

Defining categories of the human/technology coupling : theoretical and methodological issues

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We state that ergonomics of design and of specification should be an “interaction-centered” ergonomics and not just a technology -(interface) centered or subject (user)-centered one. Moreover, an ergonomics of the interaction (relationship, coupling) should rely on an interdisciplinary approach and require a relevant methodology. In order to reach this double goal, we suggest to define four categories or modalities of human/technology coupling: supplementation, assistance, support and substitution.

Definition

- In the supplementation relationship, the subject’s power of action is increased (the agent may be a group). On line, the use of this type of technology always implies the constitution of new schema or invariants, at least during the appropriation phase. These technologies are directly coupled to the user and are part of the action project.
- The assistance relationship appears as a sub-category of supplementation since it is not a crucial one for the actual and main activity. The function of this type of technology is to qualify and display the state and/or the becoming of the supplementation device which the subject is engaged in.
- A technology is dedicated to a support relationship when its use contributes to elicit and to define the user’s properties and modalities of an unfamiliar device. That is to say, the help system specifies the schema or procedures that the subject has to constitute and learn in order to obtain an optimal use and to benefit of this new power of action.
- The substitution relationship occurs when the user can delegate her/his activity to a dedicated technology. In this case, the activity of the user is generally to activate and sometimes to interrupt the device.

In order to put these definitions in context, we describe four examples related to some research work of our research team.

Specific examples

- Tactos technology is a special device (a supplementation one) dedicated to blind and low vision people which permits reading and writing of simple numerical forms. If this system (graphic tablet, computer and Braille cells) actually allows users to perceive simple graphics (e.g. a mathematical curve) on the computer interface, these new perceptual possibilities require an active learning phase in order to constitute these new percepts [2].
- With an assistance technology for driving (e.g. change of line, parking), inspired by the previous one (Tactos) we allow the user to constitute a tactile feeling in order to increase security and to perceive the driving environment (particularly some parts which cannot be visually perceived). The main difference compared to the supplementation technology is the fact that a successful driving activity can be achieved without the assistance technology [3].
- The user’s manual is one of the most common support technology and its main role is to provide guidance in the use of a given system. The studies on the situated reading of these user’s manuals have revealed their limits. They cannot offer contextualized specifications. However, the same studies have shown that the manual ergonomics can be improved if the

designer consider at the same time the properties of the manual as a specific support and those of the coupling process with the device being operated [1].

- Nowadays, a car can move autonomously on a highway (in optimal conditions) since the design of a new reliable self-decision device based on fuzzy controller has been achieved. In this extreme situation, the car can keep automatically its line and allows the driver to engage in a new activity ; his/her action on the substitution device is just to connect and/or to disconnect it [4].

Integration of the modalities

The integration of the coupling modalities in a same technical situation is a main characteristic of the design of the modern interface. The car is a very demonstrative case on this topic. The car as such appears as a supplementation technology because it greatly displaces the power of the user's mobility. Moreover, the user may consult several assistance devices in order to be inform about the actual state of the car and its relationship to the environment. If the user faces a problem, he may read the specific users' manual. Lastly, he/she may delegate operations of the global action project (move to...) to a self-acting device. At this moment, the questions are : How the driver simultaneously manages these different modalities? How can we decide and arbitrate during the design process among the four modalities ? And, what is the implicit image of the user which is produced during this design process?

Integration and design

In the framework of the HCI design, particularly the Design for all, the user's specificities on the one hand or the potentialities of a system on the other hand frequently constitute the foundation of the ergonomic choices. By doing so, the properties of the human/technology coupling are rarely made clear. We will try to demonstrate their relevance in the design of a problem solving situation in a computer environment. In reference to the four previously defined modalities, we will propose and discuss four distinct solutions : on line manual, windows for diagnosis and guidance, dedicated tool for problem solving and intelligent learning agent.

References

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