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► **To cite this version:**

Annie Luciani. Instrumental interaction. Enaction and enactive interfaces: a handbook of terms, Enactive Systems Books, pp.153-154, 2007. hal-00980212

HAL Id: hal-00980212

<https://hal.science/hal-00980212>

Submitted on 17 Apr 2014

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Instrumental interaction

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The expression instrumental interaction as been introduced by Cadoz [Cadoz et al., 84a,] [Cadoz et al., 84b] to identify a human-object interaction during which a human manipulates a physical object – an instrument – in order to perform a manual task. Classical examples of instrumental interaction are all the professional manual tasks: playing violin, cutting fabrics by hand, moulding a paste, etc....

Instrumental interaction differs from other types of interaction (called symbolic or iconic interaction) in which the media supporting the interaction are rather symbols (such as languages), icons (such as graphics), earcons, etc. It may differ also from a type of manipulation in which the manipulated object is not an instrument. Take the example of a usual object such as a stone: when it is used to sculpt another object, it becomes an instrument; when the stone is manipulated for itself, for example, to observe it, it is no longer an instrument.

A problematic case is object manipulation in 3D computer graphics. As discussed in the item [→ Immersion vs. vis-à-vis], in usual 3D interactive graphic situations, the object is ready-to-hand. So, it is an in-between situation, which alternates from considering the object as a part of environment in the aim to know it, to considering the object as being manipulated and further as an instrument. Indeed, in instrumental situation, the object with which the human interacts to perform the task is transformed in an instrument. Once sufficient learning has been achieved, the instrument is a type of second nature that prolongs the humans, who is transformed in an instrumentalist, - as discussed in the item transparency_1 [→ Transparency_1].

In instrumental interaction, the instrument is a physical object on which humans applies physical gestures and that is able to return multisensory feedbacks that are consistent between them and with the performed gestures [Luciani, 2004] [Cadoz, 1994]. Differently than in non-instrumental interaction, as for example in symbolic or iconic communication, that could be monosensorial, the instrumental interaction is intrinsically multisensorial, even if all the sensory modalities are not necessary used in the task. Indeed, being manipulated, a physical object “answers” by exhibiting perceptual behaviours. Haptic behaviour is necessary in instrumental interaction. When haptics is not necessary, it means that the task could be performed optimally through a non-instrumental interaction. Since the physical object produces haptic feedback, the object has physical behaviours at the human scale. Then, it produces necessarily visual and/or acoustical behaviours (or both) that are physical deformations in response the gesture activity. In terms of how input devices interact with virtual space [→ Control metaphors], instrumental interaction is a type of what [Ju et al. 2003] called “*the device can act as a tool*”. This is different than “*the device can act as the designed object*”.

Within the Cadoz’ typology of interactions functions [Cadoz, 94] [→ Ergotic/ epistemic/ semiotic functions], instrumental interaction is a typical case in which all the three ergotic, semiotic, and epistemic functions of man-environment interactions are present.

However, the properties to consider in the case instrumental interaction differ from those involved in the manipulation of an object, for example of the same object considered for itself. These properties are designed – or chosen – to perform a task. For example, the properties of a violin played in a concert hall are obviously not the same as the properties of the same violin when considered as an object, for instance hanged in a museum.

When aiming at designing a virtual instrument:

1) One has first to provide the following basic properties to the model: to be a simulacrum of a physical object, to be physically manipulable by the human physical body (the hands for example), to be able to generate haptic and other correlated sensory behaviours as physical responses to the action. The item “instrumental interaction: technology” [→ Instrumental interaction: technology] goes further in this analysis.

2) One has then to select, among all the properties of the physical objects, those that are necessary for the task. This means that the modelling activity necessary to model a virtual instrument differ from the physicist’s modelling activity of the object itself. Physicist’s modelling activity aims at knowing the physical object as entirely as possible. Modelling an instrument requires to have another kind of knowledge focusing on what are the necessary properties of the instrument for the task. Such knowledge is not a part of the physicists’ knowledge. For example, in the case of musical instrument, a part of the needed knowledge is related to the human action and perception capabilities. It also relates with cognition and cultural judgments capabilities.

Finally, a second aspect by which instrumental interaction is distinguished from object manipulation is that it aims at being a way for communication between humans, which is called instrumental communication [→ Instrumental communication].

References

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Transparency_1

Ergotic/epistemic/semiotic
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