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Theme E: Disabilities: Analysis models and tools

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Abstract

This paper presents the topics and the activity of the theme E “disabilities: analysis models and tools” within the GDR STIC Santé. This group has organized a conference and a workshop during the period 2011–2012. The conference has focused on technologies for cognitive, sensory and motor impairments, assessment and use study of assistive technologies, user centered method design and the place of ethics in these research topics. The objective of “bodily integration of technique” workshop, organized in the framework of Défi Sens (CNRS) was to develop a multidisciplinary approach (physiology, robotics and anthropology) of the relationships between body and technology taking as an example the prostheses for the compensation of sensorimotor disabilities. Efforts will focus on strengthening the development of a multidisciplinary research for the design of assistive technologies for elderly people and people with disabilities. The modelling of the user’s abilities and the designing of adaptable AT to the needs of the person will be carried out with other groups of this GDR and also with other GDRs.

1. Aims

Designing an efficient and adaptable assistive technology (AT) is intrinsically difficult since this process:

- involves a variety of expertise (from information communication technologies to rehabilitation medicine for example including ergonomics);
- must compensate for different disabilities (motor, sensory and cognitive);
- must consider several levels of handicap depending on the interaction between personal factors that occurs or not as a consequence of a disability and environmental factors that determine the activity of the person and the tasks being performed.

The WHO international classification of functioning, disability and health (ICF) is used to categorize the disabilities being assisted [1].

Research projects at the international level, such as the cardiac [2] and braid [3] are currently defining roadmaps on methods and tools for designing AT and services integrated these AT. Numerous emerging scientific questions at various steps of the AT design can be found in the literature. Some of them concern:

- the implication of age related changes in cognition AT [4,5];
- the variation in the ability of the disabled that involves defining adaptive process of the human computer interaction component of the AT [5,6];
- the definition of a multidimensional assessment including usability, ethical and social criteria;
- the movement analysis as an input for the design of AT; for instance manipulability cues to quantify the functional patient’s abilities [7];
- methods and models for taking into account all the components of social environment of disabled persons;
- research grounded on sensory motor theories of perception for perceptual applied for the accessibility of digital spaces [8];
- the emerging of new discipline such as the neuro-rehabilitation to better understand the process of motor learning in the context of recovery after a neural lesion.

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This discipline involves kinematic models, studies on the role of *sensori-moteur* interaction, technologies dedicated to rehabilitation, for example [9].

These challenges can be addressed through a close collaboration between different fields such as human computer interaction, cognition, movement analysis, and ergonomics, etc. with a very close interaction with end user association and clinicians.

So, the theme E aims to promote collaboration between these different disciplines, in order to propose methods, tools, models and evaluation platforms, applied to the design of useful and efficiency AT.

2. Results for the period 2011–2012

January 17–19, 2011: “the use of ICT for greater autonomy: interdisciplinary research”. This conference of three whole-days was sponsored by the GDR STIC Santé. The objectives were to:

- to present the progress of current work on assistive technologies;
- to discuss on the place of re-education centre, clinical teams both on the design and evaluation process;
- to review current initiatives for ethic consideration.

Presentations have covered several fields: perception (analysis, characterization and modelling); movement studies (biomechanical modelling neuro-rehabilitation); modelling tools of the human process for disabled and elderly people; design and evaluation methods of AT, etc.

November 29–30, 2012: workshop “bodily integration of technic”. Organized by N. Jarrasse and A. Roby-Brami (ISIR UPMC-CNRS UMR 7222) and M. Maestrutti (Cetcopra, Université Paris Panthéon Sorbonne) in the framework of Défi Sens CNRS (P. Sommer, CNRS Mission pour l’interdisciplinarité) with the support of ISCC-CNRS (V. Donzeau-Gouges, E. Kleinpeter, B. Brémont) and GDR Stic santé. The workshop was organized in ISIR and 60 persons participated.

The objective was to develop a multidisciplinary approach (physiology, robotics and anthropology) of the relationships between body and technology taking as an example the prosthesis for the compensation of sensorimotor disabilities. Sixteen participants presented a contribution. The presentations were organized into four sessions:

- tools and technique;
- motor control and prostheses;

- body and disability;
- action, perception and enaction.

3. Future plans (work in progress)

Two main meetings are presently in progress. The first one will concern the role of use studies in the iterative design process of the alternative augmentative communication aids (combining pictograms and text mode). The second one will focus on the analysis of 10 research years on brain computer interface (BCI). Feedback of tested BCI will be held on interaction with the theme B and with GDR ISIS for the validation and identification limitations of the current methods of signal processing.

The future works will also focus on strengthening the interactions with the other topics of this GDR (mainly the theme G, possibly leading to the definition of a joint action on the multidimensional assessment based on usability criteria and biomechanics cues). We will also establish a connection with the actions of the “Defi-Sens” program of the CNRS (<http://www.cnrs.fr/mi/spip.php?article58>) and the ASSISTH network. Efforts will be pursued to reinforce the collaboration on assistive robotics with GDR Robotique.

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