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Cyber-Physical-Human Interaction:
Interactions between Human, Computer and Physics

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Abstract

Interactions between humans and computers have been studied for many years. They are systematically organized as a research field called human-computer interaction (HCI). The concept of input / output is used as a simple model of human-computer interaction. Information exchange takes place via input / output devices. Inventions such as display, mouse and GUI, which are typical research results, have been widely used until now. There are input / output devices with various purposes and mechanisms, such as depth sensors, wearable devices, and 3D displays. There are also devices that measure different physical quantities for the same purpose to improve accuracy and reduce costs. On the other hand, the computer world has been studied as a Cyber-Physical System (CPS) considering the influence of the physical world without closing to the information space built on the Internet. By controlling the embedded device, a sensor measures physical quantity, and an actuator affects the physical space, and forms a feedback loop that does not directly intervene by humans.

In the computer world developed in this way, the influence in physical space can not be ignored. Therefore, I propose a new concept called Cyber-Physical-Human Interaction (CPHI) to handle human-computer-physical interaction in an integrated world. In this paper, we propose four items as key patterns of CPHI: Cyberization from Human, Realization to Human, Human-Physical Merging and Physical Augmentation. In order to consider CPHI, five studies, SleepTyping, PICALA, Augmented Typing, BluMoon, and AOBAKO, were conducted to confirm their position in CPHI. In this research, the concept of CPHI is summarized, and the physical requirements of sensors and actuators for the target interaction are determined, and physical problems such as collision, interference and shielding are considered by considering the influence of physical space in human-computer interaction. It will be possible to discover at the design stage of interaction.