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ISSUES IN INTEGRATING ROBOTS INTO ORGANIZATIONS

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Abstract:
Robots among people are not science fiction anymore. Discussions have already started on how to integrate robots into various aspects of our lives. We use robots in factories for quite some time now. Autonomous unmanned aerial vehicles are being used for both civilian and military purposes. Nowadays, smart transportation is one of the hottest research topics. Moreover, medical robots are showing promise. The scientific literature on humanoid robots and social robotics are building up. Currently, there are social humanoid robots available for purchase at affordable prices. Even though social robots are limited in their capabilities, they show prospect for various commercial, educational, and research purposes. We now envision organizations in which robots and humans collaborate. As artificial intelligence in robots becomes more capable, robots will assume roles, conduct various tasks and collaborate with people in organizations. In this study, we discuss various issues related to integrating robots into organizations.

Keywords: Robots, Robotics, Organizations, Social Robotics, Robots in Organizations, Roboethics, Integration of Robots into Organizations,

1. Introduction

In the past, the use of robots was mostly limited to factories. Therefore, industrial robots were at the core of the robotics market [5]. However, the use of robots is expanding [21]. In recent years, both remotely operated and autonomous unmanned vehicles have found many civilian and military uses [1]. Autonomous cars are being tested on roads [10]. Medical robotics is being developed to assist surgeons in various surgical procedures [17]. Robots for educational and entertainment purposes are available for purchase [2, 3]. Robots are already in society [17]. They are used in labor and services [21], military and security [1], research and education, entertainment, medical and healthcare, and personal care [17]. Robots are beginning to take care of themselves and even replicate themselves [6, 7, 8].

The current trend in robotics is moving toward robots playing a part in human lives [15, 17, 21]. Recently, Softbank Robotics, a Japan robotics company, introduced a humanoid robot named "Pepper" [4]. This humanoid robot is capable of recognizing and interpreting human emotions. Pepper responds to these emotions accordingly. Additionally, Pepper is able to learn and adapt itself according to the personality traits and

habits of people interacting with it. According to the company website [4], Pepper is being used in more than 140 Softbank Mobile stores to welcome, inform, and amuse customers. In a few years, the company will make the robot available for purchase worldwide. Moreover, the price of this humanoid robot is quite reasonable. Cozmo [3], developed by Anki, is a remarkable toy robot with improved artificial intelligence (AI). It is marketed as "a robot with a personality". According to the developer, Cozmo is self-aware. It is able to recognize its user, read the emotions of its user and interpret the environment. In addition, it can show emotions based on the interactions with its user. Again, the price of Cozmo is quite reasonable. These are also other robots available for purchase with reasonable prices. In addition, there are many research projects to increase the ability and capability of these types of robots. These developments promise us a future with more robots around.

The goal of this paper is to point out various social issues related to integrating robots into organizations. In the following section, we briefly discuss the field of robotics, in particular, research areas that will help us to integrate robots into organizations. Next, we list and discuss organizational issues when robots and people become coworkers in organizations. Finally, we conclude the paper.

2. Robotics

The term robot originates from a Czech word, "robota". The meaning of robota is "forced labor". This term was first used by Karel Čapek in a science fiction play titled R.U.R. (Rossum's Universal Robots, 1920). The meaning of the word is quite striking and it is as if robots were initially envisioned to be the slaves of people. Note that this may create interesting discussions in the future.

Robotics is a discipline focusing on the design, manufacturing, operation, and use of robots [10]. There are many research areas in robotics. Up until recent years, the focus of most robotics research was artificial intelligence and robot design. Naturally, studies on social aspects of robots were limited. However, as robotic technology advances and the production and availability of robots increase, the dream of robots and people living and working together is becoming a reality. Experts began imagining these machines among people and researchers started to study the social aspects of robotics. There are some particular research areas within the overall robotics research that will especially help to integrate robots into our lives and into the workplace. These research areas are artificial intelligence (AI), human-robot interaction (HRI), social robotics, roboethics, and humanoids.

2.1. Artificial Intelligence

For most people, artificial intelligence is almost a synonym for robots. However, there are some robotics research areas that are not directly related to artificial intelligence. Areas such as electronics engineering, mechanical engineering, control systems engineering, and power engineering are also important areas supporting robotics engineering. Therefore, for most robotics engineers, artificial intelligence is about increasing the intelligence of robots. Currently, robots are not smart enough to work and live among people. Thus, we need more research on artificial intelligence before integrating these robots into the organizations.

2.2. Human-Robot Interaction (HRI)

Human-robot interaction research has gained attention in recent years. As the vision of robots and humans living and working together is becoming a reality, scholars and scientists get more interested in examining issues related to human-robot interaction. HRI

2018, the Annual ACM/IEEE International Conference on Human-Robot Interaction, is the 13th conference in the series [26]. Each year, the conference highlights a theme and the theme for the next year is "Robots for Social Good". The journal of human-robot interaction [27] is a good resource for the current state of the art. The human-robot interaction research is in early stages. For example, early research indicates that people prefer human-like behavior or communication in human-robot interaction [21]. However, as we experiment with robots, we may invent new ways of communication and interaction with robots. We need more research, especially applied and experimental research, to help us integrating robots into organizations successfully.

2.3. Social Robotics

Breazeal offered the term sociable robots: "A sociable robot is able to communicate and interact with us, understand and even relate to us, in a personal way. It is a robot that is socially intelligent in a human-like way. We interact with it as if it were a person, and ultimately as a friend." [11]. Social robotics deal with social issues surrounding robots. Humans are social creatures [12]. Thus, a great deal of organizational behavior research revolves around social issues in the workplace. People in organizations will eventually expect a certain level of social behavior from robots if they become coworkers. Therefore, social robotics is a crucial research area for integration of robots into organizations.

2.4. Roboethics

Roboethics is the study of ethical issues surrounding robotics. The term was first coined in the First International Symposium of Roboethics held at Sanremo, Italy in 2004. One of the main goals in roboethics is the design of ethical robotic behavior.

In addition to law and culture, ethics regulate a great deal of human behavior. Ethics is an indispensable part of human behavior. It exists almost in all aspects of our lives. Managers and employees are expected to have a certain level of work ethics in an organization. If people and robots are to work together, people will expect robots to follow certain ethical rules. Roboethics will help us to successfully integrate robots into society. Table 1 provides a taxonomy of roboethics [13].

Table 1. A Taxonomy of Roboethics

A Taxonomy of Robots		
Humanoids	Outdoor Robotics	Military Robotics
Artificial Body	Surgical Robotics	Educational Robot Kits
Industrial Robotics	Biorobotics	Robot Toys
Adaptive Robot Servants	Biomechatronics	Entertainment Robotics
Distributed Robotic Systems	Health Care & Quality of Life	Robotic Art

2.5. Humanoid Robots (Humanoids)

According to Euron Roboethics Roadmap, "humanoids are robots whose body structure resemble the human one" [14]. Note that humanoid robots are also called humanoids. Humanoid robots do not only resemble humans in structure but people also expect human-like behavior from these types of robots [14, 17]. First examples of robots interacting with customers are humanoid robots. For example, the humanoid robot, Pepper, is now commercially available for businesses with affordable prices [2]. According to the developers [2], Pepper is designed to be "the first humanoid robot capable of recognizing

the principal human emotions and adapting his behavior to the mood of his interlocutor". This humanoid robot is used to as a new way to welcome, inform, and amuse the customers. Again, the developers claim that Pepper also recently became the first humanoid robot to be adopted in Japanese homes. However, some studies found that people do not prefer a humanoid as a robot [21,25]. They would like to see a machine-like look in a robot [21]. However, they prefer human-like behavior or communication [21]. One interesting study may investigate the question that whether the human body resemblance of humanoids increases the expectancy of human-like behavior and morality from these machines or not.

3. Issues Related to Integrating Robots into Organizations

Since the early days of organizational research, increasing the effectiveness and efficiency of organizations is one of the main goals in management and organization research. The use of machinery and product lines in production was innovative. It boosted the economies and created many changes within society. The introduction of robots to the society will be innovative. Organizations will try to benefit from robotic technology to the maximum extent. Naturally, many issues will arise during integrating robots into organizations. In this section, we highlight certain research areas and issues those will be the focus of many organizational research studies in the future.

3.1. Evolution in Organizational Behavior

Naturally, the focus of current organizational behavior research is human relations. However, as the number of robots in the workplace increases, the focus of organizational behavior research will shift toward human-robot interactions. This line of research will be different from the current human-robot interaction research, which currently investigates the interaction between one human and one robot. The organizational behavior research will mostly focus on human-robot interactions as a group behavior. We will need many new theories and research models with scales such as negative attitudes toward robots (NARS) [22, 23] scale.

Over the years, we learned that organizational behavior must be studied and applied in a contingency framework. Currently, the most popular topics in this field are connected with theories of motivation and leadership, work design and/or satisfaction [35]. The results of some of this work will be limited in applicability in a human-robot work environment. As a result, the organizational behavior research will evolve – may be drastically - over time due to robots in the workplace.

3.2. Acceptance of Robots in the Workplace

The use of robots is expanding [21]. There are various studies investigating the attitudes toward robots in various application areas [21,22,23,24]. For example, one study found a very positive attitude toward robots for service and personal use [21]. Yet, it is too early to tell robots will be easily accepted in the society. People tend to accept robots and treat them as social entities [30, 31, 32] and even sometimes attribute them with moral responsibilities and rights [33]. Some studies suggest that robotic interfaces can be intentionally designed to be persuasive [31, 34]. An interesting study shows that people may accept commands from a robot [17]. However, currently, we do not know exactly to what level robots will be accepted in the workplace.

3.3. Evolution in Organizational Structures and Workflows

The introduction of a new technology into an organization creates changes in the organizational structure and workflows. In fact, the main argument for the investment in the technology is the premise of effectiveness and efficiency. In some cases, the new technology necessitates structural changes and in many cases, the technology changes the organizational workflows. The existing organizational theories such as Mintzberg's organizational structures may evolve over time to explain how humans and robots efficiently and effectively work together – if they will.

Workflows separate work activities into well-defined tasks, roles, rules, and procedures which regulate most of the work in manufacturing and the office. Initially, processes used to be carried out entirely by humans who manipulated physical objects. Thanks to the introduction of information technology, processes in the workplace are partially or totally automated by information systems, i.e., computer programs carrying out tasks and enforcing rules which were previously implemented by humans [36, 37].

3.4. Evolution in Work Ethics

The work ethic is a cultural norm that advocates being personally accountable and responsible for the work that one does and is based on a belief that work has intrinsic value. The concept of work ethic has evolved from the writings of the early 20th-century scholar, Max Weber [38], who has been credited with contributing to the success of capitalism in western society with the Protestant work ethic [39, 40]. Weber emphasized the value of work commitment and raised questions as to why some people place a greater importance on work and appear more conscientious than others.

Work ethics seem to be a multidimensional set of values. An individual with a high work ethic would place great value on hard work, autonomy, fairness, wise and efficient use of time and the intrinsic value of work [41, 42, 43]. As robots enter our workplaces, work ethics will evolve. There will be interesting discussions related to work ethics. Robots are machines and they have inherent characteristics. They do not get tired. They can be programmed to be hard working, committed, precise, loyal, etc. So, how employees with high work ethics feel in an environment in which competing with robots is almost impossible. We may need a new set of work ethics with robots in the workplace. Furthermore, it is not hard to predict that there will be a close interaction between work ethics and roboethics research.

3.5. Discrimination against Robots or People

Even though there are many laws and regulations against discrimination, it is a reality in the workplace. Members of an organization may discriminate against other members of the organization due to race, color, religion, sex, or national origin. In the future, we may add one dimension to this list. That is being organic or mechanic. We currently do not know what the status of robots will be in the society and in organizations. Whether robots will have rights or not will be an interesting discussion. Moreover, the status of robots may likely to evolve over time. Robots may be viewed as properties to be owned or beings with certain rights. Depending on the discussion, discrimination may not be an issue but the discussion may only revolve around preference of robots over people or people over robots. Bosses or managers may prefer one over another. It is hard to predict how the arguments will shape at this state art in robotics and roboethics.

3.6. Privacy and Trust in a Human-Robot Collaborative Work Environment

A systematic study of the notion of privacy began with Warren and Brandeis' famous essay titled "The Right to Privacy" [44], in which privacy is defined as "the right to

be left alone". Since then, privacy is the focus of many studies. Depending on the environment, people expect different levels of privacy. For example, people expect a high level of privacy at homes but the expectancy is low in public places. Even though workplace is a type of public place, employees still expect a certain level of privacy in the workplace [48].

Trust can be defined as an individual's belief or an expectation of other's ethical behaviors under various influential factors such as risk and security [45]. Researchers use these influential factors to determine the tendency of trust [46] and construct trust as a fundamental aspect in all types of relationships [47].

Robots are machines and they are capable of recording everything. Unlike humans, robots do not forget. In addition, robots can be equipped with sensors that humans do not have. For example, in the future, robots may be able to read minds using electroencephalogram (EEG). People may not be ready for some of these capabilities and qualities of robots. We will see how the concepts of privacy and trust will evolve as robots become part of our lives.

3.7. Education and Training

The introduction of a new technology creates changes in organizations. Managing an organizational change is inherently challenging [29]. Bringing robots into the work environment will be a big technological change for many organizations. In many cases, employees resist changes. Education and training help us to overcome the resistance to the new technology, therefore, they are crucial for technology transformation [52].

Working with robots will not be easy for many employees especially if some of their coworkers lost their jobs due to utilizing robots in the workplace. However, note that we experienced such challenges in the earlier industrial revolutions. We overcome these challenges and new types of jobs emerge as technology advances.

3.8. Redesign of Workplaces for Robots

Naturally, our work environments are designed for humans. In most offices, we have office rooms, desks, a coffee room, a kitchen, restrooms etc. These are all infrastructure for humans. Robots do not need many of these and in fact, they may need others. For example, robots may need a recharging room, a cleaning room, a repair room etc. Currently, robots are not as skillful as humans in terms of movement. Therefore, maybe not in the future but in the early days of utilizing robots in the workplace, we may need to redesign our workplace to accommodate robots.

4. Conclusions

Artificial intelligence (AI) and robotic technology are advancing at an enormous speed [28]. Robots are already becoming a part of our society [17, 28]. Various scholars began investigating how humans and robots collaborate [16-20]. In one of the studies, the researchers investigated how a human teach a task to a robot [16]. There are even studies in which robots are commanding people [19]. Preliminary research shows that people are inclined to accept robots and treat them as social entities [30, 31, 32]. Moreover, they even attribute robots with moral responsibilities and rights [33]. These studies indicate that the effect of robotic technology on our lives will be significant. There will be many studies dealing with the integration of robots into various aspects of our lives. One important line of studies will focus on the integration of robots into organizations.

In this study, we identified five robotics research areas those are likely to influence organizational research in the future. These are artificial intelligence, human-robot interaction, social robotics, roboethics, and humanoid robots. Some of the studies in these

areas will be shaped by the need to integrate robots into our work environments. On the organizational research side, the use of robots in the workplace may result in an evolution in the organizational behavior, in the organizational structures and workflows, and in work ethics. Moreover, acceptance of robots in the workplace, discrimination against robots or people, achieving privacy and trust in a human-robot collaborative work environment will be important research questions. The current workplaces are designed for humans in mind. As robots enter our workplaces, we need to redesign the workplaces to accommodate this new type of coworkers. Naturally, training and education of employees will be an indispensable step in adapting to robots in the work. We discussed each of these areas and issues briefly. Finally, we believe that how people actually react to robots in the workplace and how organizational structures and behaviors will evolve when working with robots will be the subject of many research studies to come.

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