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Instrumental interaction: technology

Annie Luciani [ACROE&INPG]

Trying to implement the concepts of instrumental interaction / instrumental communication [→ Instrumental commu-nication] [→ Instrumental interaction] by using computers requires specific technologies. It leads, indeed, to the new technological paradigm of instrumental computer simulator.

Such an instrumental computer simulator, in order to allow instrumental interaction, must satisfy a number of needs [Uhl et al., 1995]:

- Since the objects to interact with are physical, their computer models have to be physically-based models.
- These models must be able to produce all the physical behaviours of the modelled objects that will be perceptible, whatever their spatial and temporal scales (auditory, visible, haptic) is .
- These models must also be able to provide the ability of being handled (ergotic interaction).
- The computer simulation of these models has to be performed in real-time; the simulation must not present any noticeable difference with the equivalent instrumental situation in the real world (when it exists; for a discussion see the item "simulation" [→ Simulation].

Such an instrumental situation re-built around a computer by using physical simulation and appropriate devices can be called a representation of real instrumental situation.

Some conceptual difference with the usual approach implemented in virtual reality can be noticed:

- There is no need of "reality" nor "immersion", but it is conversely necessary to have at disposal a genuine simulation of the instrumental universe, i.e. of the objects near or close to the body, and with the relevant properties necessary to achieve the task.
- This simulation of the instrumental universe has to be run with a range of performances comparable to the real instrumental situation, especially in terms of dynamics. This is often not required in reality

These properties are necessary in order to convey the main qualities of the instrumental situation, such as: the possibility of the progressive appropriation of the object as an instrument (that is the embodiment property); the strong feeling to have it in-hand (that is the presence property), the playability (or instrumentability) in order to stimulate not only efficiency but also creativity (for example, new way of manipulation, new strategies of exploration, etc.).

One example of such computer-enabled instrumental interaction is reported in the articles dealing with the notion of ergotic sounds [Florens, 2003] [Luciani et al., 2007]. In the experimental setup discussed, the performer, when bowing a virtual string, has a strong impression of the presence in-hand of the string, thanks to a specific implementation of the string-bow simulation and to the haptic-audio interaction in which the simulated vibrating string itself returns sensitive information to both the hand and the hear. These principles, incidentally, have been also used in the implementation of a real time instrumental simulator to learn nanophysics [Marlière et al., 2004].

Re-building an instrumental interaction in the context of computerized systems is a non-trivial modelling and implementation process. In this process, the main important features are not the objective realism, nor the subjective realism of the situation, are no more only the performance of the task, but tentative new concepts such as presence, believability, embodiment, intimacy, creativity, etc [→ Presence, in computerized environments] [→ Believability_ 1&2].

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[Cadoz, 2003] Cadoz C. «Le geste, canal de communication homme/machine. La communication instrumentale» - Technique et science de l'information. Volume 13 - n° 1/1994, pages 31-61

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