



PhD in DESIGN - 40th cycle

PNRR 630 Research Field: CO-DESIGN OF PRODUCT SERVICE SYSTEMS FOR PREVENTION AND REHABILITATION

Monthly net income of PhDscholarship (max 36 months)

€ 1300.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

Healthcare systems and services are rapidly transitioning towards a patient-centred care approach. In the Healthcare 2030 vision, personalization and one health approach for prevention and rehabilitation are main targets for research and development of innovative solutions.

Prevention is strategic to increase human "quality of life" and to limit the increase of the social costs, while new technologies offer extraordinary perspectives in the recovery of functions. Artificial Intelligence (AI) can be leveraged to analyze and develop personalized prevention pathway to be delivered to the patient so to achieve its engagement with a proper and personalized UI/UX. Again, AI can be used to deliver personalized physiotherapy rehabilitation and high UX.

In fact, one of the most recent trends is related to highly individualized physiotherapy, requiring both technological innovations and user engagement to advance into this space. Virtual Reality (VR) technologies have been explored and applied successfully towards achieving this transition, but most VR games are not customized to the individuals and not appropriate for the rehabilitation of patients with unique needs.

Another possible field of research would be the use of generative design and advanced manufacturing techniques to design and build highly customized, highly functional and aesthetical orthoses and prostheses to support or recover function.

The holistic approach to Health sees the central factor of Design for the humanization of technologies and services



	<p>and their development. In this line, this thesis will explore and exploit the role of Human Centred Design for the ideation and design of new products and services for prevention and rehabilitation.</p> <p>The objectives of the research in this field are the followings:</p> <ol style="list-style-type: none"> 1) Analysis of new technologies and related trends or healthcare in 2030 and design future health scenarios to describe new needs and opportunities, in particular for the pediatric age. 2) Analysis of the future trends in pediatric health, highlighting opportunities and requirements for all the involved actors (patients, parents and relatives, clinical personnel and all the stakeholders) 3) Co-design methods adaptation and development in light of the new scenarios and technologies: for design, test and evaluate (e.g. efficacy, usability, engagement, personalization) 4) Design and ideation of new systems for prevention/rehabilitation of the targeted scenarios 5) Exploitation analysis for the designed future health scenarios.
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>Research activities will be planned and developed through macro-phases. The method adopted follows the so-called Double Diamond model applied to the healthcare field and involving the different stakeholders since the beginning of the research. Key points of the methodological approach:</p> <ul style="list-style-type: none"> - literature review and a technological benchmark following also the trends provided by the most recent report of the POLIMI Technology Foresight working group on Healthcare in 2040 - definition of personas and related user journeys - ideation phase with codesign and focus group session to tackle the real needs and expectation of all involved stakeholders - use of advanced early prototyping technologies for testing early solutions - development/refinement of assessment methods to the specific field and use case <p>The student will be encouraged to adopt the following methods</p>



	<ul style="list-style-type: none"> - User interviews, involving patients and their families - Expert interviews, involving clinicians, therapists, engineers of the sectors of interest - Focus Group and codesign sessions - Surveys and questionnaires for UI/UX testing - techniques for early prototyping such as 3D printing of physical interfaces, the design of software for virtual interfaces (e.g. in Unity), easy platform for responsivity and interaction analysis (Arduino, microbit, ...). <p>The methodological approach must keep the focus even more on the needs of the end-users from the very beginning of the project. Where possible, observation of health processes is included to assess environmental factors and their impact, if any, on the user's experience. The information emerged by interviews and observations must be translated into guideline for the design process. Patients and caregivers will be invited to participate in active focus group sessions. Those involving children require a special effort in organisation to be as similar to play as possible. Human-centric approach has to be adopted toward phases of design process, in order to develop a flexible, resilient and above all human-friendly system. At the end of the design phase, the expected result is prototyping and testing the interactive product-service system, developed through the above-mentioned co-design process. The researcher must plan and manage pilot tests involving all target users (patients, care givers, medical staff) in practical trials, semi-structured interviews, and observations. Most of the planned research activities will take place directly on the target contexts thanks to the collaboration with the Scientific Institute IRCCS E. Medea, the research section of "Associazione La Nostra Famiglia", a no-profit organization promoting healthcare. The Medea institute, in Bosisio Parini (Lecco, Italy), is an innovative center, specialized in the developmental age, where clinical activities are combined with scientific research, offering innovative rehabilitation interventions for people with congenital or acquired disabilities.</p>
<p>Educational objectives</p>	<p>The educational objectives can be divided in three disciplinary areas: scientific, technical-practical, and</p>



	<p>educational.</p> <p>The development of the product-system solution requires a solid theoretical basis obtained through the combination of various research activities: literature analysis, benchmarking investigation and the observation and involvement of target users. The researcher must be able to merge the various information collected and define a comprehensive overview of the framework, highlighting the research and marketing gaps in which the present study can be placed and provide valuable scientific contribution. The results obtained will have to be declined to be relevant to different clinical contexts and exploitable by different professionals.</p> <p>To have the opportunity to engage more actively target users, they are involved in focus group session. The researcher has to keep the participants' attention on the topic of patient's well-being and how improving it, establishing a favourable context for the exchange of ideas and opinions.</p> <p>The subjective data that will emerge will become the guideline for the development process aimed to define a preliminary prototype of the product-service system. Technical expertise is required to achieve a prototype that is as similar as possible to the desired final product. Prototyping and its management have a crucial role in the development process allowing the organisation of pilot tests. The testing phase plays an important role in defining the final product because some problems only arise during the actual user experience.</p> <p>To spread the importance of patient's well-being and show how the right design approach can improve it, some didactical activities are performed to share the topic in bachelor's final course (Final Synthesis Studio "Design for healthcare", Industrial Product Design Course).</p> <p>Converging the several needs and opinions of users towards the central topic can be a real challenge for a junior designer. For this reason, the researcher must be able to provide the group with a detailed but synthetic explanation of methodological procedures required to approach the topic of healthcare and patient well-being.</p>
Job opportunities	The present study, due to its multi-layered nature, offers



	<p>the candidate the opportunity to meet and collaborate with people from different professional backgrounds. This assumption is the starting point for implementing and improving the ability to work in a multidisciplinary team, a very common feature in both academic and scientific research groups.</p> <p>During the PhD, the researcher will acquire a solid competence that will enable him/her to achieve a greater autonomy in organising the creative process from the early stages. Moreover, the high level of autonomy achieved will allow the researcher to enter the labour market as a senior figure and no longer as a junior one. Due to the hyper-specialisation achieved in health care and patient well-being, the researcher will also aim to be employed in research and development offices of companies dealing with the same topic.</p> <p>In today's labour market, there are constantly expanding sectors dedicated to innovative physical devices and interactive services for patient, where the researcher will be able to apply after PhD course.</p> <p>In addition, thanks to the analysis of environmental factors carried out in the thesis, also companies producing technological hospital furniture will represent a valid job opportunity.</p> <p>Finally, the internship abroad, which is mandatory during the PhD period, is a great opportunity to reach a wider range of job opportunities.</p>
Composition of the research group	<p>1 Full Professors 1 Associated Professors 1 Assistant Professors 0 PhD Students</p>
Name of the research directors	Giuseppe Andreoni

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--



Scholarship Increase for a period abroad	
Amount monthly	650.0 €
By number of months	0

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	IRCCS Eugenio Medea -Associazione La Nostra Famiglia
By number of months at the company	12
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student per year max 5.300,25 euros per student (total for 3 years)</p> <p>Teaching assistanship: availability of funding in recognition of supporting teaching activities by the PhD student there are various forms of financial aid both for research and teaching activities. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p> <p>Computer availability: 1st year, 2nd year and 3rd year: Each research group will supply PhD student with a computer, if necessary.</p> <p>Desk availability: 1st year, 2nd year and 3rd year: Each research group will supply phd student with a desk.</p>