HOSPITAL DE NEURORREHABILITACION
Badalona – Barcelona

Hospital de referencia para el tratamiento medico-quirúrgico y la rehabilitación integral de las personas con lesión medular, daño cerebral adquirido u otra gran discapacidad de origen neurológico.

Joan Vidal, PhD

NeuroTec

INSTITUT GUTTMANN: The Organization

Health care

- Specialised and High complexity services in neurorehabilitation: SPINAL CORD, ACQUIRED BRAIN DAMAGE, NEUROLOGICAL DISORDES
- Adults and children with special unit
- Intensive rehabilitation facility
- Inpatient and ambulatory services
- Surgery specialised in complications
- Public and Private activity.
- Oriented towards international collaborations

Research

- Translational research
- Clinical research
- Innovation

Teaching

- Pregraduate and postgraduate programmes
- UAB links

Social and community services

- Community services
- In home services: nursing, medical, psychological, cognitive, functional services
- NEW PROJECT. Hub in Meridiana. Cor de la Sagrera

420 practitioners and a record of **22,000 patients treated** make Institut Guttmann into one of the most advanced, world-class hospitals of its kind.

INSTITUT GUTTMANN: Health Care Activity 2014

Health care activity

- 150 hospitalization beds (half spinal, half brain), 16 Monitored beds
- 4.577 patients treated (46% BI; 37% SCI); 1.013 new patients (22%)
- 894 discharges (90% Catalonia, 8% rest of Spain, 2% other countries)
- 3.701 persons visited at the ambulatory services (8.946 visits)
- 62% admissions for specialized intensive rehabilitation
- 27% admissions for treatment of complications
- 11% admissions for specialized evaluations
- 976 surgery acts (major and minor) (2 operation rooms)
- 16.023 adults rehabilitations sessions and 5.755 child rehabilitation sessions
- 420 FTE employees (46 doctors, 76 nurses, 30 physical therapy …)
- 3 month length-of stay inpatient basis

Budget 25 millions €

- 72% public provision NHS, research grants... (18 millions €)
- 28% private provision (7 millions €)
  - Insurance Companies (traffic and labour accidents)
  - Private Patients
  - Donations

Evolution attended patients 2004 - 2014

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
TOTAL PATIENTS	3.193	3.338	3.710	3.915	4.142	4.178	4.439	4.506	4.426	4.527	4.577
INPATIENTS	772	847	937	926	922	865	848	835	796	826	894

Evolution attended patients 2004 - 2014

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
NEW PATIENTS	**799**	**830**	**867**	**922**	**997**	**999**	**1.093**	**1.013**	**966**	**983**	**1.025**
SCI	233	262	281	255	244	255	255	184	222	206	231
ABD	379	416	418	444	539	506	561	582	558	580	608
Other	187	152	168	223	214	238	277	247	186	197	186

Institut Guttmann's Organizative model; interdisciplinarity

Patients family

Admittance, patient rights, privacy…

SPINAL CORD | BRAIN INJURY | CHILD REHB

- Rehabilitation nursing
- Physical and occupational therapy
- Speech-language, social work and vocational services
- Diagnostic imaging, laboratories, pharmacy...
- Surgery: urology, orthopedic and traumatology, anesthesiology, plastic....

Discharge, Reinsertion…

Patients, family

Its modern facilities, a team of **420 practitioners** and a record of **22,000 patients treated** make Institut Guttmann into one of the most advanced, world-class hospitals of its kind.

INSTITUTE GUTTMANN: Research, Teaching and Innovation

INSTITUT GUTTMANN is, at the same tame, a Research Institute affilitated to the Universitat Autònoma de Barcelona_UAB

As a RESEARCH INSTITUTE, it has the mission of developing the academic, scientific and research aspects of neuroscience in general and neurorehabilitation and technologies applicable to personal autonomy in particular.

INSTITUTE GUTTMANN: Research, Teaching and Innovation

LINES

Spinal Cord Injury

Acquired Brain Injury

Programmes

- P1 – BIOENGINEERING APPLIED TO THE PERSON'S FUNCTIONAL INDEPENDENCE
- P2 – NEUROSTIMULATION, NEUROMODULATION AND NON-INVASIVE STIMULATION
- P3 – ICT APPLIED TO NEURPSYCHOLOGICAL REHABILITATION AND COGNITIVE STIMULATION
- P4 – NEUROREHABILITATION OF DIGESTIVE FUNCTION
- P5 – REGENERATIVE MEDICINE APPLIED TO SCI AND ABI
- P6 – QVIDLAB - ANALYSIS OF RESULTS APPLIED TO KNOWLEDGE GENERATION
- P7. PHARMACOLOGICAL INTERVENTIONS IN NEUROREHABILITATION

Bioengineering applied to autonomy of persons:
Rehabilitation Assisted Robots and Motion analysis laboratory

The laboratory is equipped with the **integral "BTS bioengineering" system** that allows a complete **motion analysis** including **kinematic** (angular & temporal & spatial parameters), kinetic (force & power) and **dynamic electromyography** data as well as **video recording** to help the **clinical interpretation of the results**.

Robotic assistive devices:

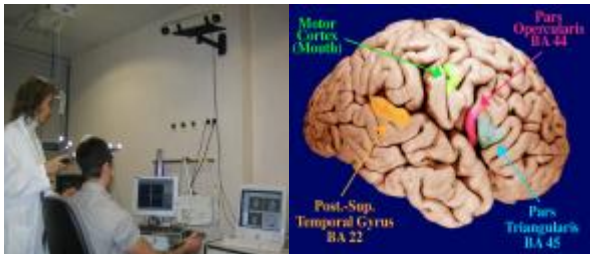
- More intensive training
- Monitoring of performance
- Motivation and feed-back
- Homogenization of interventions




The obje**ctive and quantitative movement analysis** provide **high resolution tools** to assess the impact of rehabilitation interventions, **contribute to the research of physiopathological mechanisms**, as well as to **enhance the collaboration with technological partners** to define user requirements **promoting bottom-up research from the real needs** of neurorehabilitation.

Neurostimulation, neuromodulation and noninvasive stimulation

Institut Guttmann has the most advanced **transcranial magnetic stimulation** equipments combined with a **neuroimage guided** system and **stereotactic computation**. This system allows **modulating brain cortical activity** which is in turn **combined** with **rehabilitation procedures** in order to **optimize its results**.



Institut Guttmann also has extended experience studying therapeutic applications of **transcranial direct current stimulation (tDCS)**, that allows modulating membrane excitability of cortical neurons.

This, **combined with techniques of Visual illusion** or Virtual reality to improve **neuropathic pain** or **motor control disorders** due to Acquired Brain Injury and/or Spinal Cord Injury.

This approach enables translational research on neuroscience and clinical innovation by **promoting new strategies for guiding and enhancing recovery**. This will boost both findings in neuroimage studies and cognitive neuroscience in general, and knowledge of cerebral organization of motor control, learning and rehabilitation.

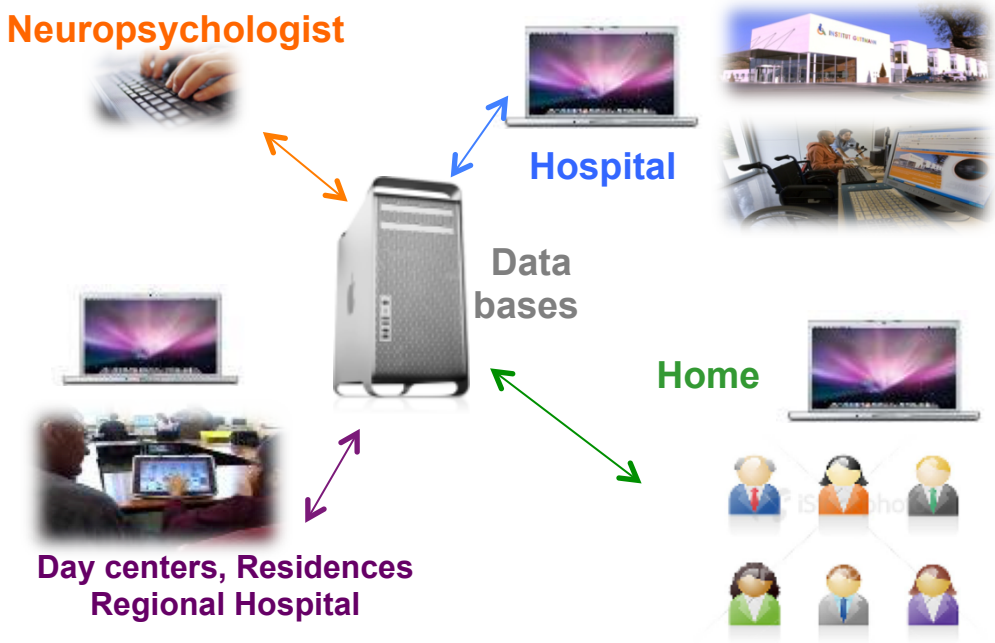
A method for treating neurophatic pain (US 13/197,883)

System and method for neuropathic pain rehabilitation (PCT/EP12380025)

ICTs applied to neuropsychological rehabilitation and cognitive stimulation

An innovative **computerized cognitive telerehabilitation platform** that allows the establishment of a **new method for provision of neuropsychological rehabilitation services** in patients with acquired brain injury.

- Optimizes time of health professionals by an asynchronous connection model.
- Increases the personalization and intensity of treatments.
- Automatic monitoring of rehabilitation activities.
- Ral-time information on results
- Guidance about most appropriate therapeutic options, according characteristics and progress of each patient.
- Generates knowledge for the establishment of clinical practice guidelines, through a patent protected algorithm.
- Makes easier clinical research.



- More than 1.000 patients has been able to benefit from the system
  - > 200 at home
  - > 400 hundred at day centers, residences, etc…
- More than 200.000 therapeutic hypothesis evaluated
- **1st EVIDENCE BASED Cognitive training system in the world**

Translational Research Program for Regenerative Medicine Applied to SCI and BI

The Institut Guttmann has integrated cutting edge technologies and developed innovative methodology under the vision to become an optimal Clinical Research Center for advanced therapies and regenerative medicine in neurorehabilitation

- Clinical and subclinical characterization of normal course (conventional treatment) of the disease
  - Advanced neurophysiological assessment
  - Kinematic analysis for objective functional assessment
- Monitor rehabilitation intervention as an active ingredient of the treatment, while new connections will be established
- Member of the Spanish Network for Biomedical Research (CAIBER)
- Member of the Spanish Network for cellular therapy (TERCEL)
- Member of the Spanish Network for Technological Innovation (RETICS)

QVIDLAB_Knowledge Discovery in Databases Platform

Knowledge generation is a intrinsic institutional value at Institut Guttmann.

- Pioneering the ICT in health system in Spain, in 1993 it introduced its own Electronic Clinical Record.
- As a monographic hospital in neurorehabilitation, it concentrates a high volume of knowledge on its specialty.
  - Every year:
    - 5.000 patients (1.000 new patients)
      - 50% SCI // 50% Brain Injury (Approx.)
    - 500 intensive rehabilitation (90 days average stay)
      - Clinical protocols with comprehensive evaluation
  - 22.000 patients since 1.965
- In 2006 it created the QVIDLAB; an Information technologies laboratory oriented to generate about interventions and factors contributing to improve Quality of Live of persons with neurological disabilities.
  - Data mining
  - Survival analysis
  - Qualitative methods
  - Multicausal correlations

Qvidlab

Laboratorio de mediadas potenciadoras de la autonomía, satisfacción personal y calidad de vida de las personas con lesión medular y daño cerebral

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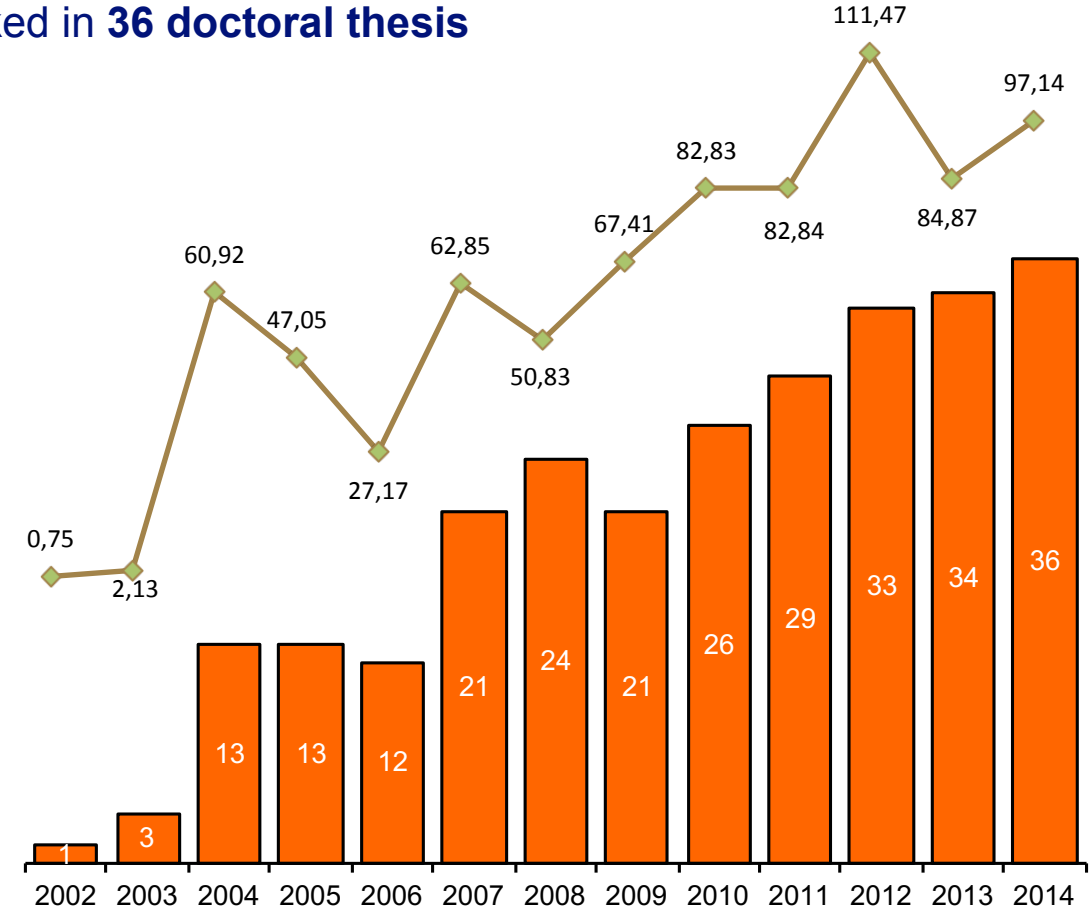
System and method for extracting and monitoring multidimensional attributes regarding personal health status and evolution (PCT/EP2011/074267)

- Active collaboration with the ICF Research branch of the WHO
  - ICF Core Sets for SCI
  - ICF Core Sets for TBI

INSTITUTE GUTTMANN: Research, Teaching and Innovation

During the period 2002-2014

- We have worked in **211 research** studies (56 for competitive bidding)
- **266 scientific articles** produced (with an impact factor of 778)
- **805 communications** done in various congresses
- and worked in **36 doctoral thesis**



Impact factor per year

Number of indexed publications per year

INSTITUTE GUTTMANN: Research, Teaching and Innovation

5 lines of teaching interdisciplinary oriented within the ECTS.

- 2 ECTS MASTERS
  - ECTS Master degree in neurorehabilitation
  - ECTS Master degree in neuropsychological rehabilitation and cognitive stimulation.

- 21 SPECIALIZATION COURSES in neurorehabilitation.

- TITLE OF EXPERTISE in neurorehabilitation -FELLOWSHIP.

During the period 2002-2014:

We have contributed to the training of **1.371 students**
(**157** Official Masters, **8** titles of expertise, **748** specialization courses
and **160** diploma and non official masters)

193 Residents rotation of three months
62 from Catalan hospitals, 87 from other autonomous communities
and 36 from foreign countries (27 from Latin American countries),

and **practical training of 708** professionals and/or students from different disciplines of health sciences related to neurorehabilitation.

Proyectos europeos

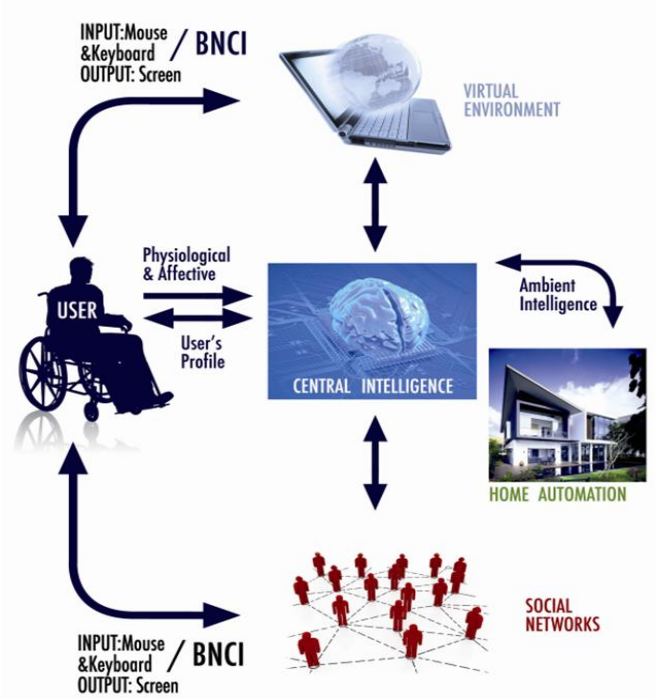
- BRAINABLE
- WAY
- BNCI 2020

Brain Computer Interface

BrainAble

This project is partially funded by the European Commission
under the 7th Framework Programme

ICT-2009 Call 4
Accessible and Assistive ICT



Task 6.3 Evaluation of the individual components of Brainable
P300 long-term study: G.TEC

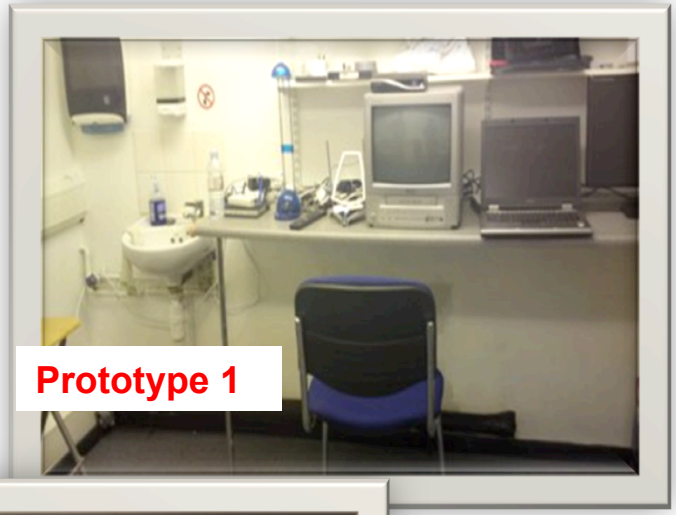
Aim

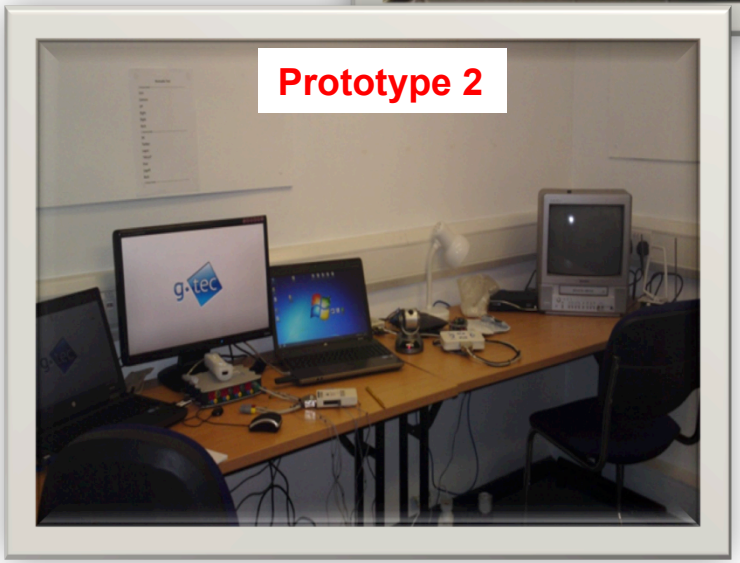
Test the usability/feasibility of P300 paradigm in a series of sessions with particular subjects with neurological disorders.

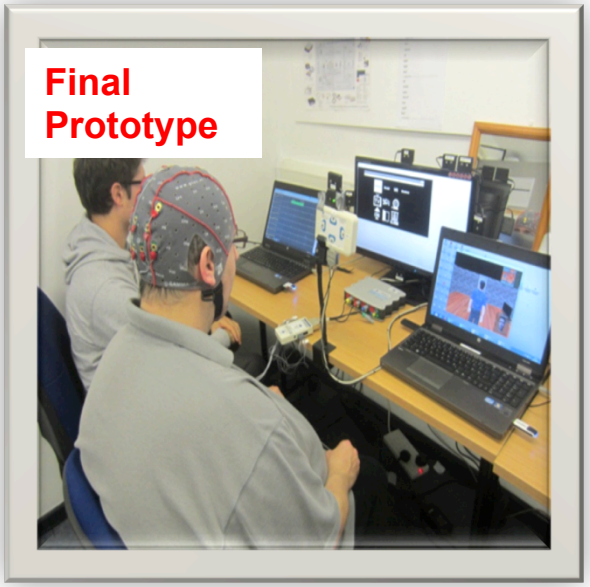
Task 6.3 Evaluation of the individual components of Brainable
ERD + HoS : TUG

Code	Age	Gender	Med. Condition	Vision	Level of education
GM01	42	M	SCI C6 ASIA A	No	Primary
GM02	21	M	SCI C5 ASIA B	No	Secondary
GM03	19	M	SCI C4 ASIA B	No	Secondary
GM04	45	M	SCI C7 ASIA C	No	Secondary
GM05	66	M	Polineuropathy	Glasses	Secondary
GM06	66	F	Guillain Barre Syndrom	Glasses	Secondary
GM07	25	M	SCI C4 ASIA A	No	Primary
GM08	19	M	SCI C4 ASIA A	No	Primary
GM09	43	F	SCI C4 ASIA A	No	Secondary
GM10	60	M	Brain Anoxia	No	Primary
GM11	47	M	TBI + SCI C7 ASIA A	No	Tertiary
GM12	41	F	Hemorrhagic stroke	Ambiblopia	Primary
GM13	19	M	SCI C3 ASIA A	No	Secondary
GM14	34	F	Multiple Sclerosi	No	Secondary
GM15	21	M	SCI C4 ASIA A	No	Secondary
GM16	24	F	SCI C2 ASIA A	No	Tertiary
GM17	46	M	SCI C4 ASIA A	No	Tertiary
GM18	23	M	TBI (Locked in syndrome)	Right eye paralysis	Secondary
GM19	39	M	SCI C6 ASIA A	No	Primary
GM20	38	M	SCI C4 ASIA D	No	Primary
GM21	65	F	SCI C1 ASIA C	Glasses	Primary
GM22	28	M	TBI+brachial plexus injury	Glasses	Secondary
AN01	63	M	MS	No	Tertiary
AN02	36	M	Muscular distrophy	Bilateral cataracts	Secondary

Task 6.4 Iterative Evaluation for user-centred design: BrainAble Prototype

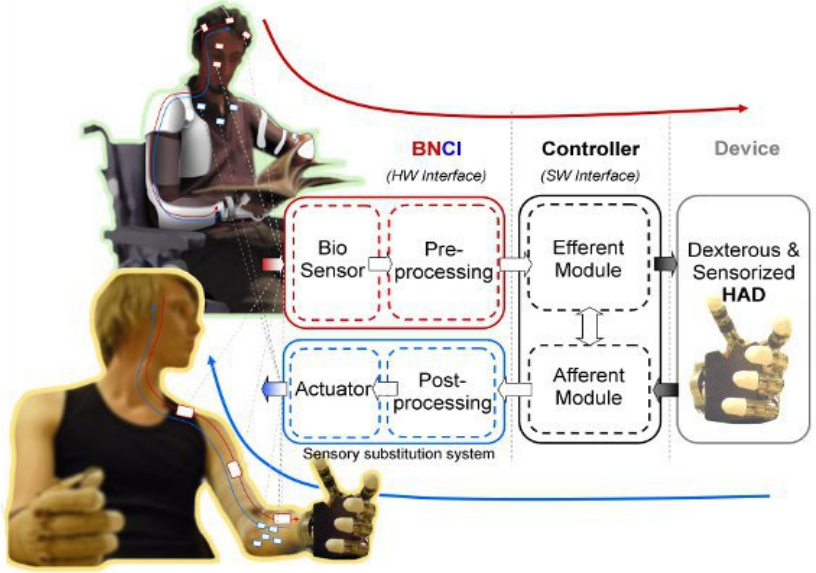






Wearable interfaces
for hAnd function recoverY

FP7-ICT-288551



Longitudinal study of DESC-like sensory feedback in stroke patients (includes Brain Mapping)

This work is included in de **Deliverable 6.7**.

SCUOLA SUPERIORE SANT'ANNA PISA

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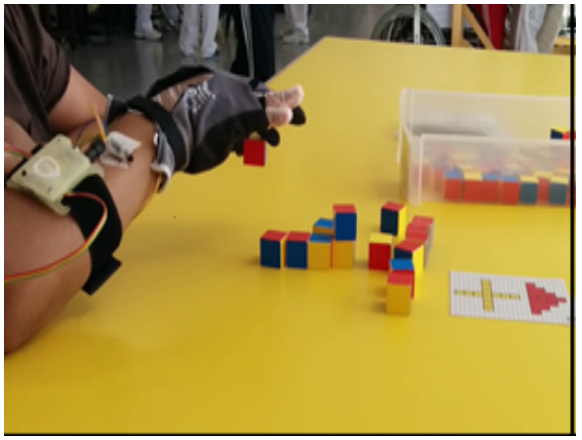
Longitudinal study of DESC-like sensory feedback in stroke patients (includes brain mapping)

Introduction:

- Sensory feedback has shown to be very promising promise in improving motor recovery after stroke in individuals with sensory loss

  (Kita et al. Journal of NeuroEngineering and Rehabilitation 2013,10:55)



Objective:

- To investigate whether subjects with impaired sensory system due to stroke can integrate discrete vibro-tactile feedback and then use it for sensorimotor control in occupation therapy (OT) activities

Subjects

Longitudinal study of DESC-like sensory feedback in stroke patients (includes brain mapping)

Characteristics					
Subjects	**Gender**	**Pathology**	**Type**	**Hand afection**	**Sensory Description (Level C4, C5, C6, C7, C8, T1)**
1	Female	Stroke	Hemorragic	Left hemiparesis	Hypoesthesia
2	Male	Stroke	Ischemic	Left hemiparesis	Hypoesthesia
3	Female	Stroke	Hemorragic	Right hemiparesis	Hypoesthesia
4	Male	Stroke	Ischemic	Right hemiparesis	Hypoesthesia
5	Male	Stroke	Ischemic	Right hemiparesis	Hypoesthesia
6	Female	Stroke	Ischemic	Right hemiparesis	Hypoesthesia
7	Male	Stroke	Hemorragic	Left hemiparesis	Hypoesthesia
8	Female	Stroke	Hemorragic	Left hemiparesis	Hypoesthesia

Longitudinal study of DESC-like sensory feedback in stroke patients (includes brain mapping)

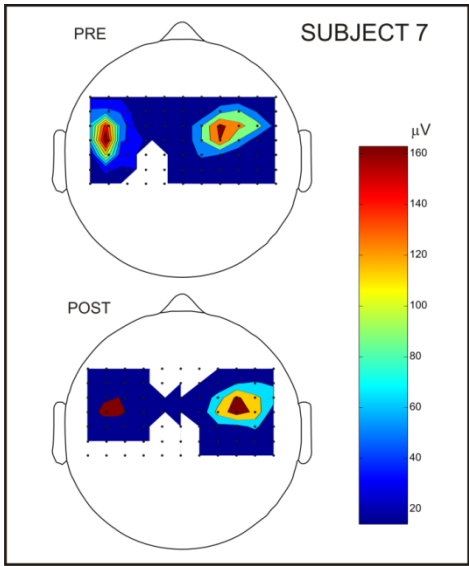
Conclusions:

Some patients did improve the functional outcomes and brain maps have significantly changed at the end of the study

Results did not show that sensory feedback was integrated in any patient (S6,S7 and S8)

Future studies would need to address the actual protocol design flaws

Real-time VT sensory feedback seems to be a new approach for rehabilitation especially for those subjects that due to a neurological condition have sensory disorders



Usability test

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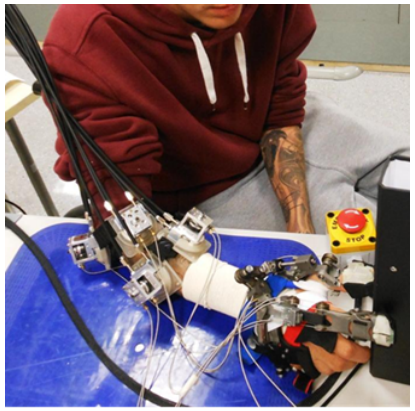
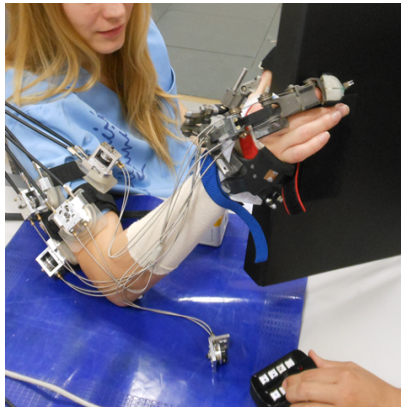
Usability test

To assess, analyze and improve the hand exoskeleton prototype (HX) with regard to:

- Usability
- Wearability aspects
- End user satisfaction
- Safety



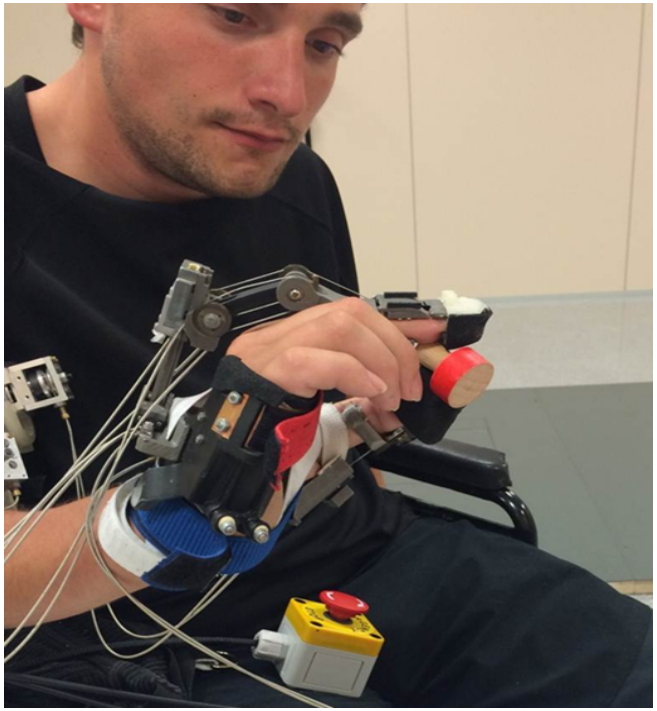
… following a user-centered design process (UCD), which consists of the early involvement of users in the design and development stages.



Usability test

Sample:

- 28 clinical experts and 9 end-users with SCI participated in the study



Participants:

- Physiotherapists, occupational therapists and medical doctors
- All subjects gave their written inform consent

Usability test

A manuscript was published

Taylor & Francis
Taylor & Francis Group

Disability and Rehabilitation: Assistive Technology

ISSN: 1748-3107 (Print) 1748-3115 (Online) Journal homepage: http://www.tandfonline.com/loi/iidt20

Usability test of a hand exoskeleton for activities of daily living: an example of user-centered design

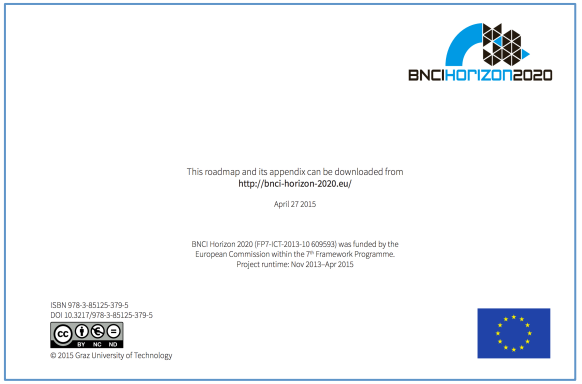
Maria Almenara, Marco Cempini, Cristina Gómez, Mario Cortese, Cristina Martín, Josep Medina, Nicola Vitiello & Eloy Opisso

BNCIHORIZON2020

roadmap

THE FUTURE IN BRAIN/NEURAL-COMPUTER INTERACTION:

HORIZON 2020


BNCIHORIZON2020

This roadmap and its appendix can be downloaded from
http://bnci-horizon-2020.eu/

April 27 2015

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Project runtime: Nov 2013- Apr 2015

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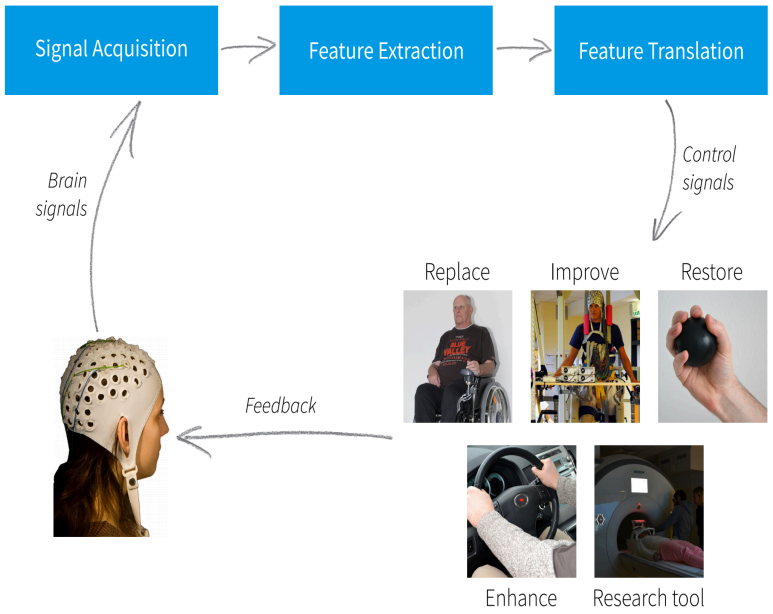
http://bnci-horizon-2020.eu/roadmap

AIM

The main objective of this roadmap is to provide a global perspective on the BCI field now and in the future. For readers not familiar with BCIs, we introduce basic terminology and concepts. We discuss what BCIs are, what BCIs can do, and who can benefit from BCIs. We illustrate our arguments with use cases to support the main messages.

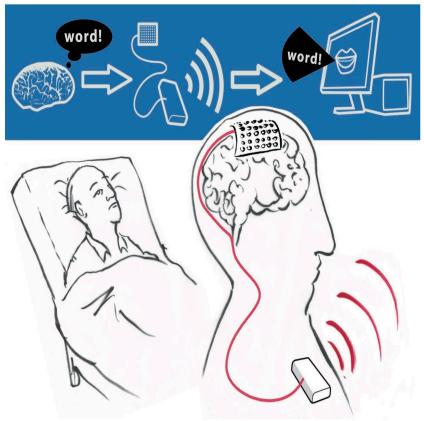
After reading this roadmap you will have a clear picture of the potential benefits and challenges of BCIs, the steps necessary to bridge the gap between current and future applications, and the potential impact of BCIs on society in the next decade and beyond.



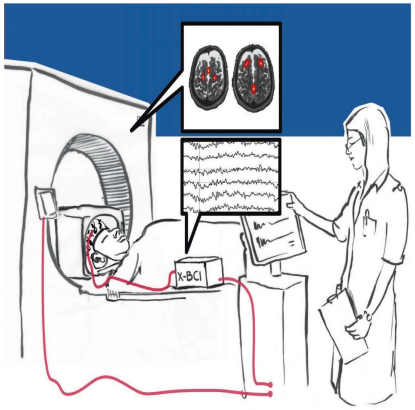
Escenarios

Improve

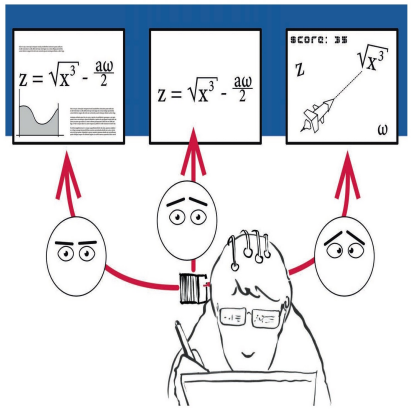
Replace



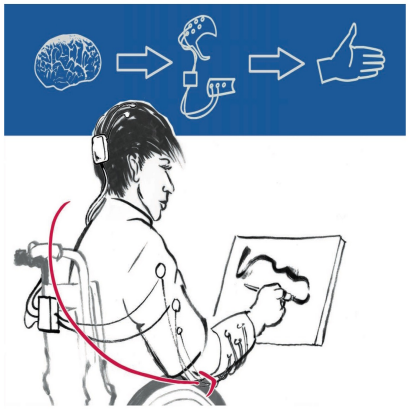
Research



Enhance



Restore



Otras colaboraciones

g.tec

mindBEAGLE®

Trastornos de la consciencia

recoverix®

Problemas motores en ictus

NE neuroelectrics®

tDCS / EEG

Dolor neuropático
Afasias
Depresiones

STARSTIM

Una oportunidad para la innovación en tecnologías médicas

EL MODELO COLABORATIVO ABIERTO EN RED

Para conseguir un mejor desarrollo de la investigación traslacional, el Instituto Guttmann tiene establecidos convenios de cooperación con más de 60 entidades de todo el mundo (instituciones, universidades, hospitales, centros tecnológicos y empresas) mediante un modelo de colaboración abierta, en red, potenciando la cooperación publico privada, con el objetivo de contribuir a impulsar en nuestro país la economía del conocimiento.