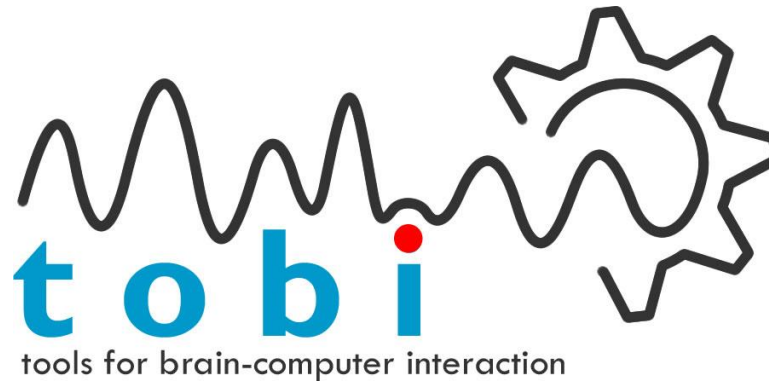


AAATE Workshop, Sheffield 2010

BCI research and user involvement: the role of independent AT centres in the TOBI project



Evert-Jan Hoogerwerf

ALIAS Bologna Ausilioteca Team

& Simona Mongardi (ALIAS), Pit Staiger-Saelzer (BUK), Claudia Zickler (U.T.)

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TOBI Project Aim

- The TOBI project aims at developing non invasive brain computer interface (BCI) controlled applications in the fields of Assistive Technology (AT) and Rehabilitation Technology.
 - *Functional*
 - *Usable*
 - *Reliable*
 - *Safe*
 - *Evaluated positively by end users (people with disabilities and patients in rehabilitation)*
 - *Very short time to market perspective*

Project period: 1/11/2008 – 31/10/2012

Work in progress (incl. self reflection)

Application fields

- Communication (speller, web browser)
- Entertainment - leisure (fast and slow gaming, photo browser, music player)
- Motor substitution (orthosis - upper limbs)
- Motor restoration (post stroke rehabilitation)

Consortium members

- Research institutes and Universities (BCI teams)
- Rehabilitation clinics
- Industrial partners
- Independent Assistive Technology Centres
 - AIAS Ausilioteca Bologna (I)
 - BUK (D)

First step: User Needs/Requirements survey

Objective: Define the most urgent needs and requirements of end-users with disabilities and professional users (AT-experts, caregivers)

Sample: *77 potential BCI-users*

48 Professional users (26 AT-experts, 22 caregivers)

Results/Conclusions:

- Dissatisfaction of end-users with current solutions:
 - *aids for manipulation: 30 %, computer access: 23%, environmental control: 17%, communications aids: 16%*
 - ➔ **need for improved AT solutions in the domains where BCI can contribute**

User Needs/Requirements survey

Other results/Conclusions:

- Most important aspects of new AT: “functionality”, “ease of use”, “possibility of independent use”, and “adaptability to the specific situation”.
 - *end-users and AT-experts: “functionality” = most important aspect*
 - *Caregivers: “ease of use” = most important.*
- Develop BCI applications which are
 - *effective (functional/robust) and*
 - *simple (ease of use)*
- Provide AT solutions
 - *with which users are as independent as possible from the support of others*
 - *which are adaptable to the specific situation of the end-user*
- Provide training for end-users and caregivers

Challenges in TOBI

- To reach a high(er) level of user-centred-ness in the development process.
- To reflect on our own role in the project starting from existing strengths.

Characteristics of AIAS Ausilioteca and BUK

- Support people in identifying appropriate technology that suit their needs in different areas of independence, participation and inclusion: supporting informed choices
- Multidisciplinary teams
- Independent advise (no binding ties with industry)
- Intervention in different settings (centre, home, work, etc.)
- Long term relationships with clients
- Wide range of solutions available in the Centre
- Personalisation, loaning, training and support
- Background as user organisation (AIAS Bologna)

Contribution to the project

Coherent with the service delivery principles:

- A psycho-social approach vs. a medical approach.
- Definition of users: not “patients” vs. “healthy subjects”, but people with disabilities/potential end users, AT experts, professional carers: collaborative models to increase usability of solutions. Framework provided by MPT model.
- Working with potential users in multidisciplinary teams.
- Consider areas of use: user scenario's to assess needs, wishes, requirements, preferences and constraints of BCI use by potential beneficiaries.

Methodological choices

- Need to start testing with AT users as early as possible in the project:
 - *Cross over of BCI technology to AT sector as early as possible to capture AT knowledge and exchange.*
 - *Impact on outcomes and increase market potential.*
- Testing with potential users prototypes in different stages of development
- Avoid testing with people with very severe motor restrictions.
 - *Stress - fatigue - motivation - mood*
 - *Not fulfilled conditions: reliability of technology, understanding of all factors, collaborative context*
 - *Ethical implications - responsibility for success*
 - *Unfair power balance*
 - *Conditions for full involvement in all stages of the project*
- Contracts and payment of people with disabilities involved in the project

Living Labs – features*

A “permanent” community of users who are iteratively asked to become integrated in some stages of the design/development/validation and marketing process and who’s feedback is collected by means of various socio-ethnographic research methods (focus groups, surveys, testing, polls, etc.)

- Different stakeholders working together for innovation
- Open innovation concept: sharing and spreading
- Real life testing environment: seamless and spontaneous interaction between people and technologies (+ environments)
- User centric approach to innovation: people’s feedback is put at the core, especially at the beginning

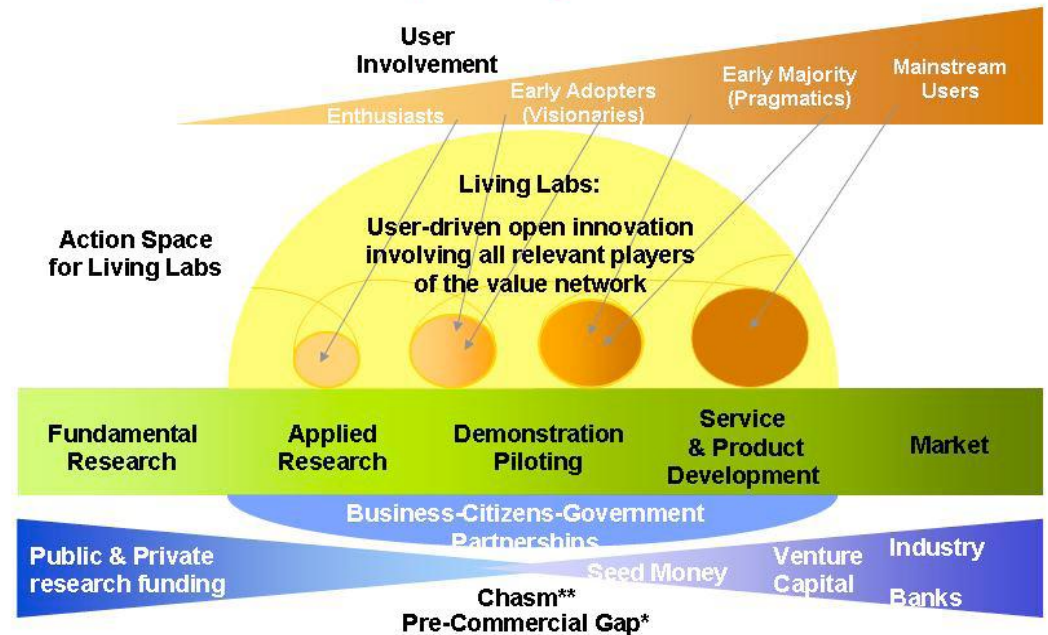
* Study on the potential of the Living Labs approach, including its relation to experimental facilities for future Internet related technologies. A study by ALTEC on behalf of the EC DG information, Society and Media. Directorate F “Emerging Technologies and Infrastructures”. 2007.

Living Labs

METHODOLOGICAL CHOICES:	<i>User forums of end users and independent AT experts (professional users).</i>	<i>Testing in clinics, AT Centres starting from first prototype, feedback, impact on development prototypes</i>	<i>Increasing number of end users involved in different settings</i>
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AT Centres as permanent Living Labs?

Action space for Living Labs along the technology adaption cycle

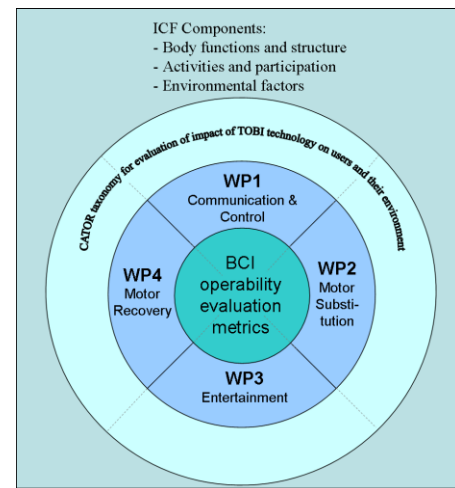


* MacDonald and Associates, 2004

** Geoffrey A Moore: Crossing the Chasm, 1999

Evaluation Metrics and User Involvement

- **BCI operability evaluation metrics**
 - Signal acquisition and processing, control, speed, reliability, accuracy, etc.
- **Application specific metrics to measure functionality**
- **General Metrics: Impact on users and environment**
 - *Evaluation by end-users and AT-experts*
 - *Assessment of data through questionnaires (developed for assessing AT related outcomes) and structured interviews:*
 - *Subjective workload (NASA TLX)*
 - *Device satisfaction (based on QUEST 2.0)*
 - *Satisfaction with TOBI application as AT-solution (ATD-PA)*
 - *Influence of TOBI applications on activity, participation and quality of life (LIFE-H, SEIQoL-DW, ACSA, PIADS)*
 - *Establishment of user forums in AIAS and BUK*
 - *Involvement of experienced end-users with disabilities*
 - *Agreement on treatment, trials and feedback methods*
 - *Interview and discussion about TOBI applications and their impact on the life of end-users with disabilities, possible application fields, acceptability, etc.*



First achievements

- Technical partners have transferred BCI competence to user group representing partners: AIAS and BUK. AIAS is independent in testing BCI driven AT applications.
Technology transfer = Sharing of ownership
- At AIAS and BUK testing has started and considerable numbers of people with disabilities and AT experts have started using the BCI.
- AIAS and BUK user forums have been set up and have started meeting (Living labs).
- Users are motivated and interested in the whole project and future directions\development of BCI applications and they feel active part of the project.
- Additional feedback loops are under development which will provide qualitative data to the BCI and application developers.

Conclusions

- AT Centres (as described) seem to be appropriate settings/resources for the implementation of user centred design processes in AT.
- They can *benefit from* and *contribute to* the understanding and further development of User Centred Design principles and practices.
- Research and service delivery could be merged, creating the conditions for permanent living labs that contribute to ongoing innovation in AT.
- Need for user training and empowerment.

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