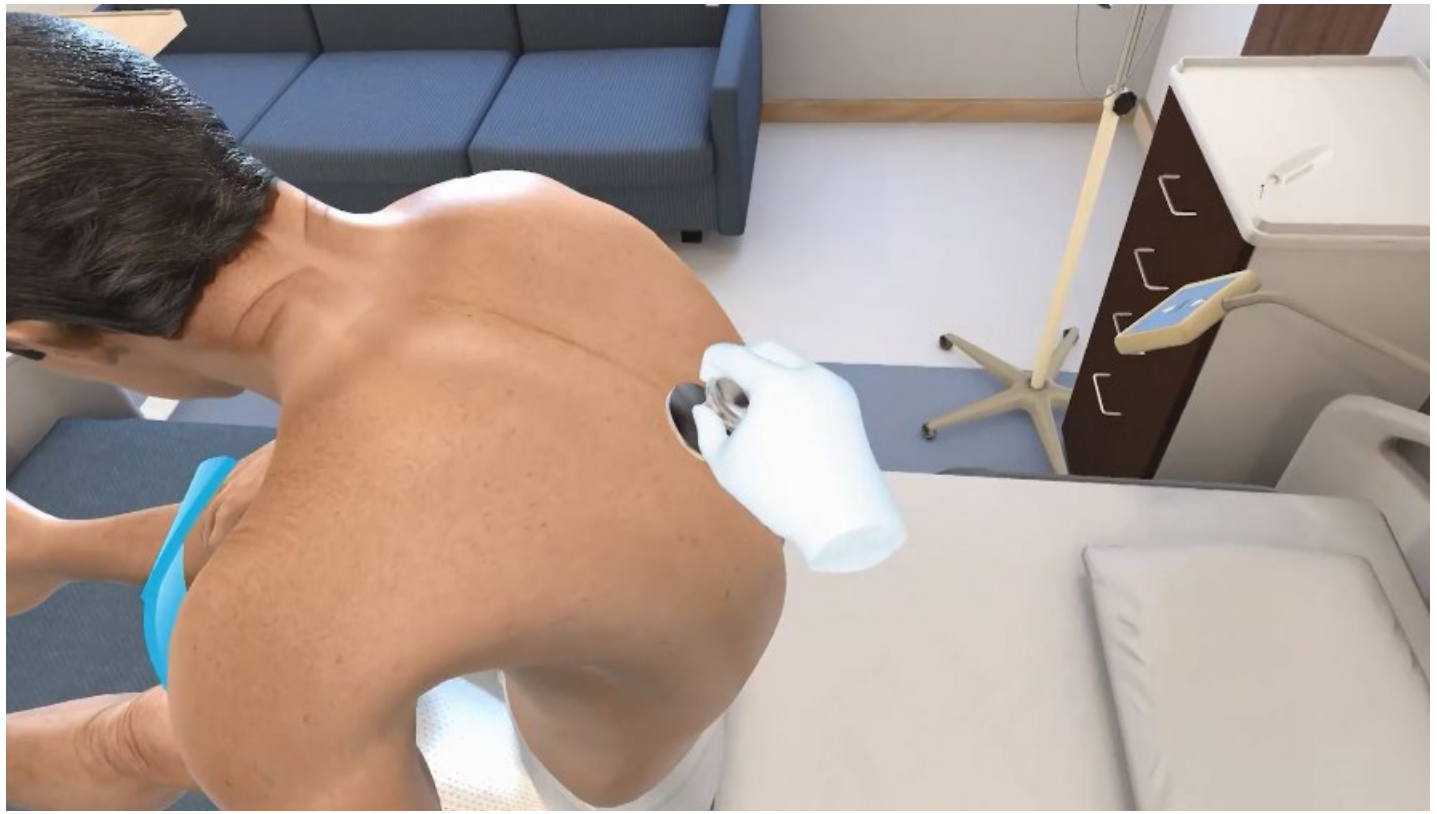
2.4 The birth of the Heah-Mounted Display

Ivan Sutherland (1967): first (heavy**) Head-Mounted Display** developed during his PhD in MIT

"A display connected to a digital computer gives us a chance to gain familiarity with concepts not realizable in the physical world. It is a looking glass into a mathematical wonderland."

"The ultimate display would, of course, be a room within which the computer can control the existence of matter. A chair displayed in such a room would be good enough to sit in. Handcuffs displayed in such a room would be confining, and a bullet displayed in such a room would be fatal." (1965). [W]

2.5 What is now possible : Training a procedural skill



Ubisim training module for students from the Clinique La source (with HMD)

2.6 Training a coordinated skill

Berescuer training demo for cardiac re-animation 2018 (with HMD)

3 Conclusion

Virtual Reality can leverage on the way we interact in the world through embodied interactions.

Embodied ***skills*** involve ***much faster perception-action loops compared to cognition***. When fully mastered they are usually performed "automatically" without involving the cognitive layer.

More generally, beyond **skill** training, VR can be also used to training complex 3D **procedural knowledge** and for **rehabilitation**.

Recently applications have greatly benefited from the mass market of games and associated interaction devices, e.g. curing phobia, entertainment etc...

Next week: what are the conditions for producing a convincing virtual reality ?

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[H1927] Heidegger, M.: Being and Time, John Macquarrie and Edward Robinson, translated in English in 1962, New York: Harper and Row (1962)

[O2001] Shigeru Obayashi, Tetsuya Suhara, Koichi Kawabe, Takashi Okauchi, Jun Maeda, Yoshihide Akine, Hirotaka Onoe, Atsushi Iriki, Functional Brain Mapping of Monkey Tool Use, NeuroImage, Volume 14, Issue 4, October 2001, Pages 853-861

[O2008] O'Neill S.: Interactive Media: The Semiotics of Embodied interaction, Springer 2008

[W] http://en.wikipedia.org/wiki/Ivan_Sutherland