

Issues and Prospects of Robotization in the Social Field

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Abstract—The article presents a sociological analysis of the first trends in the robotization of the social field. It describes the emergence and the beginning of mass distribution of the so-called “service robots” which are intended for use by various social groups in daily activities for the purpose of meeting human needs. The article lists their characteristics and raises some ethical issues of the use of robotics in the social area. We also analyze a threat to life and health due to robotization using the first case of the man killed by an unmanned taxi as an example (2018). The first predictive calculations of unemployment rates in the UK, caused by the use of service robots in the future, are given. It also characterizes the social significance of the functionality of several samples of service robots invented over the past 20 years, and the most popular ones in the world. Among them are the Paro robot (Japan) in the form of a baby seal for the elderly and sick people (which is “the most healing robot” according to the Guinness Book of Records); Asimo android robots (Japan), Actroid (Japan), EveR (South Korea), Repliee (Japan), Topio (Vietnam), Aiko (Canada), HRP (Japan), Ibn Sina (United Arab Emirates, 2009), Frank (Switzerland) aimed at communicating and performing a number of useful functions for a person; and also the Kirobo Mini child robot (Japan), the Jibo “social robot for the family” (USA) and the Russian service robot Promobot, which reached the level of mass production and distribution. The experience of introducing service robots in various areas with Promobot as an example is considered in detail. On the whole, it is shown how robotization of the social field contributes to the autonomization of an individual, and changes the social processes in society.

Keywords—information technology, information society, robotics, service robots, social field, robotization

I. INTRODUCTION

Possible Consequences and Ethical Issues of Robotization in the Social Field

The latest trend of our time is the creation and an increasing use of robots designed to communicate, interact with people and help them to implement certain everyday practices. Robotisation is the use of robotics in various areas of public life. For the social field it is necessary to create intelligent robotic systems based on the study of the needs of contemporary man.

Such studies and developments started relatively a long time ago. G. Hu identifies four stages in the development of robotics (Fig. 1). The modern stage, which began in the 2000s, is characterized by the creation of the so-called “service” robots, that is, robots that serve humans.

Scientists agree that service robots designed to help people organize life in various fields, contribute to the autonomy (that is, increase independence) of individual. This is a very important achievement in the history of human civilization and is thought to be a kind of scientific and technological revolution. Such robots have the following characteristics:

- mobility,
- programmability,
- sensors’ availability,
- mechanical abilities,
- movability.

Development of Robotics

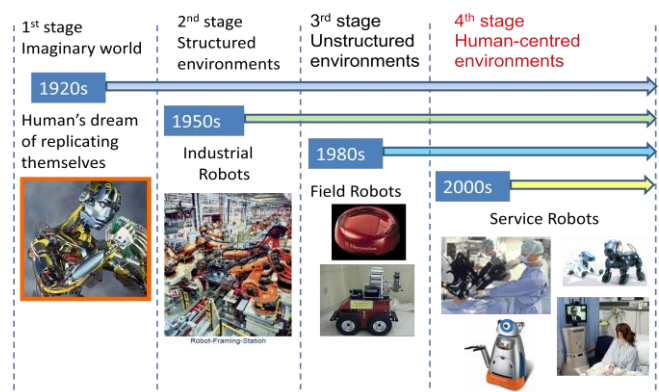


Fig. 1. Stages in the development of robotics (G. Hu (2010) Mike Brady Research Symposium: From Oxford AGVs to Human-Centred Robotics [Powerpoint Presentation]. University of Essex)

These new features allow robots to be useful in various areas of the social sphere, including, for example, health care or social services.

However, there are disputes in the scientific environment:

- can a service robot completely replace a person?
- can such robots effectively meet people's social and emotional needs?
- do we need to consider the robots' care of the human being as "fake"?

- how will robotics affect the labor market and the economy, and will low-skilled workers be completely replaced by robots?
- who should be held responsible in cases of damage caused to a person by a robot as a result of a breakdown?

All these issues are related to the topics of the future research. In 2018, a robot, for the first time in history, killed a man: an unmanned taxi of the "Uber" company in the US hit a pedestrian. This caused a lot of controversy about the prevention of the negative consequences of robotics both in the professional and scientific community, and at the Philistine level as well. "The Future of Life" Institute organized the signing of an appeal to the UN against the development of killer robots by representatives of 160 companies from 90 countries. Among them are Tesla CEO Elon Musk, the founders of Google Deep Mind and X Prize, as well as the Russian company Promobot. The Development Director of the latter Oleg Kisakurek believes that the problem is urgent not only for ethical reasons, but also since there is a real danger that artificial intelligence could escape from human control and destabilize the situation in each country and person .

British scientists have already calculated that in 2032, 250 thousand "public sector" employees in the UK will lose their jobs due to the fact that they will be replaced by robots. Service robots will perform their work more efficiently and allow employers to save significantly on salary payments.

Similar studies in the area of problems and prospects of robotics in public life are of great interest for the scientific community worldwide (Y. Amichai-Hamburger [1], S. Arnab, I. Dunwell, K. Debattista [2], N.A. Dewan, N.M. Lorenzi, R.T. Riley, S.R. Bhattacharya [3], R. Harris [4] A. Holzinger, Ziefle, C. Röcker [5], P.G. Johnson, J.M. Westmore [6] and others). In Russia, such studies, undoubtedly, are also becoming increasingly popular (O.G. Pensky, K.V. Chernikov [7], O. P. Alexandrov [8] and others).

II. SOME EXPERIENCE IN THE USE OF SERVICE ROBOTS IN THE SOCIAL FIELD

Initially, Japan became the undisputed leader in the field of robotization of the social sphere. The government of this country actively supports the development of robotics and industry.

For instance, since 1993 Takanori Shibata from the "AIST" Japanese Intelligent Systems Research Institute, has worked on the creation of the Paro robot in the form of a baby seal (Fig. 2). Its development took many years, the seal robot was introduced in 2001 and immediately gained popularity. At present it is used in more than 30 countries. Almost all people are touched by its appearance (Fig. 3). The developers are positioning Paro as a robot designed to provide a soothing effect and cause positive emotions in patients of hospitals and residents of nursing homes. In Japan, the proportion of the population over 60 accounts for 29.7%. Older people need support, so the Japanese are trying to use modern technology to solve this problem. In addition, according to the creator, the robot may well replace a cat or dog as a pet. The robot can be used not only in an apartment or house, but also in health and

social services. The Paro has several sensors that allow you to capture different events, reacting to them accordingly. If the robot is pet, it wags its tail, opens and closes its eyes. It reacts to sounds, responds to its own name. Paro is capable of showing emotions such as surprise, joy, or anger. The robot's voice is like the real voice of a baby seal. To make it realistic, it was programmed to be awake during the day and be asleep at night [9]. This is the "most therapeutic robot" according to the Guinness book of records. In Russia it can be purchased for 590 000 rubles.



Fig. 2. Japanese engineer Takanori Sibata (on the left) – the creator of the Paro robot for the sick and the elderly (on the right)

Later, robotics in the social area was characterized by the spread of humanoid robots-androids (from the Greek. άνήρ "man, man" + suffix-oid "similarity").

Back in 2000, the Asimo Android was created by Honda Corporation at the Waco center for basic technical research (Japan). By physique he resembled a human being. The improved version of the 2014 robot has a height of 130 cm and weighs 50 kg. It is able to move at a speed of up to 7 km/h, go down the stairs, recognize moving objects and follow people, recognize gestures, objects and surfaces, distinguish sounds through built-in microphones. The robot is able to recognize people's faces and refer to them by name, respond to its own name, turn its head to the interlocutors, as well as turn to unexpected and disturbing sounds – such as the sound of falling furniture. Asimo knows how to use the Internet and local networks. After connecting to the local network at home, it, for example, will be able to talk to visitors through the intercom, and then report to the owner, who has come. Once the host agrees to receive guests, Asimo will be able to open the door and bring the visitor to the desired location.

In 2003, the first Android woman in the world was created in Japan (the so – called, "gynoid" – i.e. an Android with female appearance). Actroid forever changed the humanity's perception about androids because it looked almost like a human being (Fig. 3). It was developed by Hiroshi Ishiguro's research team from the Osaka University. Its functionality, however, was limited, since only the upper part of the body was moving. Experts call it the first gynoid in the world.



Fig. 3. Gynoid "Actroid-DER 01", demonstrated by Osaka University in conjunction with the "Kokoro" Corporation at "Expo 2005" the exhibition in Japan (Actroid-DER series. *Kokoro* [Online]. https://www.kokoro-dreams.co.jp/english/rt_tokutyu/actroid/)

The second gynoid in the world soon became a Korean girl-robot EveR. It is similar to a 20-year-old Korean girl who is 1.6 m tall and weighs 50 kg. Her developers from the South Korean Institute of Industrial Technology (KITECH) assumed that EveR will be able to serve as a guide in museums, a consultant at Department stores and children's entertainer. She received her name EveR from the name of Eve and the first letter of the word "Robot". The first version of the South Korean Android could not move either – the lower part of the body is chained to the chair. Gynoid could move only the upper half of the body and hands, demonstrate four facial expressions (joy, anger, grief and happiness), "understand" 400 words, move her lips simultaneously with their pronunciation, establish eye contact with the interlocutor. The second version of EveR learned to stand¹.

In 2005, another Japanese invention of the Osaka University Intelligent Robotics Laboratory was presented together with the Animatronics Department of the Kokoro Company (Kokoro Company Ltd) – a model of a humanoid robot Repliee in the form of an adult woman. She was able to gesticulate, speak and even imitate emotions and breathing. This was made possible by the functional ability to move the eyes, eyelids, mouth and neck. Repliee's body is covered with silicone, very similar to human skin. The internal part of Android is made of urethane.

In 2008 there was a new, improved version of Repliee with the appearance of a Japanese five-year-old girl (Fig. 4). This gynoid drew public attention by the fact that it was created to care for the elderly and disabled people. Functionally, it is designed to assist in finding things and moving, supporting conversation and entertainment.



Fig.4. Android Robot **Repliee** designed to care for the elderly and disabled people (Repliee – a line of female android robots. *News of Technology*. 2008. 12 Oct. [Online]. <http://techvesti.ru/node/491>)

Another model of Repliee was programmed to conduct long complex conversations and interviews. Its prototype was news reader Ayako Fuji (Japan). The head of the Intelligent Robotics Laboratory at Osaka University Hiroshi Ishiguro is convinced that in a few years robots will be so similar to humans that it will be impossible to visually distinguish a person from an Android robot, and someday people will be deceived, taking robots for their own kind.

In 2005, the Vietnamese company TOSY developed an Android robot Topio for playing table tennis against a man. He has the appearance resembling a human being, moves on two legs. The first public demonstration of the robot took place in Tokyo at the International Robot Exhibition in 2007. The latest version of the robot is 1.88 m tall and weighs about 120 kg. All models of the robot use a self-learning artificial intelligence system that allows to improve its skills in the game of tennis.

In 2007, Canadian amateur robot engineer T. Lee developed Aiko gynoid with the height of 151 cm and weight of 30 kg which was able to imitate the following human feelings: touch, hearing, speech and vision. The model of an Android girl with artificial intelligence became known not only for talking, but also reading texts, recognizing objects and colors, reacting to touches and external stimuli, and solving mathematical tasks. Aiko is able to provide simple assistance to the owner, for example, depending on the weather, to bring an umbrella or cap, etc.

Android robot HRP (Humanoid Robotics Project) was created at the Japanese National Institute of Science and Technology (AIST). Its gynoid modification of 2009 became famous since it was designed to demonstrate clothes as a model and perform other tasks. The height of the robot is 158 cm and weight together with batteries is 43 kg. According to the developers, it represents an average Japanese young women of 19-29 years old. She can speak, recognize speech, express emotions and walk clumsily on her half-bent legs².

In 2009, there appeared Android Ibn Sina (United Arab Emirates), named after the ancient Persian philosopher and physician. It is designed for travel and is able to find their own place on the plane, to communicate with people in

¹ Koreya obnarodovala devushku-androida [Korea unveiled an android girl]. *Membrana*. 2006. 10 May. [Online]. <http://www.membrana.ru/particle/9965>.

² Novyy robot-zhenshchina userdno upodoblyayetsya cheloveku [New robot woman diligently likened to man]. *Membrana*. 2009. 16 March. [Online]. <http://www.membrana.ru/particle/13589>.

Arabic. The robot recognizes the facial expression of the speaker and uses facial expressions appropriate to the situation.

In 2011, Berthold Meyer from the University of Zurich created the world's first biorobot Frank (Frankenstein). It is named after Victor Frankenstein in honour of the 1818 novel by Mary Shelley. Its distinctive feature is that it is equipped with a functioning blood circulatory system and a beating heart. Frank has 200 built-in processors and over 1 million sensors. The bionic body's height of 183 cm consists of 28 artificial parts. Frank can walk, talk and answer questions. It is controlled by a remote control or remotely via a computer connected via Bluetooth. Frank's face is made of silicone based on the prototype of the appearance of its creator Dr. Meyer. Meyer, being a social psychologist, believes that in the future bionic robots will allow to create developments for the replacement of sick or damaged parts of the human body and the implantation of artificial organs [10].

Since the 2000s, social services in Western Europe, began to use the first child robots that mimic the behavior of newborns to work with young women planning to have a child (Fig. 5). Over the last decade this trend has been developing more and more actively, which allowed to achieve interesting results.



Fig. 5. Children-robots (robotic dolls) given to young women and families in Germany by the "MaDonna" social service in order to prepare women for motherhood and responsible parenthood (the town of Lüneburg), 2006



Fig. 6. Child robot Kirobo. Mini device of the Japanese "Toyota" company, 2015 (Toyota has developed a child robot for the elderly Japanese. *Habr.* 2016. Oct. 3. [Online]. <https://habr.com/post/372727/>)

Thus, in 2015, the Japanese company "Toyota" developed and launched sales of Kobo Mini "electronic

children" (Fig. 6). The price of such a robot is 392 dollars. Initially, they were positioned as robots for the elderly and those who want to have a child, but for some reason they are unable to do so. But it turned out that this development was no less popular among other social groups, such as families with children. The approximate age of such a "child" is one year old. Kirobo Mini is small enough to be placed on the palm of a person, it can walk a little and its lack of ability to move properly is designed by engineers specifically to cause in a person tender feelings and stimulate an emotional connection with the robot. This robot is able to respond to gestures, show something on its own, is able to determine the emotions of the owner and react accordingly, is trying to talk by using a child's voice (the level of speech habits can be changed in the settings. Included in the set with the robot is a special docking station, similar to a child car seat and suitable in size to the holder of glasses in the car. Curiously enough, the "Toyota" company will also collect data about the driving characteristics of the owner of the robot, if they agree to this and will take the Kirobo Mini with them in the car. This will be impersonal data, the analysis of which might be used by experts to improve car designs³.

In 2016, the first "social robot for the family," Jibo, was designed by the Massachusetts Technological Institute (USA) under the supervision of Cynthia Breazeal, a specialist on robotics, PhD (Fig. 7). The price of this robot is \$ 499. It added a number of robots designed specifically to communicate with humans. It is equipped with a large number of sensors and modern software that allows the device to recognize all family members (recognize faces). The developers claim that Jibo establishes an "emotional connection" with each person and communicates in different ways. He can assist in the work, performing the role of an assistant, reminding about scheduled events in the calendar or reading messages. Jibo can help, for example, in the kitchen while cooking, finding at the request of the owner and reading the necessary recipes on the Internet⁴.



Fig. 7. "Social robot for the family," Jibo, designed by the Massachusetts Technological Institute (USA) under the supervision of Cynthia Breazeal, a specialist on robotics, PhD, 2016

³ Toyota razrabotala robota-rebenka dlya pozhilykh yapontsev [Toyota has developed a child robot for older Japanese]. *Habr.* 2016. 3 Oct. [Online]. <https://habr.com/post/372727/>.

⁴ Jibo [Online]. <https://www.jibo.com/>.

III. THE RUSSIAN SERVICE PROMOBOT ROBOT: PROSPECTS FOR THE IMPLEMENTATION IN THE SOCIAL FIELD

In Russia, in 2013 the Perm company "MIP Intellect" introduced to the market its own development: service (or supporting universal) robot Promobot (fig. 8). It is designed for interaction with people and entertainment. First of all, it is recommended to perform tasks in large crowds of people, where he, moving autonomously and avoiding collisions, helps people to navigate, get acquainted, communicate and answer any questions, advises on given topics, broadcasts promotional materials on his display and remembers everyone with whom he communicated. The robot can tell jokes and pay compliments that can not but cheer up people. It automatically pulls up to the charging device after 8 hours of operation. In order to convert audio files into text ready-made services of speech recognition from Google and Yandexspeechkit are used. Communication is supported in 7 languages on the basis of an extensive linguistic base and integration with search systems. Promobot can be integrated with external devices, services and systems.



Fig. 8. Russian service robot Promobot with Russian President Vladimir Putin (Materials of the "Prorobot" website <https://promo-bot.ru/>)

Later, to promote this world popular development, it was decided to establish the "Promobot" company, which became a resident of the "SKOLKOVO" Fund. It is the largest manufacturer of autonomous service robots in Russia, Northern and Eastern Europe. Today, several hundred of these robots are working in almost every continent, in more than twelve countries. In 2018, for example, five new contracts were signed with Brazil, Canada, Romania, Kuwait and Germany for \$ 2 million, which is half of Russia's exports in this industry. Companies in these countries have received the status of official dealers and will introduce Promobot robots V.4 in business centers, shopping centers, banks, museums and other places of increased congestion of people.

According to experts, thanks to the "Promobot" company in no country in the world except Russia, there is such a large number of Android service robots which serve various companies. They work all over Russia from Krasnodar to Yakutsk as administrators, promoters, hostesses, museum guides, in such companies as Sberbank, MFC (Multifunctional Centres), Beeline (telephone company), the Museum of Modern Russian History, Moscow Underground,

Permenergosbyt, various shopping centers and are able to improve the quality of service and customer loyalty.

For example, since 2015 in the town of Yakutsk MFCenter, Promobot has acted as an administrator to tell visitors about the services of the company. It can consult on almost any issue, such as "What documents are needed for an international passport?" or "Where can I make a copy?". According to the experts of the MFC, the robot reduced the administrators' load, many visitors now turn to it with questions. It took three months for visitors to get used to this procedure⁵.

The developers of the Promobot Robot offer today to replace employees of various organizations with robots (Fig. 9). The advantages of such a "worker" are as follows:

- the robot is always happy and will advise with a smile on any issue, without fatigue and breaks;
- having a unique appearance, the robot is able to win any client;
- robots-employees-this is what will distinguish any company among the competitors;
- robot, unlike man, might be retrained in no time;
- robot will reduce the risks associated with the human factor.

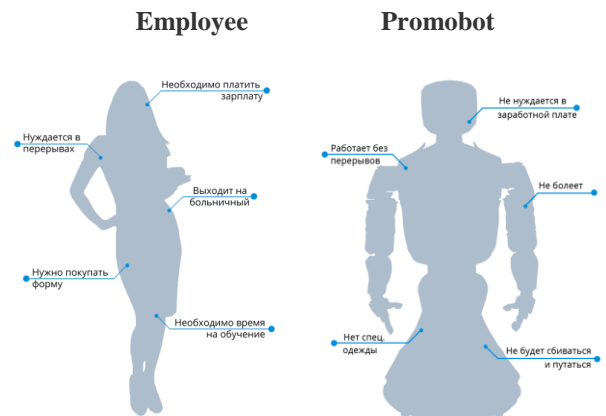


Fig. 9. The advantages of the Promobot robot in comparison with the human employees. The title: Employee – needs to be paid a salary, uses a sick list, needs time for training, needs to buy a uniform, needs breaks. Promobot – does not need to be paid a salary; never falls ill; will not get confused; does not have a uniform; works without breaks (<https://promo-bot.ru/>)

IV. FINDINGS

Today, service robots are entering the stage of mass use. Most often they replace workers in the following areas.

- 1) Robot for education (as an educational stand, on the basis of which students will receive relevant technical competence).

⁵ Servisnyye roboty na sluzhbe torgovykh tsentrov Permi i MFT's Yakutii [Service robots in the service of shopping centers in Perm and the MFC of Yakutia]. Promobot. 2015. 9 Feb. [Online]. <https://promo-bot.ru/blog/trk-perm-mfc-yakutiya/>.

2) Robot as a consultant (consultations on any questions, scanning of the passport and registration of the contract, integration with the system of the electronic queue and the issue of coupons, doing monetary transactions by means of the built-in Bank terminal, pronouncing promo-speeches).

3) Robot for retail (informing customers about the range of products and events, visitor identification, promotional mode or mode of interaction, cash transactions through the Bank terminal, printing checks and coupons, integration with the customer accounting system and the system of accounting of goods, reading barcodes, production and issuance of cards, customer support to the required rack).

4) Robot – bank employee (identifying visitors' faces, greeting, issuance of the electronic queue ticket, informing about the Bank's products, feedback, conclusion of a contract for the Bank's services with the client).

5) Robot-promoter (high-quality reporting of any information and advice without excitement, fatigue and speech defects).

6) Robot-employee of the business center (assistance in navigating the room, demonstration of photo and video materials, information about the infrastructure of the center, services and products, identification of visitors, communication).

7) Robot – an administrator (informing and consulting visitors, identifying visitors, communication).

8) Robot – tour guide (excursions for visitors, information about exhibits, answers to questions and broadcasting of photo and video materials on the built-in monitor).

In recent years, a sharp increase in the sales of service robots and attracting interest in them, thanks to their increased functionality and practical usefulness, is noted by the International Federation of Robotics (IFR) which conducts and publishes such studies⁶.

We suppose, the next step will be the acquisition of a personal robot for the house by each family. Such a service robot will help with cleaning, communicate, entertain.

Thus, robots designed for social use, are gaining popularity and contribute to the autonomisation (that is, to the process of the formation of an independent) personality. This leads to revolutionary changes in the social field. Fundamentally new opportunities for work, creativity, education and entertainment at home are being created. Thanks to the process of robotization of the social field, the information culture of society can increase and public consciousness can change.

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⁶ Why service robots are booming worldwide. *IFR Press Releases* [Electronic source]. <https://ifr.org/news/why-service-robots-are-booming-worldwide>.