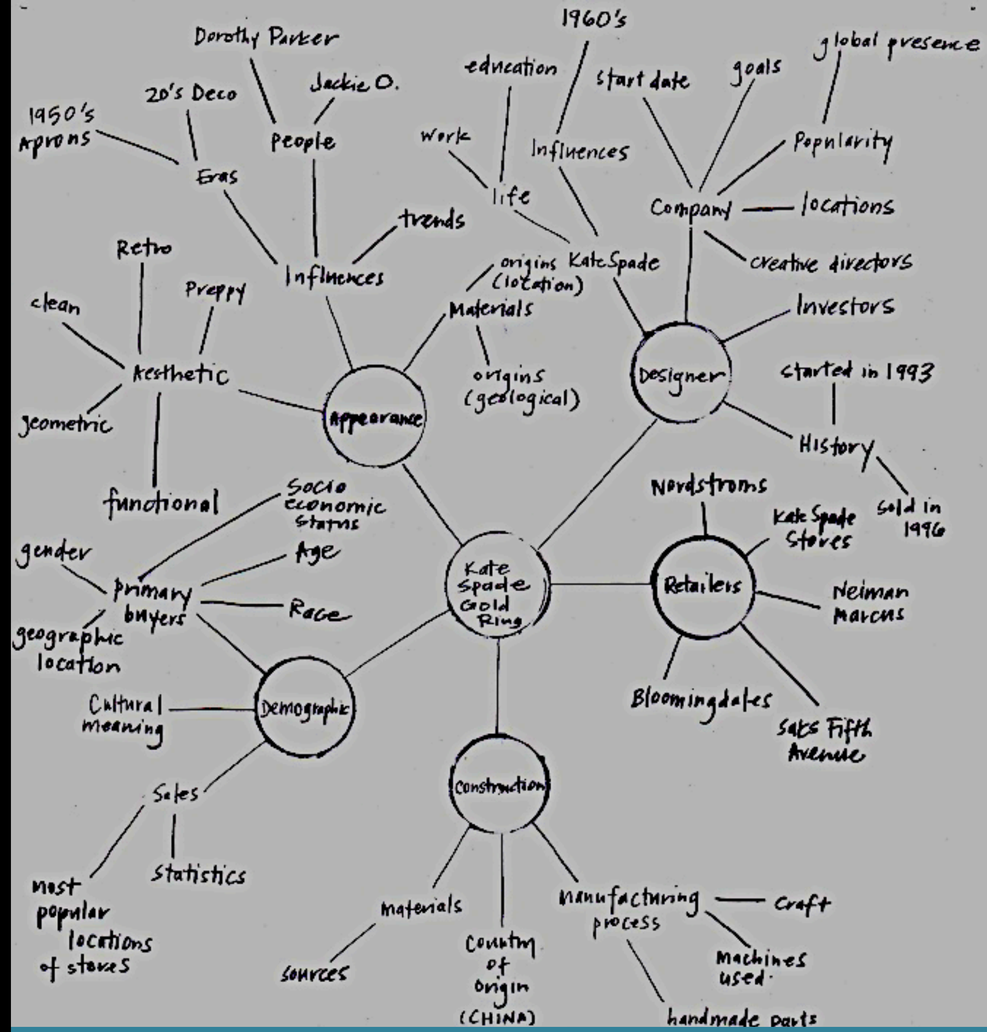
UX RESEARCH PORTFOLIO

FEDERICA FELICI

UX RESEARCHER AND USABILITY EXPERT



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ABOUT ME

I am a subtle and wide-ranging researcher on human brain and behavior, who is passionate about technology, arts, communication, and social relationships.

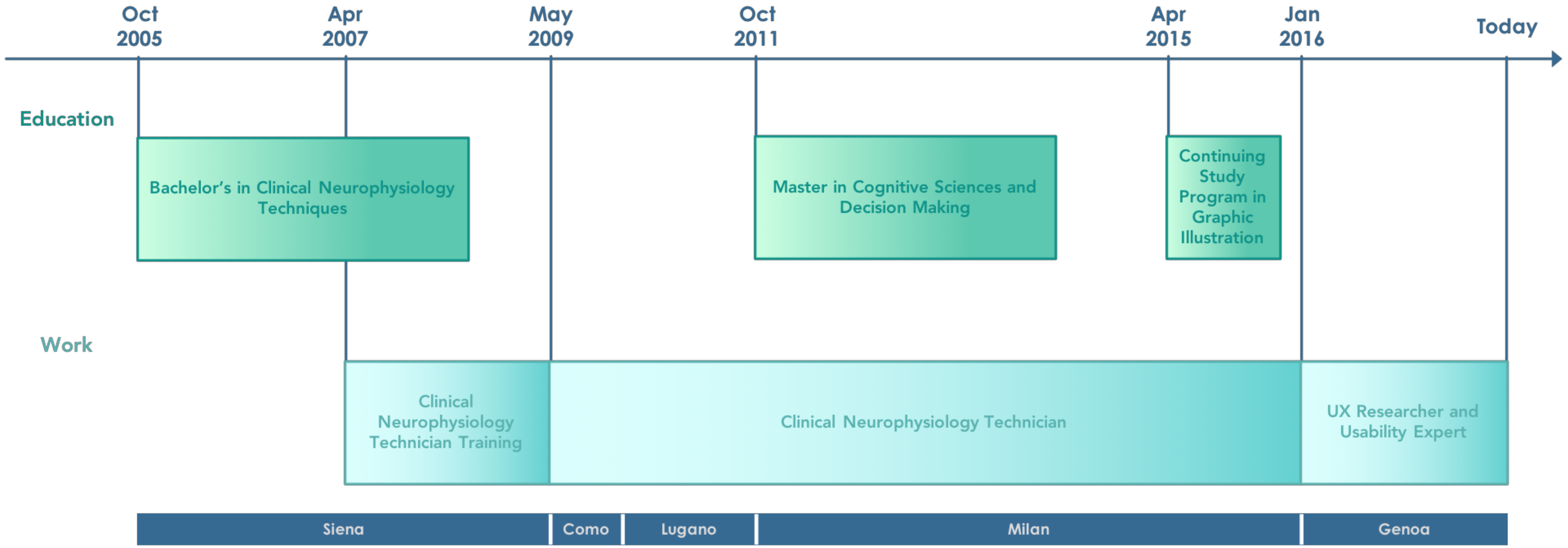
Guided by my skills and interests, I work as UX Researcher in a technology center and spend my time off practicing dance, listening to live music and going to art exhibitions. I constantly try to shape my work by enriching it with inputs coming from my leisure, thus producing results that can really stand out.

UX draws upon everything that I have ever studied and done in my different careers.

I'm currently located in Pisa and willing to relocate for the right opportunity.

MY JOURNEY

I turned into UX Research from clinical practice in an ongoing process.
At the beginning, I had to fix some methodological issues and fill some theoretical gaps.
My path led me to build a transversal knowledge of the human mind.



MY AREAS OF FOCUS

COGNITIVE SCIENCES

I studied physiological and pathological conditions of human brain. I focused on cognitive functions, such as information processing and emotive responses, by exploring scientific literature and conducting experiments on Nervous System functions. I am interested in how specific stimuli influence the brain by generating neural responses and triggering people into certain behaviors and choices.

USER RESEARCH

I carried out Qualitative and basic Quantitative UX Research. My goals were to provide positive UX and get better human-machine interaction by applying principles of human-centered design. I collaborated with designers and engineers to translate the results of research into functional and aesthetic requirements, i.e. which affordances and how to communicate them. I iterated the devices in a design thinking approach.

CLINICAL RESEARCH

I designed and conducted clinical research with amputees and neurological patients. I am proficient in using measures and techniques for the assessment and mathematical modeling of human motion and in picking the ones that are best suited for my protocols. I edited the documentation for healthy authorities and supervised the prototyping work in order to be compliant with ethical requirements.

TOOLS I KNOW

SurveyGizmo

UsabilityHub

Ethnio

Neurophysiology Techniques

Prosthetic Outcome Measures

Illustrator

Photoshop

InDesign

Gimp

iMovie

Keynote

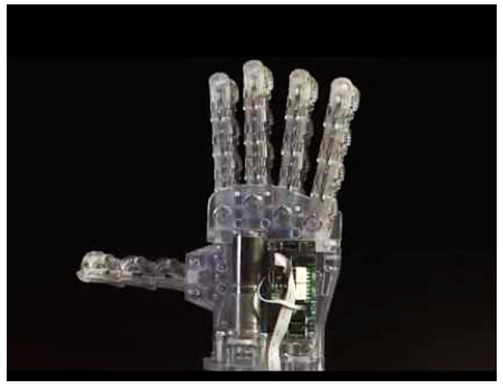
Latex

Excel Data Analysis

MY PROJECTS

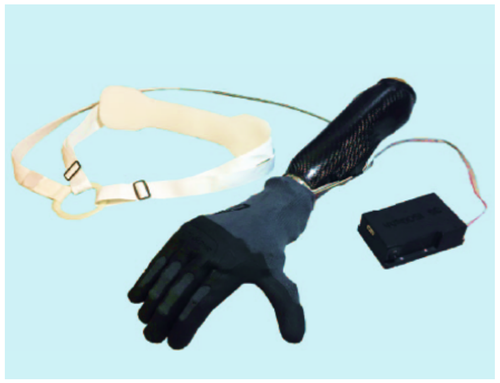
SOME PARTNERS I HAVE WORKED WITH

SOME OF MY WORK



SOFTHAND PRO

A completely redesigned robotic hand turned into prosthesis, it fits amputees' needs and it is suitable both for men and women, easy-to-control, robust, comfortable, and pleasant.

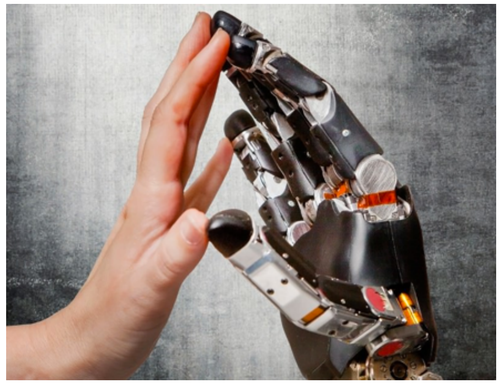


SOFTHAND PRO-H

A new model of prosthetic hand originated from SoftHand Pro that, by merging innovative design and different controls, can be enough robust to be used without constraints in all domains of daily life.

SOFTHAND X

An innovative device based on SoftHand, able to improve the functional outcome of the upper limb of stroke patients by finding new assistive or rehabilitative strategies for therapy.



EMBODIMENT

A novel protocol to unveil and assess qualitatively and quantitatively embodiment in using assistive or rehabilitative technology, overcoming the current lack of a valid methodology.

BIOMECHANICS

Modeling of human upper limb movements and coordination of different joints according to specific spatio-temporal patterns, that could be exploitable in control of robotic devices.

SOFTHAND PRO-H

ITALIAN INSTITUTE OF TECHNOLOGY
UNIVERSITY OF PISA
QBROBOTICS
AZIENDA USL TOSCANA NORD OVEST (CLINICAL PARTNER)

PROJECT SUMMARY

Reduce the abandonment rate of prosthesis by providing amputees with a robust and easy-to-control hand that results suitable for the most challenging situations of daily life.

MY RESPONSIBILITIES

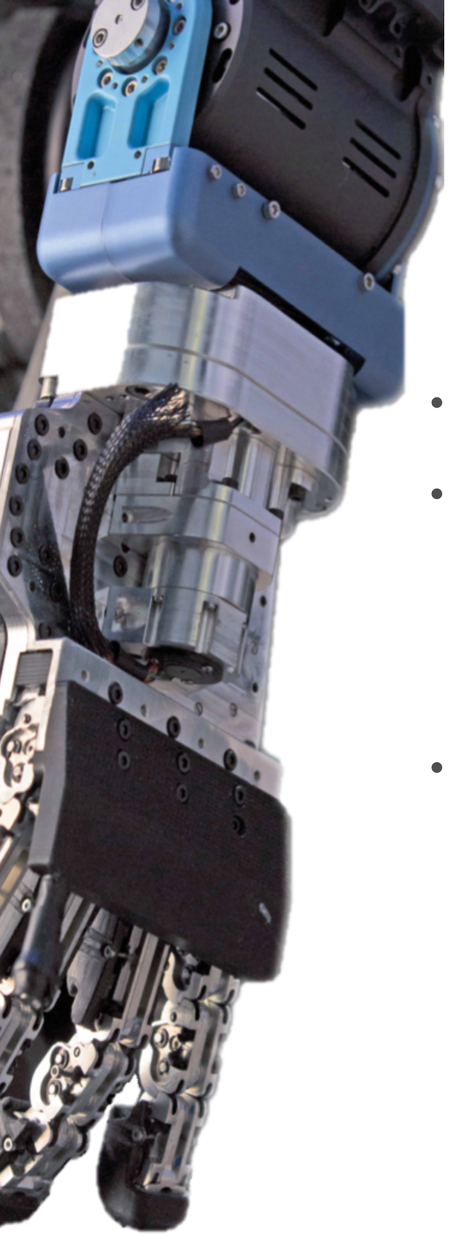
- UX Research plan
- Ethics management
- Qualitative UX Research
- Quantitative UX Research
- Final report for EU Commission.

TIMELINE

1 year, according to H2020 European Project SoftPro, from design of the first survey to data analysis of the last Usability test.

INTERESTING FACT

SoftHand Pro-H took part in Cybathlon, a championship of the state-of-the-art technical assistance systems for people with physical disabilities.



SOFTHAND PRO-H

UX RESEARCH PLAN

- SETTING OF EXPECTATIONS: to iterate a former robotic hand (SoftHand) turned into prosthesis (SoftHand Pro), in order to provide users with a device that can be used in daily-living situations and embodied (SoftHand Pro-H).
- DEFINITION AND PRIORITIZATION OF GOALS:
  - compensate amputees' disability (according to International Classification of Functioning, Disability and Health)
  - make patients comfortable in achieving their goals and solve their problems with the prosthesis
  - set a real emotional connection and embodiment between device and users
  - be compliant with ISO 9241–11, IEC 60601-1:2010, IEC 62366-1:2015, ICH-GCP Guidelines.
- SCHEDULING:
  - statement of the problem
  - definition of a strategy to solve the problem
  - management of ethical reviews and authorization
  - achievement of agreements with clinical partners
  - resolution of critical issues in adapting UX Research methods to a medical device (e.g. literature review on Clinical Outcome Measures)
  - conduction of Generative Primary UX Research (Qualitative)
  - iteration of prototype
  - conduction of Generative Primary UX Research (Quantitative)
  - production of scientific publications and final report to EU Commission.
- TIME AND BUDGET: time and budget are set by the framework of H2020 project and approved by EU Commission (4 years for the whole project, 1 year for SoftHand pro-H; budget based on people's time, equipment costs, production processes costs, travel costs).

SoftHand

SoftHand Pro

I STARTED SEARCHING IN SCIENTIFIC LITERATURE, THEN PLANNED AND CONDUCTED QUALITATIVE UX RESEARCH TO CHARACTERIZE THE TARGET AND CREATE PERSONAS.

1. Scientific literature

By searching in literature data from former surveys, I found high abandonment rate of prosthesis due to motley amputees' needs not met by the state of the art of myoelectric prostheses.

2. Ethnographic interview

I conducted interviews to clear up what are the unfulfilled needs and define scenarios in which patients want to use their prostheses, highlighting main difficulties in working with prostheses because of arm fatigue and concern for prosthesis fragility.

3. Thinking aloud

5 healthy subjects and 5 amputees used SoftHand Pro to interact with standard objects (multiple shapes and sizes), while referring pro and cons of the device in terms of functionality and design.

4. Survey

After Thinking aloud session, patients were asked to complete a short survey about needful, desired, and redundant features of prosthesis. The survey included also questions about aesthetics, in order to collect insights for design.

5. Personas

Maria is a 41 years old transradial amputee that works as reporter, she is not compliant in using prostheses because she feels not confident in myoelectric control, she does not trust in the prosthesis resistance when she has to move fast to go hunting for the next scoop, and she feels uncompetitive with her colleagues because of the aesthetics of her prosthesis. In the end, she prefers to use a passive prosthesis and being limited in functionality rather than manage the cumbersomeness and expensiveness of myoelectric ones.

Picture from Thinking aloud session

Extract from presentation about results

I INTERACTED WITH MY TEAM BY USING COGNITIVE WALKTHROUGH AND USER JOURNEY, AND TRANSLATED RESULTS OF QUALITATIVE UX RESEARCH IN REQUIREMENTS FOR PROTOTYPE ITERATION.

Technical requirements

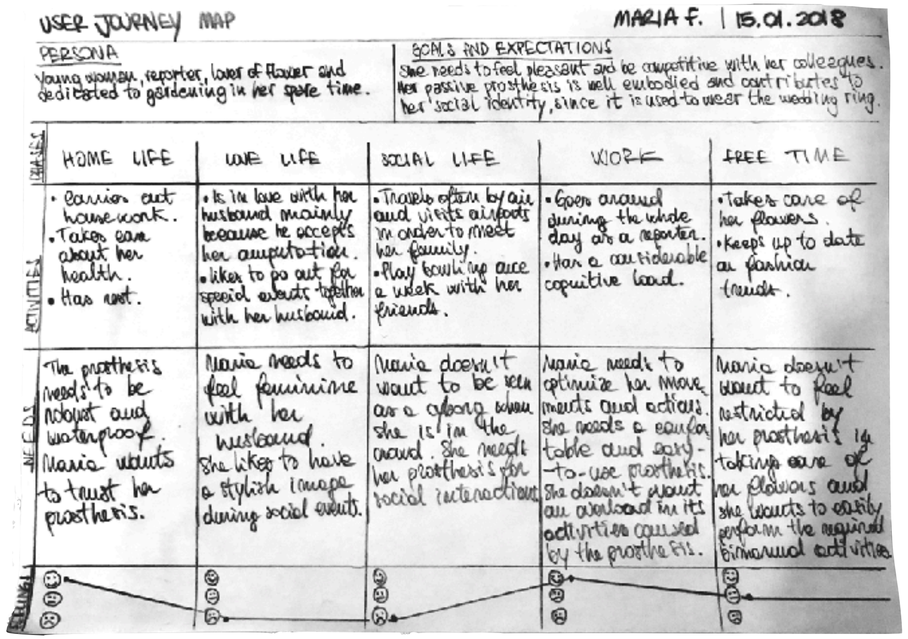
Together with engineers, final features of SoftHandPro-H were defined in order to optimize the performance and maximize the pleasantness:

- robustness
- lightness
- intuitiveness
- adjusted size
- low-cost.

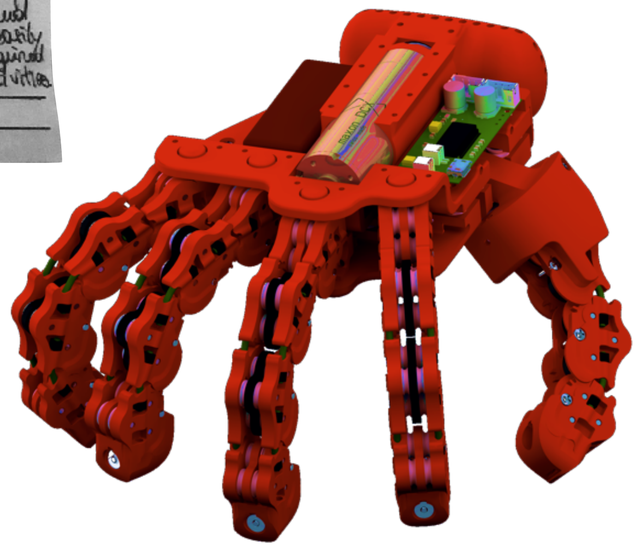
Inputs from Qualitative UX Research were fundamental to ideate an innovative hybrid control, that merges the power of myoelectric control with the intuitiveness of body-powered control.
Due to the heterogeneity of mechanical solutions for the implementation of described features, we decided to develop 4 variations of SoftHand Pro-H.

Aesthetic design requirements

Together with a designer, it was decided that the aesthetics of prosthesis should be customized depending on user's preferences, gender, race. The identified solution was the use of a glove, this avoided any changes to the internal structure. Further inputs from a larger sample of healthy subjects and patients are needed.



Sketch of Maria's journey with her own prosthesis



3D Technical drawing of SoftHand Pro-H

I DESIGNED AND CONDUCTED MULTIVARIATE TESTING AS USABILITY STUDY BY MYSELF, AND COLLABORATED WITH TEAM MEMBERS IN BENCHMARKING AND GAP ANALYSIS.

Why a quantitative study?

I needed assessment of the Usability to reflect whether the device was easy to use, since we were iterating the device. I needed a scientific experiment to publish data and I had to fulfill the project deadline.

Requirements for Usability study

- Test 4 prototype variations (dependent variables: user interface, control)
- Conduct experiments with patients
- Run the experiment with a small sample
- Detect small differences
- Avoid inaccuracy due to random noise
- Minimize cost.

Design and methods of Usability study

- Generative Primary UX Research
- Multivariate testing
- Within-subject design
- Clinical Outcome Measures: Assessment of Capacity for Myoelectric Control (ACMC), Box and Blocks Test (BBT)
- Standardized Usability Questionnaire: System Usability Scale (SUS).

Choice based on target features and on psychometric properties of tests

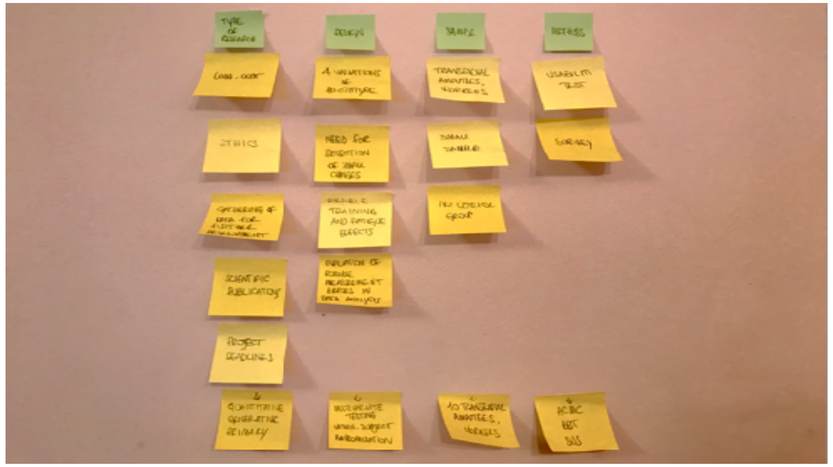
Chosen for its generic structure and appropriateness with medical devices

Critical issues

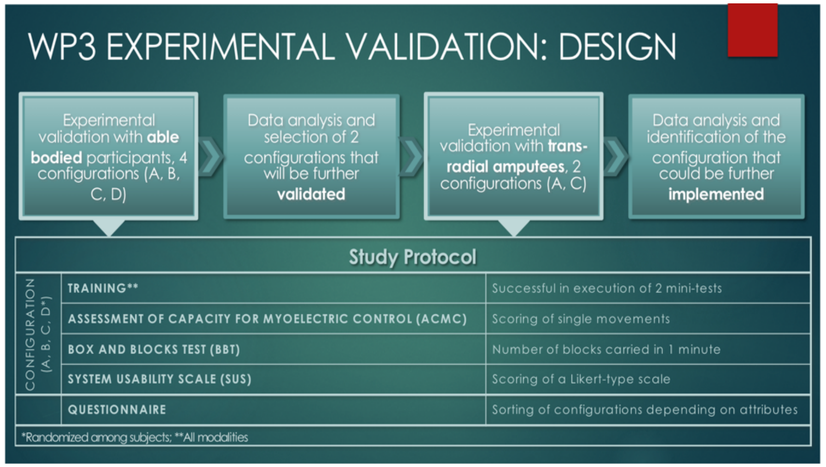
- Training effect
- Fatigue effect.

Solutions

- Randomization
- Analysis of variability due to training or fatigue.

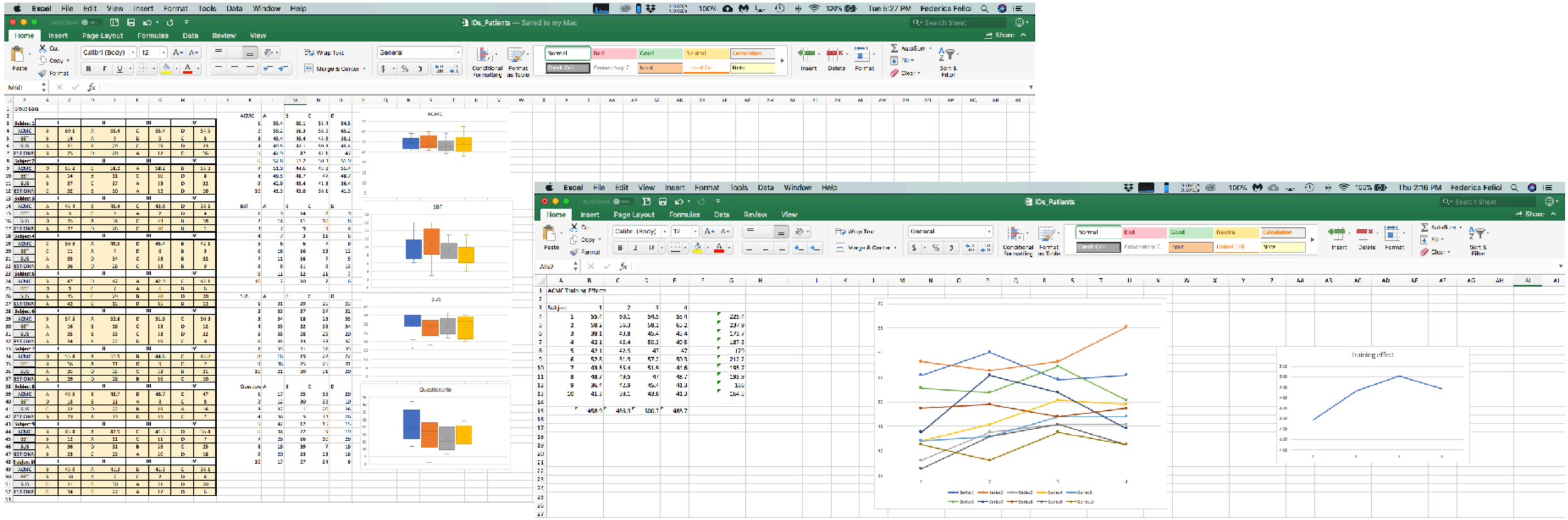


Brainstorming requirements and design of the study



Extract from presentation about protocol design

I ANALYZED DATA, GOT THE RANKING, AND SET FUTURE WORK TOGETHER WITH MY TEAM.



Extracts from sheets of data analysis

Future work

Improve aesthetic design by collecting inputs from a larger sample. I am collaborating with an interaction designer for carrying out an email survey.

EMBODIMENT

ITALIAN INSTITUTE OF TECHNOLOGY
UNIVERSITY OF PISA
RESEARCH CENTER “E. PIAGGIO”

PROJECT SUMMARY

Design and validate a protocol for the assessment of embodiment with a prosthesis, by considering latest neuroscientific theories on brain plasticity and newest techniques for monitoring of body functions.

MY RESPONSIBILITIES

- UX Research plan
- Secondary UX Research
- Primary UX Research design
- Planning of Primary UX Research implementation and validation
- Internal report.

TIMELINE

3 months for conduction of Secondary UX Research + 3 months for design of Primary UX Research.

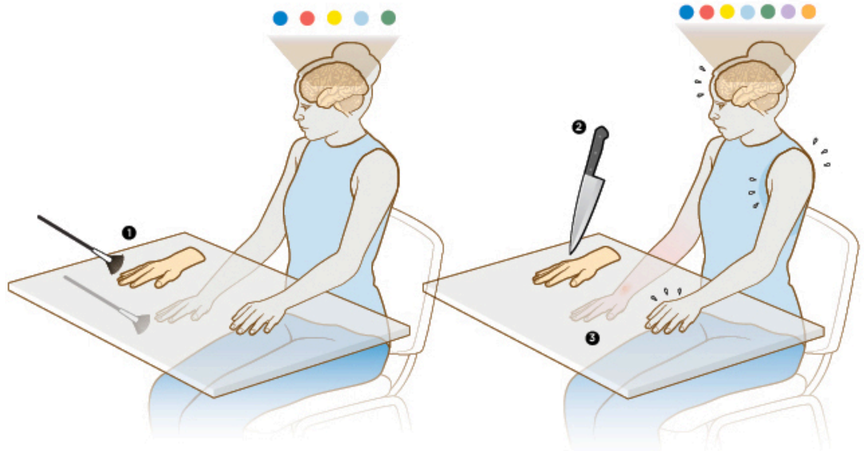
INTERESTING FACT

Based on the most recent and accredited definition of embodiment, my protocol is the first protocol suitable for the exhaustive analysis of the integration between human and technology.

EMBODIMENT

UX RESEARCH PLAN

- SETTING OF EXPECTATIONS: start from Exploratory Research and then move to Constructive Research, in order to set up a robust and repeatable method for the assessment of embodiment and overcome the lack of pre-existing methods.
- DEFINITION AND PRIORITIZATION OF GOALS:
  - provide to engineers an instrument for measuring the innermost factor of Human-computer interaction and improve product development
  - devise an exhaustive description of embodiment
  - capitalize upon results of Secondary UX Research and translate them in inputs for Primary UX Research design
  - achieve the acknowledgment of the protocol as an official measurement tool.
- SCHEDULING:
  - collection and review of assumptions on embodiment and definition of the subject domain of the research
  - conduction of Generative Secondary UX Research
  - interpretation of results and discussion with the team
  - design of Primary UX Research
  - check of ethical issues
  - planning of Primary UX Research implementation and validation
  - production of scientific publications and internal report.
- TIME AND BUDGET: 6 months, budget based on people's time.



Rubber Hand Illusion

AS A RESULT OF BRAINSTORMING AND SCIENTIFIC LITERATURE REVIEW, I OUTLINED WHAT TO MEASURE AND COLLECTED RELATED ASSESSMENT METHODS USED IN PREVIOUS STUDIES.

Why Secondary UX Research?

The field of investigation takes a lot of years of study, ranging from neuroanatomy to engineering. Earlier consultation of collected data was unavoidable because of time and resources constraints. Moreover, due to the aim of the research, the method required a solid foundation.

1. Definition of research domain

A lot of considerations on embodiment were formulated in publications about neuroscience, psychology, and prosthetics. Currently, the most accredited and complete theory defines the embodiment to be composed of 3 levels: phenomenological, neural, cognitive.

2. Formulation of specific research questions

I decided to explore embodiment defining what the 3 levels mean. First I highlighted subcomponents of embodiment; then I inquired and identified possible indicators for each level. In the end, the required topics to be searched in literature emerged through a concept framework.

3. Gathering of external secondary data

I collected main contributions to the state of the art of neuroscientific theories on brain plasticity and techniques for monitoring body functions. I enriched literature review with personal considerations on social implications of embodiment, by exploiting my knowledge on cognitive sciences.

4. Comparison of data from different sources

I compared data and selected studies according to inherence, reliability, feasibility.

5. Analysis and interpretation of data

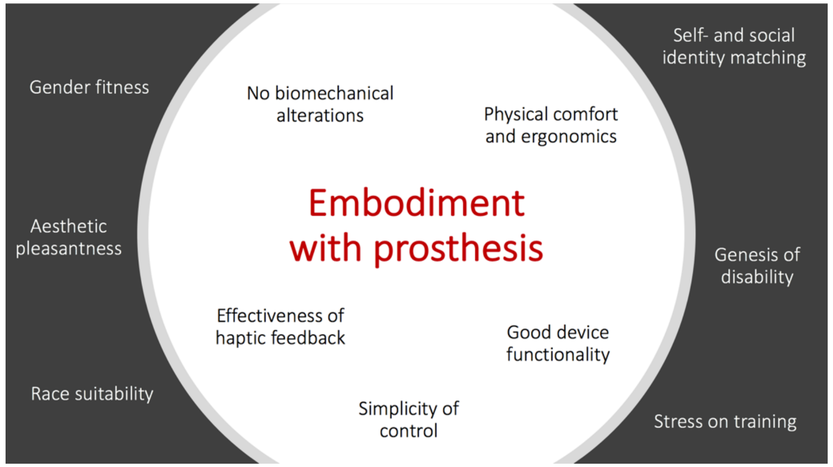
I outlined 8 functions to be measured for a complete investigation of embodiment. Phenomenological level: non-verbal communication, peripersonal space, body representation, balancing. Neural level: prosthetic control. Cognitive level: reaction times. Psychological level: compensation of disability.

6. Evaluation of the research

I drafted an evidence report and shared it with my team.

METHODS

1. Brainstorming
2. Literature review
3. Concept framework
4. Evidence report



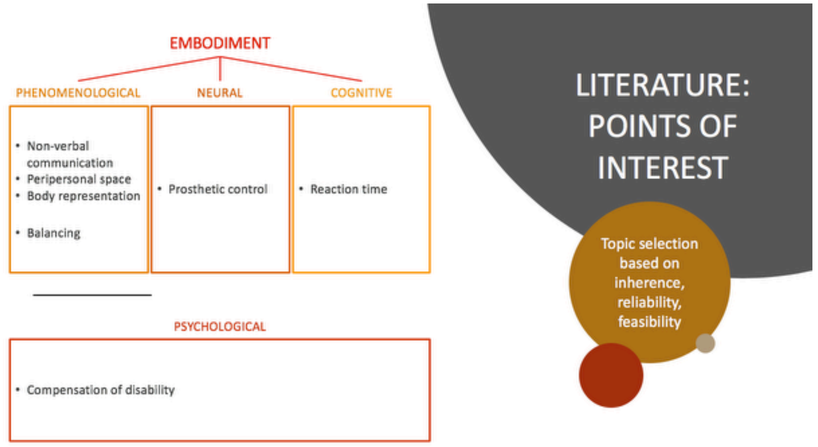
Conceptual framework

I APPLIED THE AFFINITY DIAGRAM RESULTING FROM SECONDARY UX RESEARCH TO MODERATE THE - SUBSEQUENT BRAINSTORMING FOR THE DESIGN OF PRIMARY UX RESEARCH.

Design of Primary UX Research

I discussed about Secondary UX Research findings with my team, then I selected scientific protocols from literature and adapted them to my Primary UX Research. I designed a specific protocol for the exhaustive assessment of embodiment with prostheses:

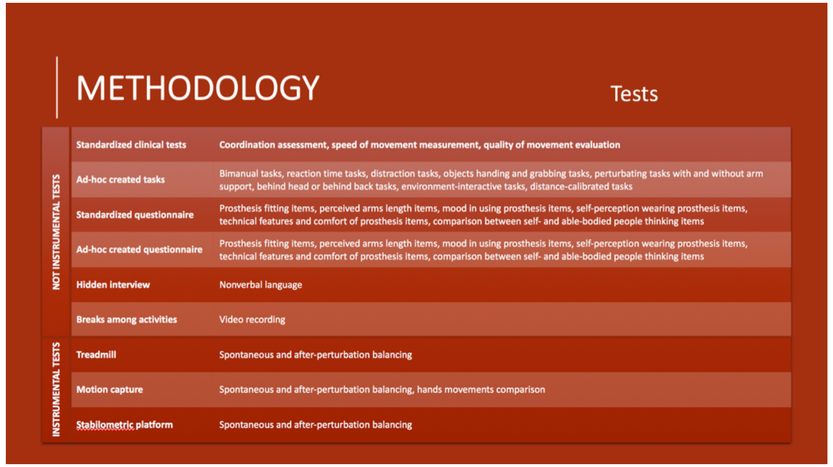
1. Hidden interview (non-verbal communication)
2. Reaching task (peripersonal space + body representation)
3. Perturbation test (balancing)
4. Assessment of Capacity for Myoelectric Control (prosthetic control)
5. Poffemberger paradigm (reaction time)
6. Standardized Questionnaire (compensation of disability)
7. Interview.



Affinity diagram

Planning of Primary UX Research

I drew up a plan for the implementation of the protocol. The plan includes setting of expectations, definition of goals, scheduling, considerations on time and budget.



Extract from presentation about protocol design

Future work

1. Discussion about the planning with the team leader.
2. Primary UX Research implementation and validation.

PUBLICATIONS

Analytical and Experimental Analysis for Position Optimization of a Grasp Assistance Supernumerary Robotic Hand.
A. Ciullo, F. Felici, M. Catalano, G. Grioli, A. Ajoudani, A. Bicchi.
IEEE Robotics and Automation Letters, Oct 2018.

Unvealing the Principal Modes of Human Upper Limb Movements through Functional Analysis.
G. Averta, C. Della Santina, E. Battaglia, F. Felici, M. Bianchi, A. Bicchi.
Frontiers in Robotics and AI, Aug 2017.

Heart rate variability analysis during muscle fatigue due to prolonged isometric contraction.
A. Guidi, A. Greco, F. Felici, A. Leo, E. Ricciardi, M. Bianchi, A. Bicchi, G. Valenza, E. P. Scilingo.
39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Seogwipo, Jul 2017.

Simultaneous recording of electroencephalographic data in musicians playing in ensemble.
C. Babiloni, F. Vecchio, F. Infarinato, P. Buffo, N. Marzano, D. Spada, S. Rossi, I. Bruni, P.M. Rossini, D. Perani.
Journal Article: Cortex, Oct 2011, My Clinical Trial was added in the acknowledgements.

Modulation of Corticospinal output in professional piano players during motor imagery of listened, viewed and listened + viewed triad chords. A TMS study.
D. Spada, G. Bianco, A. De Capua, M. Ulivelli, S. Bartalini, F. Felici, R. Spidalieri, R. Mazzocchio, D. Perani, S. Rossi.
Brain Tuning Workshop: Music, emotions, and brain plasticity, Helsinki, Feb 2009.

Post-irradiation Peripheral Nerve Hyperexcitability (PNH) in unilateral masseter and tongue muscles.
G. Greco, L. Franci, F. Felici, M. Malentacchi, F. Giannini.
Journal Poster: The Official Journal of The Peripheral Nerve Society, Jun 2008.