Robots as Our New Coworkers: The Influence of Anthropomorphism on Employees' Preference of Levels of Automation

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ARTICLE INFO	ABSTRACT
	Objectives: Eldercare facilities are one of those organizations which are expected to use robots in order to fulfill the needs of aging population. So, the main aim of this study is to understand employees' standing point about their potential robot coworkers in eldercare. While variety of designs were developed for robot appearance, it is important to see whether there is any influence of this appearance on users' preference of level of automation.. *Methods:* 102 caregivers who work for eldercare in a nursing home (aged between 19 and 40) participated in designed experiment. Independent samples t-test was used for analyses. *Results:* The degree of human likeness of robots was not an influencer for preference of level of automation. Moreover, demographic variables such as gender and education level did not make a considerable difference on the preference of levels of automation. *Originality:* This is the first time that the influence of anthropomorphism on the preference of levels of automation was focused. Also, the idea of understanding the potential users', employees' perception for designs of robots was emphasized; and therefore human-centered approach for technology adaptation was supported.

Yeni İş Arkadaşlarımız Olarak Robotlar: İnsan Biçimciliğin Çalışanların Otomasyon Seviyeleri Tercihi Üzerindeki Etkisi

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MAKALE BİLGİSİ	ÖZ
	Amaç: Yaşlı bakım kuruluşları yaşlanan nüfusun ihtiyaçlarını karşılamak için robotları kullanması beklenen örgütlerdendir. Dolayısıyla, bu çalışmanın temel amacı yaşlı bakımında çalışanların potansiyel çalışma arkadaşları olan robotlara karşı bakış açısını anlamaktır. Robotların görünümü için çeşitli dizaynlar geliştirilirken, bu görünümlerin kullanıcıların otomasyon seviyesi tercihi üzerinde etkisinin olup olmadığını görmek önemlidir *Tasarım/Yöntem:* Yaşlı bakımı için huzurevinde çalışan 102 bakıcı (19 ve 40 yaş arasında) tasarlanan deneye katılmıştır. Analizler için bağımsız gruplar t-testi kullanılmıştır. *Sonuçlar:* Robotların insansılık oranlarının otomasyon seviyeleri tercihinde bir etken olmadığı bulunmuştur. Ayrıca cinsiyetin ve eğitim seviyesinin de otomasyon seviyeleri tercihinde bir fark yaratmadığı anlaşılmıştır. *Özgün Değer:* Bu çalışmayla tercih edilen otomasyon seviyeleri üzerinde insan biçimciliğin etkisine ilk defa odaklanılmıştır. Ayrıca robotların dizaynı hakkında potansiyel kullanıcı olarak çalışanların bakış açılarının anlaşılması fikri vurgulanmış, insan merkezli teknoloji adaptasyonu desteklenmiştir.

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1. Introduction

When civilized humanity first met the machines in the industrial age, they might not have expected the huge change that they would experience. However, most of them felt it and influenced by it one by one. The daily life in terms of economic and social aspects is affected more than these people might have imagined. From that time to these days, giant steps have been taken in technology. Every innovation came with new changes. Every step in technology, added new aspects to the development of machines; machines which have the strength and abilities to do things like a human! Their potential abilities are growing with the research in psychology, neuroscience, and computer science and engineering (Nitsch & Popp, 2014). And finally, with these steps we started to see the reality of artificial intelligence. A human-made entity would be just like a human.

As time goes by, new robot factories are established. With more investments, more developed robots are obtained. Today's big companies like Google and Toyota and many others are leading their investments in robotics (Gibbs, 2013; Reuters, 2016). In universities, more research is taking place. Today, the number of international journals about robotics is more than 20 (Google Scholar, 2017). According to International Federation of Robotics, more than 240.000 industrial robots were sold across the globe in 2015 and this means 8 % global growth in the sector; besides, between 2016 and 2018 the estimations show that this growth will be at least 15 % (International Federation of Robotics, 2015). Thus, the undeniable reality of robotic age has already been started.

We expect that the main purpose of a robot is to replace us for repetitive and high-risky jobs (Jenkins, Nicolescu, & Mataric, 2004). So, the range of work areas of robots is quite wide, new ones may also appear depending on the new developments. In line with that, robots are integrated into organizations in a very fast trend (Mutlu & Forlizzi, 2008). For decades, the association between technology and organizational issues are examined via various studies (Mutlu & Forlizzi, 2008). Some of these studies focused on the influence of technology on organizational structures, working schemas and their productions (Orlikowski, 1996). Furthermore, some of these studies interested in the social side of the organization such as conflict management and interests of the workers under the conditions of adopting and using technological advances (Orlikowski, 2000). Hence, the recent technology, robots, started to have a big influence on the social dynamics and work schemas of the workers (Mutlu & Forlizzi, 2008). The organization proactively should take into consideration that how the workers will approach and react to robots as coworkers, how the organization will change, when this change will occur and what kinds of strategies will be effective in the process of adapting these robotic innovations (Mutlu & Forlizzi, 2008). Besides, it is not the only requirement to understand how the worker will do the new activity recreated by the employing robots, but also it has to be thought that what attitudes of the worker will be towards these activities (Mutlu & Forlizzi, 2008).

Recently, the humanity has little knowledge about the effects of robots on individual and organizational variables in various workplace environments (Shenkar, 1988). Nonetheless, we have to conduct new studies if we believe that comprehending this issue is important in terms of the interactions between human and robot with better implementation of robotics in organizations (Shenkar, 1988). Employees are the ones who will come face to face to welcome robots at the workplace. Hence, the question is how are employees' perspectives formed towards working with robots? Do employees have any desire to work with them and can it change according to robot appearance and does it relate to robot automation level? Finding answers to these questions may give us a better understanding about introducing robots to organizations and potential problems that workers may stress in close future.

Today's developed countries are facing another issue which is growing year by year and needs urgent strategic planning: aging population. The number of old people who need long-term health care increases as the population is getting aged (Jacobzone, 2000; Kiata, Kerse, & Dixon, 2005). Findings indicate that the aging population comes with a high demand for personnel who can take care of them and prevent the potential psychosocial and physical damage that can happen in the nursing home. Hence, it has to be made some plans to get over this problem (Lutz, Sanderson, & Scherbov, 2008). While, thanks to home based care technology, a variety of assistive innovations

helps elders to stay at their home for a longer time (Broadbent, Stafford, & MacDonald, 2009; Wada et al., 2003). Nonetheless, the demand for the nursing homes is increasing dramatically, so, the need for the care staff is accelerating at the same speed. As it is predicted that millions of "baby-boomers" will retire in next 30 years, the society should extend the number of the eldercare facilities (Schneider, 1999). United Nations' report (2015) states that aged population (aged over 60 years) almost tripled in last 50 years and according to predictions of the report, it will triple once more in next 35 years. According to World Health Organization (WHO) (2007), especially the West will not find enough number of skilled staff for eldercare in future. Here, a sustainable solution appears that substitutive or assistive technology seems inevitable in nursing homes to supply older people's physical and psycho-social demands.

Regarding these issues, all in all, in our study, we propose that the appearance of a robot may influence caregivers' preference of level of automation for that robot. The explanations of the variables and the hypothesis of the research are stated in the following section.

2.   Theoretical Background

Today, there are many classifications of robot types. According to the International Federation of Robotics (IFR official website), two main types can be mentioned functionally: industrial robots and service robots. Industrial robots are carrying on activities in production units in the industrial frame. However, the other one, service robots, have an assistive role beyond the industrial production. For example, a robot in an automobile factory, which produces a part of the automobile (i.e. steering system) can be classified as industrial robot; but, a robot in a healthcare environment can be named as service robot. Furthermore, a robot which is used for educational purposes, domestic duties, and security concerns can also be seen as an example of service robots. Therefore it can be said that the main aim of service robot is supporting human user for job related duties (Thrun, 2004).

In the beginning of robotic transference to eldercare facilities, people firstly inspired by known science-fiction robotic characters (Dautenhahn et al., 2005). However, the main reason behind the huge demand for robots in care technology is about tasks which a person doesn't have the ability or is not efficient as much as robots (Gearon, 2013). Eldercare means having a heavy workload, it needs extensive labor. In daily elder care, people need assistance while toileting, taking shower, wearing dress and many other daily activities. Furthermore, older people often need to be transferred between bed and chair. Some elders need support while eating. People who are bound to bed should be moved from side to side in regular time circles. Hence, many studies are going on in robotics for elders in order to support moving and walking (Dubowsky et al., 2000; Graf, 2009). Therefore, robots which can be ordered for food and drink, to open door or windows, to move an item may help elder care issues very much (Toshiba to Showcase Advances in Sophisticated Home Life Support Robot, 2005). They can also help elders for walking and getting up (Severin, 2004). Particularly, elders who are bedridden could be turned and lifted more easily by robots in eldercare facilities (Kitano, 2005). Furthermore, in nursing homes, robots can have a crucial role by monitoring elders, particularly for dementia patients, and giving immediate information to the staff (Pineau et al., 2003). With these robots, even if the facility may not increase the number of staff that they employed, it can give higher standards of care service (Kageyama, 2002).

In care technology, service robots in nursing homes usually involve two kinds. One of them is *assistive* one which helps user for tasks that they are charged with doing. Another one is *socially interactive* ones that socially interact with users and can communicate with them. However, there are also robots that take place between these two. These robots, which are called as *socially assistive robotics,* can do some tasks and also non-physically communicate with people (Feil-Seifer & Mataric, 2008). Socially assistive robotics (SAR) tries to help people in important issues by automating several tasks with a wide range from supervision to friendship. The most famous social robot types which have a big potential for socially assistive robotics can be given as example: humanoid and android.

Humanoid Robot A person can easily understand that humanoid is a machine. It is a machine but it has several characteristics special to humans. For example, it has a head without facial features, a torso, arms and legs. Designing of the humanoid doesn't require facial features like mimicking which requires more complex research; so, today's technology obtained an advanced level (Bar-Cohen, Marom, & Hanson, 2009).

Android Robot The main purpose of designing an android is to replicate a person (Bar-Cohen et al., 2009). A person may not differentiate the android from a real human because of the appearance of the android. The android's head may have hair, and also may be covered as if they have human skin (Bar-Cohen et al., 2009).

2.1 Anthropomorphism

Anthropomorphic form is a creative production that is composed of a non-living entity which has same human-like physical and cognitive characteristics. Robot appearance can be seen in a range of between full mechanical and full anthropomorphic form (Riek et al., 2009).

The main reason to apply anthropomorphism for robots is coming from the intention to obtain an effective system that can adapt to social interaction more easily (Duffy, 2002). In this way, robots can communicate more natural, mostly with humans, in predicted social scenarios. It is known that a humanoid is not the ideal designation that can work in the most efficient way; however, it is also known that humans tend to anthropomorphize (Duffy, 2002). This tendency fact shows us that we can interact more easily and effectively with robots which have more anthropomorphic form; because familiarity helps (Choi & Kim, 2009; Fasola & Matari'c, 2012). It can be easily observed that robots, which had wheels before, are now given legs (Chew et al., 2010). To many researchers, to obtain a robot which can adapt to social interaction with a human, we should provide them a system through which they can sense the world like us (Spexard et al., 2006). Using cameras for the eyes can be given as an example. Furthermore, as it is predicted that robots will be seen more in social environments; it is also economically important to keep them safe. People may damage them (Rehm & Krogsager, 2013). So, perhaps anthropomorphizing robots may be a solution to lessen the negative behaviors of humans; because people treat better to human-like robots comparing to other robots (Bartneck et al., 2010). In this study, to be humanlike is handled as the degree to which a robot's appearance is like a human.

2.2 Automation

In automation, robot behaves according to determined rules in a known environment for a well-framed task; human involvement depends on the degree that found appropriate to obtain effective and efficient performance while doing the task. For example, the tasks which are risky for human life can only be solved through the autonomous working of robots. Here, the risk mainly comes from the unknown environment. So, success can be obtained through autonomy of robot. However, for example in eldercare, using some degree of automation is more appropriate; because the environment is known and certain rules are necessary, and also human can be in control to some degree to increase the overall performance of the task.

Automation consists of selecting data, transforming it, making decisions and implementing the decision (Lee & See, 2004). Therefore, the work is being done with electricity or mechanics. However, the important point is which side (human or agent) puts efforts to what degree from the start to finish of the work. This is generally called as task allocation. Earlier designs of automation involved only one-side allocation either human completes the task or the machine does it (Rouse, 1988). After a while a new perspective came out. In the task completion process, a flexibility approach may obtain higher performance which is called as system adaptability. Thus, according to the dynamic demands of the work, the allocation of task may change hand between human and machine (Hancock & Chignell, 1989).

The usage of robots in real life generally shifts according to when the user need and want it (Dorais et al., 1999). Therefore, a person decides when robot behaviors should be under control and when it should be autonomous (Riek, 2015). Automation can be thought in a range between zero automation (which can be called as manual

control) and full automation. Therefore, in this range, tasks can be done partially by human and partially by machine (Nof, 2009; Sheridan & Parasuraman, 2005). Between these two edges, task allocation can be varied according to intended control degree. Studies about this issue brought many models (see Endsley, 1987; Endsley & Kaber, 1999; Ntuen & Park, 1988; Sheridan & Verplank, 1978).

2. 3. Automation Levels

During carrying over the activities, automated functions can be classified into four: acquisition of data, analyzing the data, making decisions and implementation of the decision. (Parasuraman et al., 2000). Each one of these functions can be executed with a different level of automation. For example, acquisition of data may require high level of machinery control; however, implementation process may need high human support. So, what these four processes function for? In the acquisition of data process, the function is kind of searching information and registering it. In the second stage of analyzing data, the function is to understand what the situation is. In the third process, making decisions, the function is to decide what can be done according to registered and analyzed data. In the final stage, implementation, the function is to execute the action. These functions can be executed with different levels of automation according to the users' approaches and preferences about the issue. Hence, Parasuraman and colleagues brought an idea that their proposed four-stage model of human information processing can be tied to Sheridan and Verplank's 10-points scale of levels of automation. Therefore, they examined that which functions should be automated to what degree (see Figure 1).
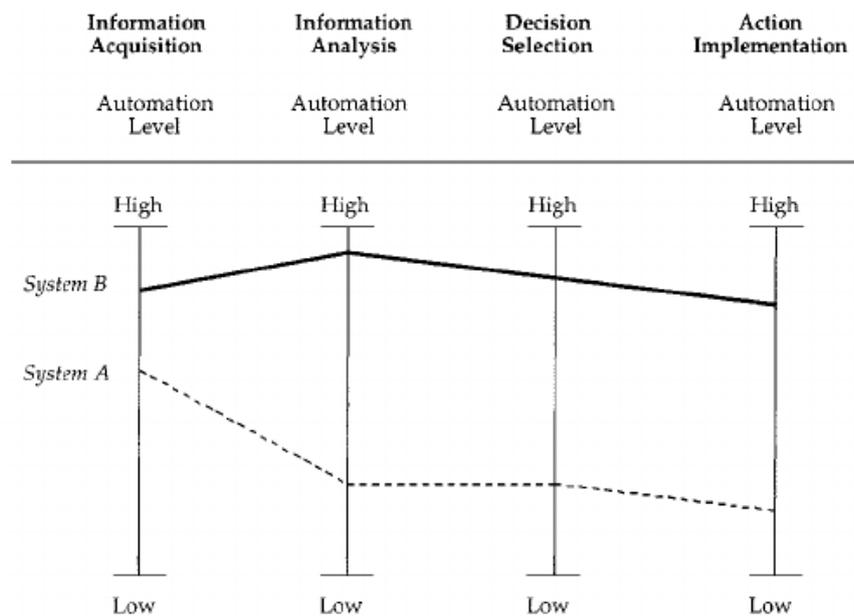

Figure 1 *Levels of automation for different functions based on two systems*
Source: *Parasuraman, R., Sheridan, T. B., & Wickens, C. D. (2000). A model for types and levels of human interaction with automation. IEEE Transactions on systems, man, and cybernetics-Part A: Systems and Humans, 30(3), 286-297*

In the figure, two systems are compared to each other: system A and system B. Regarding the figure, it can be inferred that system B can have higher automation level than system A in order to handle information acquisition process. Likewise, the action implementation process can be executed with low level of automation of system A but high automation for system B. So, it can be said that, system B can behave more autonomously than system A for these functions.

2.4 Present Study

Regarding all these research results and theoretical propositions which are stated above, it is a requirement to understand employees' standing point about their potential robot coworkers. Eldercare facilities are one of those organizations which need immediate robotic service and this need will keep increasing. Caregivers, who work in these facilities for elders, are the first ones who will be in touch with robots during daily tasks in case of being coworkers with robots. Hence, it is very beneficial to take their perception and preferences of robot into consideration for adaptation, better performance and productivity. In particular, we propose the following hypothesis.

Hypothesis: *Robot types (human-likeness of a robot) influences caregivers' preference of level of automation in robots while working with them. Such that, a robot which has more human-likeness such as an Android will be preferred with higher level of automation by caregivers more than a robot which has less human-likeness such as a Humanoid.*

3. Methodology

3.1. Sample

102 caregivers (43 females, 59 males) who work in an eldercare facility in Istanbul participated in the experiment. 50 caregivers (21 female, 29 male) were given the picture of humanoid robot as one of the experimental manipulations. Of those, 2 people had primary school diploma, 30 people had high school diploma, and 18 people had college diploma. The mean age was 30 (ranging from 20 to 39), and the mean of work years was 5 (ranging from 1 to 14). 52 caregivers (22 female, 30 male) were given the picture of android robot, another of the experimental manipulations. Of those, 2 people had primary school diploma, 34 people had high school diploma, and 16 people had college diploma. The mean age was 31 (ranging from 19 to 40), and the mean of work years was 5 (ranging from 1 to 16).

3.2 Procedure

The experiment took place with consecutive sessions in psychological counseling rooms. It was aimed to host four participants for each session. In each room participants sat around the table where they could easily see the computer's 17 inch LCD screen which was settled on other side of the table. The experimenter gave information about the experiment after settlement of participants.

The pictures were shown and the scales were given after the statement. Before entering the room, each group had been assigned to one of two experimental situations. So, participants who had been assigned to first experimental situation saw the picture of humanoid robot that is called as AILA which is developed by the German Research Center for Artificial Intelligence (see Picture 1). Participants who had been assigned to second experimental situation saw the picture of Android robot which is called as HRP-4C which is developed by the National Institute of Advanced Industrial Science and Technology in Japan (see Picture 2). The pictures which are publicly presented obtained from these institutes' web pages. Robot pictures were consisted of a body picture and a face picture. Both robots could easily be perceived as having a female appearance.
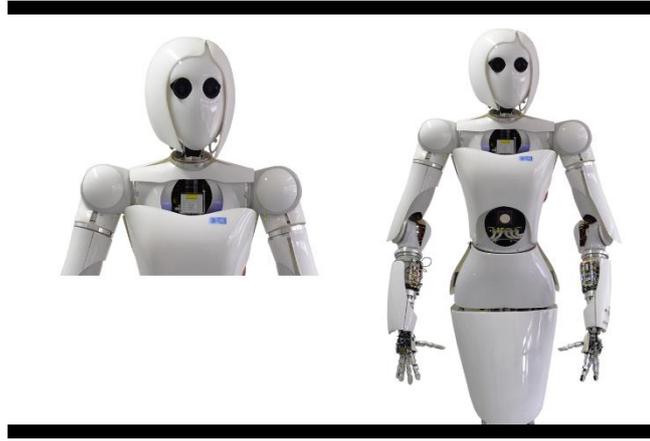
Picture 1 *Humanoid Robot AILA*

Picture 2 *Android Robot HRP-4C*

During the experiment, picture stayed on the screen. Therefore, participants had the opportunity to reexamine the picture while answering the scales. Besides, the demographic questions were fulfilled by participants after answering the scales. Also, the experimenter warned participants after experiment process for avoiding talking about the experiment. Finally, they were given the contact information of the researcher to communicate in case they want to learn the results of the study.

3.3 Measures

A pilot study was executed with a sample of 32 participants (17 females, 15 males) from the same eldercare facility (these participants were excluded in the main experiment) in order to be sure that scales that was prepared to be used in the experiment can give valid and reliable results. Same experiment rooms which are described above were used. However, this pilot experiment was carried on by four trained psychologists at the same time in four different residential sites. The participants were taken to the room one by one. In the room, same procedure which was followed in the main experiment was executed until the end. As an addition, each participant was asked to tell the scale questions that cause any confusion or ambiguity. The experimenter noted the feedbacks. Following scales were decided to be used in the experiment after evaluation of the feedbacks.

Manipulation Check: A new scale was developed to measure anthropomorphism of robots with three items based on one of the items of Godspeed I: Anthropomorphism in order to check the manipulation whether participants perceived Android robot more human-like than Humanoid robot; because the feedbacks from participants showed that participants had so much difficulty to understand and answer the Godspeed I: Anthropomorphism scale of

Bartneck and colleagues (2009). The item was the range from machinelike to humanlike. As we conceptualize the anthropomorphism issue as an appearance and show only the picture of robots, this item was the most understandable and appropriate one. The Cronbach's alpha value of the scale was .73.

Automation Levels of Robots: Caregivers' preferences for automation levels for robots were determined via adaptation of automated functions of Parasuraman and colleagues (2000). These functions were classified into four: acquisition of data, analyzing the data, making decisions and implementation of the decision. Each one of these functions was matched with an item and asked on a 6 point scale ranging from 1 (strongly disagree) to 6 (strongly agree) to determine caregivers' preference of level of automation to execute the tasks that a caregiver do in eldercare. For example, for the function of analyzing the data the following item was formed "I make robot analyze the data which was collected about the situation of the resident". The Cronbach's alpha value of the scale was .84.

Demographics: Demographic information about the participants was collected during the experiment. It includes age, sex, tenure in care giving, education, and also familiarity with robot shown in the picture.

4. Findings

In the first step, independent samples t-test was executed in order to indicate that two robot types which were used as manipulation of the anthropomorphism in the experiment were rated differently than each other on an anthropomorphism scale. This manipulation check showed that android robot was perceived significantly more anthropomorphic than humanoid robot (see Table 1).

Table 1
Results of Independent Samples t-tests showing the Difference of Anthropomorphism

Robot Type	N	Mean	Std. Deviation	t	Sig. (2-tailed)
Humanoid Robot	52	3.71	1.21	-5.749	.000
Android Robot	50	4.95	0.94		

In the second step, independent samples t-test was executed in order to reveal the difference between caregivers' preference of levels of automation for robot types. This analysis showed that there is no significant difference between Humanoid and Android robot types for preference of levels of automation (see Table 2). Hence, the hypothesis of the study was not supported.

Table 2
Results of Independent Samples t-tests showing the Difference of Preference of Levels of Automation between Robot Types

Preference of Levels of Automation (PLOA)	Robot Type	N	M	Std. Deviation	t	Sig. (2-tailed)
PLOA for Information Acquisition	Humanoid	52	3.15	1.55	-.414	.680
	Android	50	3.28	1.53		
PLOA for Information Analysis	Humanoid	52	3.10	1.52	.646	.520
	Android	50	2.90	1.54		
PLOA for Decision Selection	Humanoid	52	2.56	1.38	-.008	.993
	Android	50	2.56	1.46		
PLOA for Action Implementation	Humanoid	52	2.98	1.42	.863	.390
	Android	50	2.74	1.40		
Mean of PLOA	Humanoid	52	2.95	1.21	.320	.750
	Android	50	2.87	1.22		

To visualize these preferences of levels of automation, Parasuraman and colleagues' (2000) proposed four-stage model of human information processing was tied to this study's 6-points scale of levels of automation (see Figure 2). In this model, it can be seen that the inclination of preference of level of automation for information acquisition favors Android robot; but, the inclination of preference of level of automation for information analysis, action implementation and overall mean of preferences level favors Humanoid robot. Furthermore, it can be seen that there is no difference at all in the inclination of preference of level of automation for decision selection for both robot types.

Finally, it was also intended to examine any difference that demographic factors were related. In the aim of this, independent samples t-test was executed and it was found out that the only statistically significant difference was about the preference of levels of automation for action implementation which was in favor of Humanoid robot in the female sample ($t = 2.573$; $p < .05$) (see Table 3 and Table 4).
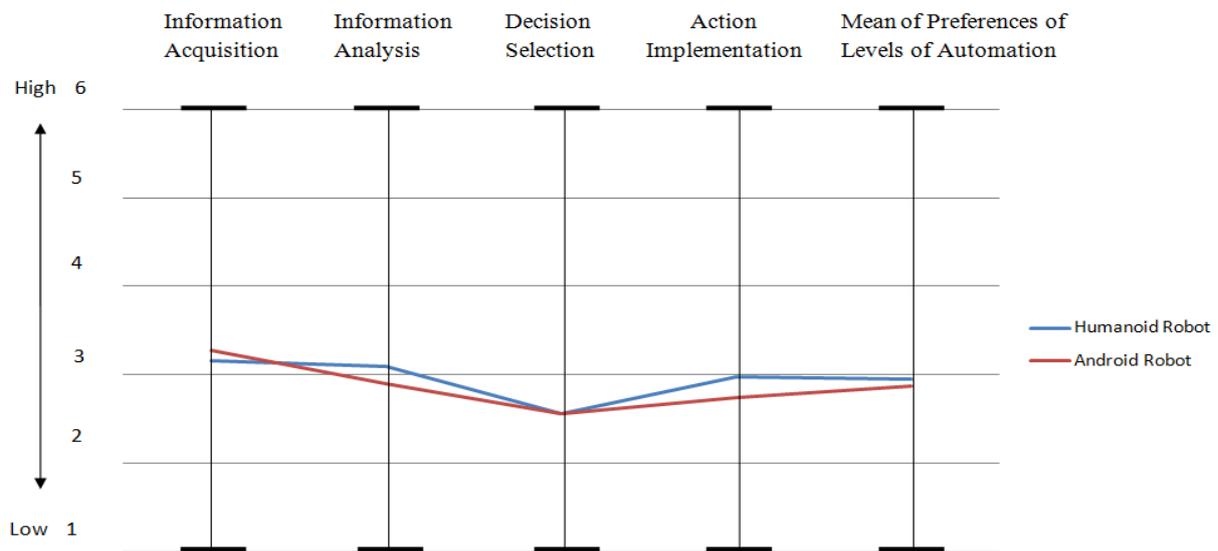

Figure 2 *Levels of Automation for Different Functions Based on Robot Types*

Table 3
Results of Independent Samples t-tests showing the Difference between Female Participants' Preference of Levels of Automation for Robot Types

Preference of Levels of Automation (PLOA)	Robot Type	N	Mean	Std. Deviation	t	Sig. (2-tailed)
PLOA for Information Acquisition	Humanoid	22	3.36	1.36	0.890	.379
	Android	21	2.95	1.66		
PLOA for Information Analysis	Humanoid	22	3.23	1.51	0.427	.161
	Android	21	2.57	1.50		
PLOA for Decision Selection	Humanoid	22	2.55	1.37	1.091	.282
	Android	21	2.14	1.01		
PLOA for Action Implementation	Humanoid	22	3.18	1.50	2.573	.014
	Android	21	2.14	1.11		
Mean of PLOA	Humanoid	22	3.08	1.19	1.802	.079
	Android	21	2.45	1.09		

According to the demographic information, there were only four participants who had primary school diploma. Therefore, in the second step, independent samples t-test was executed in order to find possible differences between peoples' preference of levels of automation for both robots according to having high school or college diploma. According to this analysis, there were found no significant differences for regarding education (Table 5 and Table 6).

Table 4
Results of Independent Samples t-tests showing the Difference between Male Participants' Preference of Levels of Automation for Robot Types

Preference of Levels of Automation (PLOA)	Robot Type	N	Mean	Std. Deviation	t	Sig. (2-tailed)
PLOA for Information Acquisition	Humanoid	30	3.00	1.68	-1.280	.206
	Android	29	3.52	1.40		
PLOA for Information Analysis	Humanoid	30	3.00	1.55	-0.341	.734
	Android	29	3.14	1.55		
PLOA for Decision Selection	Humanoid	30	2.57	1.41	-0.738	.464
	Android	29	2.86	1.66		
PLOA for Action Implementation	Humanoid	30	2.83	1.37	-0.928	.358
	Android	29	3.17	1.44		
Mean of PLOA	Humanoid	30	2.85	1.24	-0.996	.323
	Android	29	3.17	1.25		

Table 5
Results of Independent Samples t-tests showing the Difference between High School Graduates' Preference of Levels of Automation for Robot Types

Preference of Levels of Automation (PLOA)	Robot Type	N	Mean	Std. Deviation	t	Sig. (2-tailed)
PLOA for Information Acquisition	Humanoid	34	2.91	1.33	-0.259	.797
	Android	30	3.00	1.39		
PLOA for Information Analysis	Humanoid	34	3.00	1.37	0.092	.927
	Android	30	2.97	1.52		
PLOA for Decision Selection	Humanoid	34	2.50	1.24	-0.779	.439
	Android	30	2.77	1.50		
PLOA for Action Implementation	Humanoid	34	2.82	1.19	0.695	.489
	Android	30	2.60	1.38		
Mean of PLOA	Humanoid	34	2.81	1.00	-0.089	.929
	Android	30	2.83	1.20		

Table 6
Results of Independent Samples t-tests showing the Difference between College Graduates' Preference of Levels of Automation for Robot Types

Preference of Levels of Automation (PLOA)	Robot Type	N	Mean	Std. Deviation	*t*	Sig. (2-tailed)
PLOA for Information Acquisition	Humanoid	16	3.75	1.91	0.138	.891
	Android	18	3.67	1.61		
PLOA for Information Analysis	Humanoid	16	3.19	1.76	0.328	.745
	Android	18	3.00	1.57		
PLOA for Decision Selection	Humanoid	16	2.75	1.73	0.676	.504
	Android	18	2.39	1.38		
PLOA for Action Implementation	Humanoid	16	3.44	1.82	0.497	.622
	Android	18	3.17	1.34		
Mean of PLOA	Humanoid	16	3.28	1.61	0.455	.652
	Android	18	3.06	1.28		

To sum up, according to results, the degree of human likeness of robots was not an influencer for preference of level of automation. Moreover, demographic variables such as gender and education did not make a considerable difference for the preference of levels of automation according to robots' anthropomorphism.

5. Conclusion, Discussions, and Suggestions

Last decades have passed with huge developments in technology. The same trend continues in the current decade and seems progress in future ones. The robotic technology is part of these developments that is predicted to improve more and more in close future. In the heart of robotics, there is a desire to be full autonomous; that's why, a certain amount research is going on in order to obtain results according to this desire. Not surprisingly, many important steps were taken in this path; the area of robotics came to a point which can make people realize that robotic age has already begun. The current study may also be called as a part of this age.

The study findings were in the line of rejecting the main hypothesis as revealed that caregivers' preference of levels of automation was not different in certain two cases of changing human likeness of robots.

Mori and colleagues (2012) stated for Mori's hypothesis that people perceive anthropomorphism of robot positively until a point where the distinction between a robot and human disappears. According to him, after that point the positive inclination for robot reverses. Thus, android robot which was used in the current study may take place on this reverse inclination where caregivers' perception of android robot comes a point similar with where humanoid robot stands.

Moreover, participants' preference of levels of automation mostly did not ascend middle of the scale. One of the reasons of that situation may be caregivers' job related anxiety towards robots. As machines in work life changed workers' life more than a century, it still keeps changing. People are aware of this change through reading news, watching TV or experiencing it themselves. In this frame, there is a big question "Do robots support us or replace us?" Although in the study, participants were encouraged to think robots as supporters, people who had this question may not get over this anxiety and this may be reflected to their preferences. As the experimenter stated that it was wanted to learn their perspective in the beginning of the experiment, participants may have thought that if they preferred higher levels of automation, they would increase the likelihood of adoption of robots which

can replace them. Thus, more humanlike robot may mean more job insecurity for them which may lead them not to favor Android robot.

As it is mentioned in the methodology section, robots which were used in the experiment could be easily perceived as female. However, robots' gender may have affected caregivers' preferences of levels of automation. Participants' perception of gender capabilities may be reflected to these robots. So, more female like robot may represent this prejudice more which converts this advantage to a disadvantage for Android robot. Therefore, they may have preferred lower levels of automation for them.

Examination of demographical factors indicated that preferred automation levels were not changing according to education level. Although, it can be thought that people who have higher education may be more into reading technology news and using technology related tools and they may have more experience with technology; but, they did not prefer more automation level for robots regarding their expected experiences. As it is known, eldercare is a sensitive work which requires helping elders in a very soft manner both physically and psychologically. In the physical frame, most of the eldercare tasks involve touching elders such as caregivers help elder wearing, bathing, eating, walking etc…The sensitiveness of these tasks may have made participants doubt that how a robot can help like a human without hurting elders. Participants who hesitate about this issue may not care robot appearance that much to robots and also prefer lower levels of automation for both robots.

All in all, robotic age has already begun. Big changes are waiting ahead of people of world. Individuals, organizations or countries, all have to see these changes and make preparations for them; otherwise they cannot be away from negative consequences. Individuals who plan to work or who are already working may follow technological developments and make inferences how these developments may influence the nature of their work. Moreover, lifelong learning philosophy is a big helper for individuals if they want to adapt the changes that technology brings. Also, they should not put limits to their imagination about the works that robots can do. It should not be forgotten that currently there are some technological advances that could not be imagined a few decades ago.

Organizations also one of these entities which have to adapt technological changes if they want to survive. For centuries, technology has been a factor that puts its owner ahead of every organization. Firstly, as this study also points out, automation has started to take their places in the production industry and it is extending to several sectors and the examples of service and healthcare sector are only some of these sectors. Therefore, human source which has the capability to follow and adapt technological developments may help the organization's survival in long term. Also, as automation can do many tasks, the creative part of its cognitive abilities still cannot catch human ability, and it seems it requires very long time to reach that point. Hence, if organizations focus on creativeness and develop their human source's creative abilities, they can be the ones which are followed by other organizations. Furthermore, research and development departments should be ultimate part of each organization which follows outside world constantly. Also, continuous trainings for the personnel are another way to support this strategy.

In automation process, researchers generally think what to automate and then find the simple answer: you can automate everything you can (Chapanis, 1970). Technology that automates everything can be evaluated as a technology-centered approach which excludes human side of the issue (Lockhart et al., 1993) and tries to find solutions just for the automation (Endsley, 1995) by leaving human users encounter to tasks that machines cannot do (Lockhart et al., 1993). This situation requires more training for human to do left difficult jobs (Lockhart et al., 1993). This situation creates a dilemma; because, one of the main aims of the automation is to obtain less need for training due to the cost (Parasuraman et al., 1993). The problems that are derived from technology-centered approach are examined and tried to be solved by another approach which is human-centered perspective. According to this perspective, human and the machine should be seen as a team and human should not be put in a situation just for doing difficult tasks. In this perspective, our study also tries to support human-centered approach by evaluating human-robot collaboration and team as a very important step in organizations. So, as this paper tried

to find out the influence of anthropomorphism, designs that are human friendly and which enhance collaboration and productivity may help human-centered approach while adapting technologies into organizations.

6. Limitations

The main limitation of the study is the lack of real interaction between participants and robots. Nevertheless, using photos in the experiment gave the opportunity to eliminate some confounding variables such as participants may learn the moving ability of robots which can influence their perception related to robot appearance.

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