INBOTS
Inclusive Robotics for a better Society

Results
&Conclusion

Introduction

Robotic technologies are progressing faster than ever, delivering new and powerful technologies that will transform society in the near future. **The changes will create new opportunities for people, but will also create new dangers and responsibilities that need to be elucidated and contained.** Furthermore, the rapid advances in robotics make it difficult for the general public to completely understand the state of the technology, which creates negative perceptions and overestimated expectations that should be clarified. This is the reason why it is of outmost importance for all stakeholders to collaborate and identify the most important aspects needed for an effective responsible research and innovation in robotics. Thus, INBOTS project aimed to coordinate and support relevant efforts in the field that covers those robots that are in close proximity and interact with a person:

The goal of the INBOTS project - << To create a community hub that can bring together experts to debate and create a responsible research and innovation paradigm for Interactive Robotics>> - was to provide a platform to establish a working synergy between the main pillars that cover all stakeholders in Interactive Robotics.

The INBOTS structure covered the following pillars: the technical expertise pillar, the business expertise pillar, the ethical, legal, and socio-economic (ELSE) expertise pillar, as well as the end-users, policy makers and general public pillar. The project strived at coordinating and supporting actions among these pillars **to promote debate and create a responsible research and innovation paradigm that potentiates EU leadership on robotics.**

The INBOTS project has been developed during 2018 -2021 by a consortium of partners under *the Horizon 2020 Research and Innovation Program of the European Union (GA No 780073).*
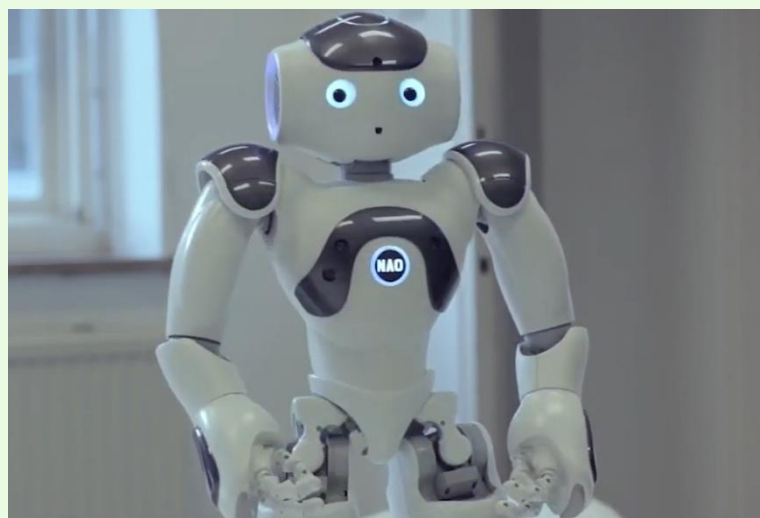
Main Findings

Business Pilar

- Global forecast reports estimate, during the next decade, an **exponential growth of the interactive robotic (IR) applications in <u>different domains</u>, such as healthcare, consumer and <u>industrial</u>.**
- Companies working in this sector are still relatively a few. INBOTS has identified main potentialities and barriers of the different IR fields through a systematic approach based on quantitative and qualitative KPIs delivering a **complete overview of the companies working in these sectors.**
- <u>**Europe has a lead with its widespread use of IT**</u>, which is considered the main enabler for adoption and acceptance of the further development that robots and AI entail. However, **commercialized robots available to consumers on the market are not enough.** They need to have a relative advantage over already established ways of meeting users' needs and preferences.

Ethical, Legal and Socioeconomic Pilar

- **Debate on ELSE issues in IRs today is multifaceted.** It focuses on defining the position of the robot in relation to the human being on the basis of values, which are expressed through voluntarily acquired business commitments (CSR) or legal norms of various kinds (civil, IP, labor & tax).
- **Existing robotic applications do not display sufficient autonomy to be deemed subject of the law.** As objects, designers of the products are still primarily responsible, although a functional analysis might support a reform.
- <u>**IR technologies are replacing workers in some tasks, while complementing them in others.**</u> Countries with older workforces adopt more robotic technologies.
- A major challenge for the robotics community is **identifying standards that are applicable for their devices.** They also face problems with affixing the CE mark. They ask for a user-friendly categorisation of standards they can follow to affix the CE mark. In this way they will ensure that their products are aligned with the basic safety requirements of the European directives. This is a challenging task due to the increasing modularity of robots and their fast-changing nature.

Technical Pilar

- To propose a regulatory and risk management framework for interactive robotics, it is necessary to **identify and assess relevant norms on standardization, product safety, certification and liability, different technical standards applicable to interactive robotics,** as well as specific national regulations and the functioning of some administrative and governmental authorities that are of relevance for emerging robotics.

End users, Policymakers and General Public Pillar

- **Education plays a fundamental role in building a common language** between the multidisciplinary, technical, and non-technical subjects. The proposed paradigm shift on educational robotics in school based on the concept "make your own robots", **which fosters creativity and the other 21st century skills: problem solving, critical thinking, and teamwork.**
- **The social uptake of robots in Europe is promising** in terms of individual applications **but it is difficult to generalize due to the lack of coherent European statistics** and the fragmentation of countrywide statistics.
- An increased understanding of adoption in its context is required. A limiting factor is the **lack of European wide policies and the diversity of health care systems and welfare systems in Europe** that is slowing down procurement and collaboration in regulatory frameworks.
- **Policies for social uptake of robots are rare, but promising methods for moving forward**. Policy labs are a relatively new way of working with policy development in Europe that can be used to increase the social uptake of robots. These policy labs exist today in a handful of member states in the EU including groups of actors engaged in developing regulatory frameworks.
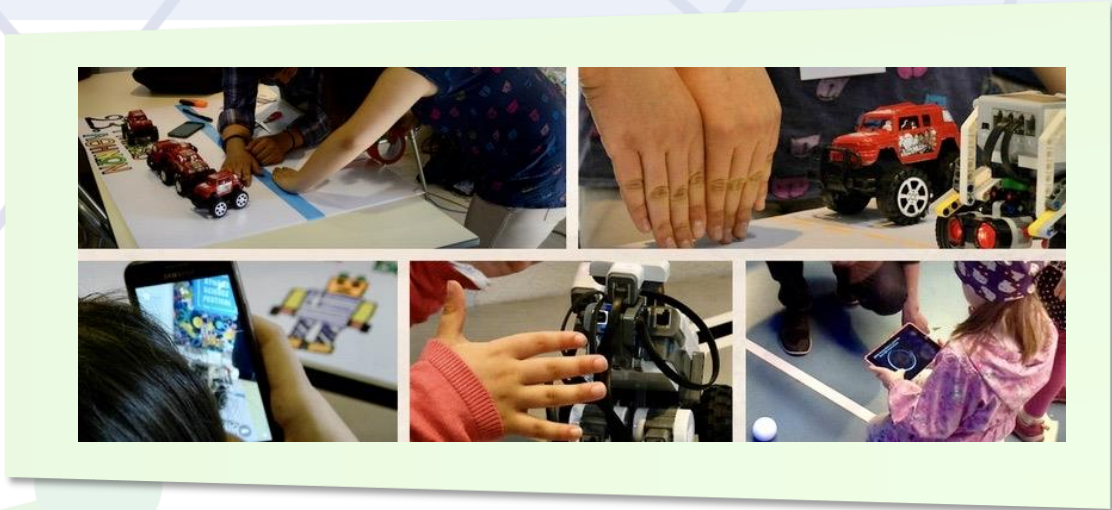
Recommendations

For the future

For Policymakers

- Guidance is needed on whether interactive robot-created works of art **can be protected by copyright**; and on whether an interactive robot-created invention **is patentable**, or a human inventor is required; and who should own them.
- It is necessary to identify the values and ethical principles that should **regulate the interaction of robotic systems with human beings**.
- The implementation of inclusive robotics should take into account the **UN Convention on the Rights of Persons with Disabilities and the Convention on the Rights of the Child**, given the importance socio-technical mediations have for full enjoyment of human rights. To avoid the "robotics divide", the capabilities approach allows analysing the effect of robotic innovations on functioning environments.
- Attention should be paid to the treatment of **women in robotics**, and how far robotics advances or hinders women's position in the workplace and the business world. The EU Member States should care for the establishment of economic and institutional incentives to encourage the **use of responsible systems that respect every human right in the deployment of artificial intelligence and robotics**.

- Given the differences in their technical features and uses, as well as in the legal, social and economic implications they bring about, **robotics and AI based technologies must be regulated in class-of-application by class-of-application, functional, and bottom-up way**.
- **Liability issues should be inspired by a Risk-Management-Approach**: decouple ex-ante safety regulation, to be fostered through narrow tailored technical standards at the European level, and ex-post compensation, where is called to compensate the subject who is in the best position to manage risk and cover damages claim, in combination with default compensation schemes, mandatory insurance.
- Being the IR market not yet mature enough but is one of the most promising in the next decade, it is **important that policymakers continue the public funding strategies** used in the last ten years to strengthen the position of European companies worldwide.

For Researchers

- **The environmental impacts of robotics cannot be ignored** (e.g., in research and remediation; or the materials employed and their degradation).
- INBOTS recommends the **provision of subsidized advisory services on how to identify and apply standards, and European research projects to elaborate further and initiate standardisation activities** on key performance indicators and test methods for interactive robots and robotic devices. It is also recommended to **provide an initial set of key performance indicators for the manufacturing** (robotic exoskeletons) **and healthcare domain** (surgical teleoperated robots), which can be used as a basis for future European standards.
- In the discussion on whether robots should be granted legal personhood, the ontological and functional approaches should be kept separated. While **robots are not subjects but objects** – products – there may be cases where it could be appropriate to grant a specific application with legal personality, e.g., as a means of achieving the most efficient management of the risks associated with it.
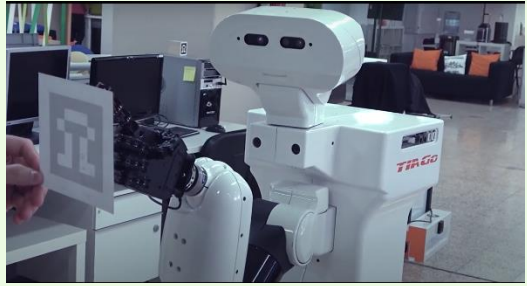
- Technology transfer from the academic world to the business side is one of the most important ingredients for creating new companies in this innovative field; however, **entrepreneurs should be guided** in this hard conversion process to avoid wrong mindset and be able to create profitable companies.

For Citizens

- Technological neutrality cannot entail a disadvantage for vulnerable workers. People's employability and the **rights of workers in their interaction with robots** in the workplace should be guaranteed. To manage the speed of automation and obtain funds for reskilling and the provision of assistance to redundant workers with minimum income, some defend the creation of a tax on robots.
- Public Finances could promote socially responsible robotics through tax expenditures. Better societies should not be defined by techno-economical possibilities, but by real human and social needs, considering finitude and vulnerability as universal human feature.
- Statistics on the social uptake of robots among individual users and special groups could contribute to a **better adapted consumer market and robot use in welfare**.

- In the key findings of the business pillar, one of the most critical barriers to the adoption of IR technologies in real world applications was the **end-user acceptability**. Therefore, it is important to foster the knowledge of the general public about IR aspects and solutions. This should be done making aware people about opportunities and disadvantages of IR technologies.
- **Robotics is a very interdisciplinary subject with several connections** among traditionally different domains: the engineering domain (e.g., mechanics, electronics, computer science, etc.), the human physical domain (e.g., physiology, ergonomics, anatomy), the human non-physical domain (e.g., psychology, ethics, economy). **Finding a language for connecting them is paramount to get an aware and safe robotic evolution and diffusion**, but it presents challenges. **The availability of accessible education resources as those collected and developed in INBOTS will foster the knowledge diffusion**, but also the discussion and the collaboration between such manifold realities.

Main project
Results

White Paper on Interactive Robotics market analyses and support tools for SMEs (business models and exploitation strategies): Overview of the companies working in the IR sector, their approaches to the public funding strategies, to the IP management and geographic distribution.

White Paper on Interactive Robotics' legal, ethics & socio-economic aspects: Overview of the legal, ethical and socio-economic aspects of IR.
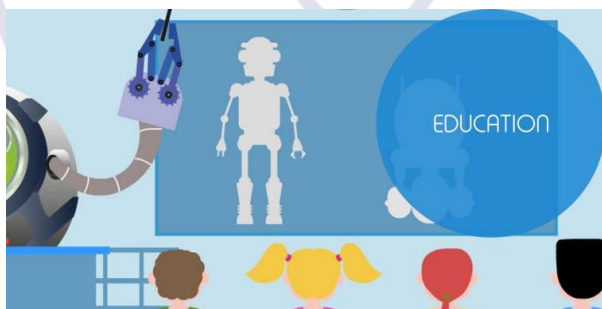
White Paper on Interactive Robotics' education programs and learning activities: Available and accessible educational resources for learning and teaching robotics, focusing on accessible online resources and on the applications of new technologies as VR/AR.

White Paper on Standardization and Interactive Robots: future interactive robotic and robotic device standardisation activities. The focus lies on IR in the manufacturing, healthcare, and consumer domain.

White Paper on Interactive Robotics regulatory and risk management framework: Proposal of a regulatory and risk management framework for interactive robotics.

White Paper on strategies to increase Interactive Robotics public awareness and acceptance: existing best practices and analysis of societal values, needs and expectations for the uptake of IR.

Link to the White Papers: https://goo.su/NR1JrW

INBOTS documentary: https://goo.su/uRyT

INBOTS Publications: https://goo.su/WFVR

INBOTS conferences:

The consortium has organized three International INBOTS Conferences.

http://inbotsconference2018.org

http://inbotsconference2019.org

https://neuralrehabilitation.org/INBOTSConference2021

Document
Information

The
Consortium