The recent development of technologies at a very low cost (either hardware devices like arduino, teensy, raspberry ft, or software tools), the public's enthusiasm for the "DIY" (Do It Yourself – Do It Yourself own) (Hurst, 2011) and dissemination of knowledge in human-computer interaction (HCI) show that it is possible to design "customized and personalized" assistive technologies. Moreover, empowering disabled users with development of such aids may improve the adoption and diffusion of these technologies.
In HCI, one of the goals of rapid prototyping is to test a number of innovative solutions that can be useful to users. The feedback process can then be used for example to guide further developments. We believe that this process is adequate to design useful systems for deficiencies. We illustrate this process through an experiment conducted for the design and the implementation of assistive technologies for quadriplegics.

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Nanostructured flexible implantable microelectrodes for stimulation and recording neural activity

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Many people severely disabled following a stroke or a lesion of the spinal cord, remain totally immobilized. In most severe cases, as in the case of locked-in syndrome (LIS), patients are completely deprived of means of communication and action, while their cognitive abilities are preserved. BCI devices, based on functional connections between brain and machine, are employed to direct a cursor on a computer screen in order to use software, to type text... The new assistance systems are based evidently on knowledge of brain functioning but also on the design of adapted machines (robots, computers, etc.). The physical interface between the brain and the system, composed usually by implantable microelectrodes, is a third fundamental element of the device whose properties directly affect the quality of the recording and stimulation.
Currently, whatever the kind of employed microelectrodes, two critical aspects very disadvantageous for long-term implementations concern the lifetime of electrodes, not exceeding a few months after implantation in general, and their biocompatibility with a high rejection rate for many implants.
Our work combines the surface nanostructuring of electrodes and the use of flexible substrates promoting intimate contact electrode-neurons. These complementary approaches favor the growth and adhesion of neuronal cells [1]. The modification of the electrode by electrochemical deposition of conducting polymers (PEDOT) results in an increase of electrode lifetime/stability and improved biocompatibility of devices. Also doping of PEDOT by nano-objects or organic compounds increases the signal to noise ratio by reducing the electrical impedance and promoting the injection of electric charges which will make the devices much more efficient to stimulate and record brain activity. We will present our preliminary results showing that our approach reduces the impedance of microelectrodes of more than one order of magnitude.

Reference

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Proposed method to assess walking aids in the elderly with observation and simple timing parameters

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Smart walking aids with robotics, adapting to the person and the environment, are most relevant for walking difficulties in the elderly (adding motor, visual, cognitive, hearing impairments...). Such devices don't cope with the French refunding agreement scheme. A trial-based medicotechnical evaluation is required, prior to medical-trials, to check that the device, used by the volunteer, provides the expected service.
Method.– Four healthy aged volunteers (H) and 4 patients (P) with walking ($v < 1$ m/s, Timed Get Up & Go > 13s) and cognitive ($MMSE < 26$) impairment had 3 tries at 4 M straight-line walk (4 M) then modified TGUG (including going round the chair before seating again) with their usual way (U), then a regular walker (S), then Robuwalker (rW) motorized automat with command buttons on the handles, tests were filmed by a single camera.
Results.– In both H and P: there is no big difference on 4 M between U and S, with rW time is more increased in the healthy subjects (X5 to 10 vs. 2 to 3). One patient failed using the interface even during 4 M. Steps average duration is increasing 1.8 to 3.4× between S and rW, for H, vs. 1 to 1.5× for P. The duration of double contact is increasing in H with a median of 15% (extremes 3 to 18%) vs. only 5% (3 to 11%) in P. Some P and H failed to turn smoothly in front of the wall with rW or to use it to stand.
Discussion.– Increased duration of tasks and steps in H are a clue of a lesser benefit for them in terms of stability. The trend towards an increased proportion of double contact could mean a push of healthy subjects against rW (fixed max speed). This fits with the variations of trunk to vertical and to the shoulder-wrist axis as clinically observed. The failure of two patients, the difficulties at turns and to stand with rW imply a human robot interface (HRI) problem. We propose that the speed should adapt to the user and the HRI be improved.

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Communications affichées

Version française

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Prise en charge multidisciplinaire d'un cas complexe de positionnement

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Introduction.– La démarche de positionnement est le processus clinique visant à placer une personne ayant des troubles posturaux, dans une posture requise au moyen d'une aide technique à la posture. La complexité de certaines situations cliniques associant des déficiences multiples, des limitations d'activité variables et devant être maintenues ainsi que la prise en compte de l'environnement, impose des stratégies multidisciplinaires structurées dont voici un exemple.
Observation.– Une patiente de 20 ans présentant un syndrome cérébelleux bilatéral avec dystonies à type de myotonies prédominant au membre supérieur droit et hémiparésie gauche suite à l'exérèse d'un astrocytome pylocitique du cervelet est adressée. La principale doléance était l'apparition de douleurs de hanche gauche au fauteuil, limitant la capacité de transfert et de propulsion podale du fauteuil.
En position assise, on observait une rotation droite du bassin de plus de 25°, pas d'obliquité de bassin, un membre inférieur gauche plus court en rotation interne et en abduction. En décubitus dorsal : limitation de la flexion de hanche gauche à 60° avec une spasticité des adducteurs cotée à 3 (Ashworth). Les radiographies