

COGNITIVE TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE IN SOCIAL PERCEPTION

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Abstract:

Cognitive technologies and artificial intelligence dynamize the development of the modern world in various spheres. Modern man is not always aware of how often he uses this type of technology, both in everyday life and at work. The conducted literature research has shown a growing interest in the discussed issues. The diagnostic survey allowed the assessment of the level of familiarity with the terms "cognitive technologies" and "artificial intelligence" in the perception of students, doctoral students and employees of a selected university. The auditorium survey technique was used for the research. The research shows that the distance between humans and an intelligent robot is decreasing. A man is inclined to let intelligent robots enter even the most intimate spheres of his life. The article contributes to filling the gap in knowledge about the perception and application of intelligent technologies and the readiness to use them. Furthermore, it sets out further directions for research on this phenomenon.

Key words: *cognitive technologies, artificial intelligence, social perception, modern business service*

INTRODUCTION

Artificial intelligence and cognitive technologies are terms that have already entered the common lexicon of the world of science, business and technology. However, they evoke different associations in the wider society, where they are known primarily thanks to science fiction films. This observation mainly applies to the issue of artificial intelligence, even though modern man is often unaware that he (unconsciously) uses solutions based on artificial intelligence (AI) and cognitive technologies. Familiarity with the term cognitive technologies is relatively less common, even though various functionalities of cognitive systems and tools are already used daily.

Cognitive technology is defined as "a field of computer science that mimics human brain function through a variety of means, including natural language processing, data mining and pattern recognition" [1]. Forecasts indicate that these technologies will be instrumental in shaping human-technology interaction in the coming years, particularly in the areas of automation and robotics, machine

learning and IT. Cognitive technologies should be considered a subset of the broader field of artificial intelligence, which in turn is often considered a subset of biomimetics. Artificial intelligence research has a fairly long tradition. On the other hand, cognitive technologies have evolved primarily out of the Internet itself (mainly the web and the cloud). IBM's Watson has become a symbol of cognitive technologies. Cognitive technology has also been applied in the Netflix streaming service, with its introduction largely contributing to the company's spectacular success [1]. In other approaches (definitions), cognitive technologies are a broader set that includes such subsets as artificial intelligence, advanced analytics, high-performance computing and cyber-physical systems [2]. Cognitive technologies are extensively discussed with the fourth industrial revolution and the development of Industry 4.0 [3], as well as with modern business service solutions encompassing things like Business Process Outsourcing (BPO), Information Technology Outsourcing (ITO), shared service centres (SSC) and Research & Development (R&D).

For business and science, technical progress is both evident and comprehensible. The need for continuous development and improvement of technological solutions, which by definition are intended to streamline and optimise industry and service processes, is strongly emphasised. Various industries are pinning their business successes on the application of cognitive technologies. Nonetheless, the perception of new technologies among the public is typically varied. While young people tend to be fascinated by technological innovations, older generations are not as proficient at using them. The gadget craze is widespread not only in Western societies but also in countries of the poor South, where despite the ever-present food scarcity, people have access to state-of-the-art mobile phones. However, many people remain generally opposed to the progressive technologisation of individual and social life, and the perception of people and interpersonal relations through the prism of technology.

LITERATURE REVIEW

Interest in issues related to the development of artificial intelligence and cognitive technologies has recently grown significantly. The scientific community is studying, analysing and stimulating the development of these technologies from various perspectives. The popular Google Scholar database shows 2,730,000 results for the search query "Cognitive Technologies" and 3,490,000 results for "Artificial Intelligence". However, the search query "Cognitive technologies and artificial intelligence" returns 896,000 results in the above database. Data for the last 10 full years were analysed using the method of time series analysis, consisting in examining a sequence of observations of a certain phenomenon in assumed time units. Time series are the basis for analysing the dynamics of observed, measured and analysed phenomena (Figure 1, 2).

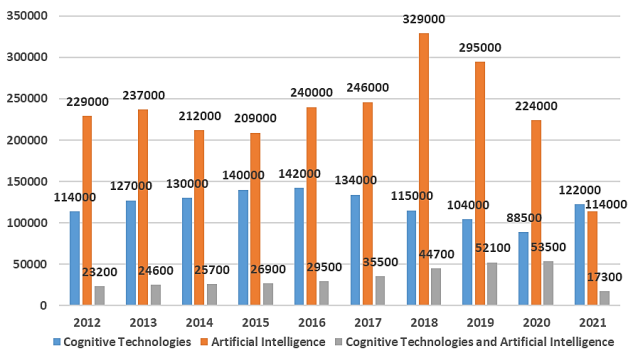


Fig. 1 Google Scholar data for queries "Cognitive Technologies", "Artificial Intelligence", "Cognitive Technologies and Artificial Intelligence", taking into account the nominal values (8 January 2022)

The data shows that scientific interest in cognitive technologies, which translates into the number of scientific papers published, peaked in 2016, and in the case of artificial intelligence, in 2018. There are relatively fewer studies referring to both terms simultaneously in each of the time series analysed.

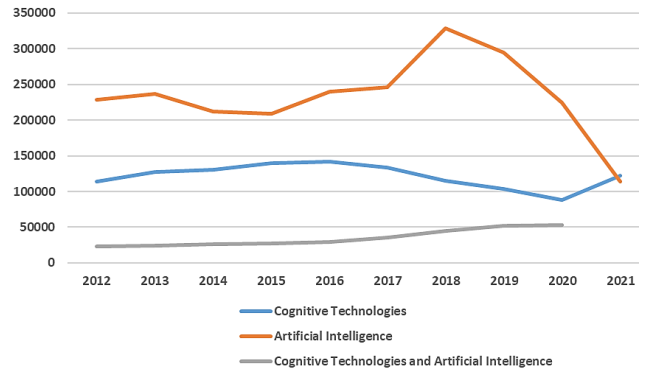


Fig. 2 Google Scholar data for queries "Cognitive Technologies", "Artificial Intelligence", "Cognitive Technologies and Artificial Intelligence" including time series (8 January 2022)

The past year (2021) was marked by a decreasing trend in all three categories. Nonetheless, there is still interest in this issue, especially since the Google Scholar database contains 1,800 inventoried papers on "Cognitive Technologies", 2,160 on "Artificial Intelligence" and 1,340 for both categories published within less than 10 days of January 2022.

The lines of the research undertaken concern management [4, 5, 6, 7] accounting and auditing [8, 9, 10, 11], in finance and banking [12, 13, 14, 15] social security [16], development and economic growth [17], education [18, 19, 20, 21], cognitive engineering systems [22], ethics [23, 24, 25, 26] and neuroethics [27], labour market impact [28, 29, 30, 31], marketing and the impact on the creation of human needs and behaviour [32, 33, 34, 35], medicine and health care [36, 37] natural language processing and machine translation [38, 39] and more.

The development of cognitive technologies and artificial intelligence is currently focused on such issues as the use of cognitive technologies to create an artificial mind for humanoid robots. Such an artificial mind is supposed to be an imitation of the human mind. However, this requires the implementation of mental processes related to thinking and consciousness, and particularly, the modelling of cognitive and creative functions using networked means of logical and associative information processing, as well as neuromorphic modes of information processing [40]. Further work is also being carried out on computing systems [41]. The origins of interest and research in artificial intelligence and cognitive technologies can be traced back to research conducted by specialists in the 1950s and 1960s. Examples include efforts to build a robotic arm to explore the possibility of a digital computer interacting with the physical world; the computer was programmed to autonomously perform certain functions usually attributed to humans, such as perceiving the world or determining ways of acting [42], as well as work on programming languages considering the problems of artificial intelligence research and simulation of cognitive processes [43]. Yet here, too, one can find even earlier sources and inspirations.

In contrast, there is relatively little research that directly addresses human perception, reception and knowledge

of modern cognitive technologies and artificial intelligence. The authors undertook the present study to fill this research gap.

RESEARCH METHODOLOGY AND ASSUMPTIONS

The researchers involved in the research process attempted to investigate how the development of cognitive technologies and artificial intelligence is perceived by the academic community of a selected university in Ukraine. This is part of a larger research project, under which analogous studies are planned to be conducted at selected universities in the USA, Poland and Slovakia.

The aim of the study conducted in Ukraine was as follows: Firstly, to determine whether the terms "cognitive technologies" and "artificial intelligence" are known in the student/academic environment, i.e., an environment that deals with modern technologies every day. Since cognitive technologies have been hailed as a megatrend of modern development, exploring this issue was crucial. The cognitive technologies market is developing rapidly. Such technologies are used in customer support and HR departments, Smart City solutions, as well as other applications. Global business software manufacturers vow to introduce new cognitive technology-driven solutions into the products they offer. The global market for smart solutions is growing rapidly. According to Transparency Market Research, the cognitive business solutions market is estimated to reach USD 5 billion by 2022 [44]. The development of cognitive technologies is also visible in the industry sector.

Secondly, to determine the attitudes of the students and staff of the studied university towards such solutions based on artificial intelligence and cognitive technologies. To carry out the study, a survey questionnaire prepared by one of the authors was used in combination with the random survey technique commonly used in the social sciences, which, unlike other survey techniques used in the quantitative method, offers the possibility of achieving a nearly 100% completed survey return rate. The researchers ensured the full anonymity of the respondents by allowing them to drop their surveys into a special closed urn. The time needed to complete the survey questionnaire was less than 20 minutes. A total of 700 staff members and full-time students and doctoral students of the studied university took part in the survey. A non-probabilistic method of selecting the research sample was used – purposeful selection. The research was conducted among selected groups of students and doctoral students from all fields of study available at the university, including among foreign students from Afghanistan, Angola, Anguilla, Azerbaijan, Bangladesh, Brazil, Congo, Democratic Republic of Congo, Ecuador, Ethiopia, Finland, Gaza Strip, Ghana, India, Iran, Iraq, Ireland, Israel, Jordan, Kenya, Lebanon, Libya, Mongolia, Morocco, Nigeria, Pakistan, Rwanda, South Africa, Zimbabwe, Sudan, Sweden, Syrian Arab Republic, Tunisia, Turkey, Turkmenistan, Uganda, Egypt, Tanzania, United States of America, Uzbekistan, Yemen, Zambia. The surveyed group of university employees and

foreign students did not constitute a statistically significant research sample.

The initial phase of the research process involved formulating research questions, research conceptualisation and operationalisation, as well as selecting research methods and tools. In line with the premise of such papers, the research was carried out based on the scientific method, aiming to investigate the truth and ensure its proper conceptual presentation.

The following research questions were posed in the study:

- Are the terms "cognitive technologies" and "artificial intelligence" widely known among respondents?
- How much interest do individual respondents have in using the capabilities (present and hypothetical) of artificial intelligence and cognitive technologies?

Once the individual data were collected, the data were aggregated. The study conducted was designed as a pilot study. Pilot studies are used when a phenomenon or mechanism characteristic for a certain community is relatively unknown and are carried out on a small scale, to be followed by a study on a representative sample. The research tool was also piloted before the start of the study, which made it possible to refine the original questions. Respondents could complete the survey questionnaire either in Ukrainian or in English, and as such, the survey was effectively conducted in two languages.

RESULTS

The study involved 700 respondents, including 348 women and 352 men. Figure 3 shows the age ranges of the respondents.

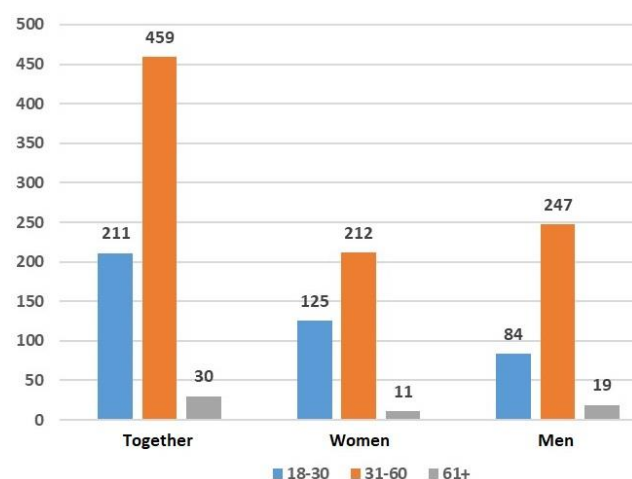


Fig. 3 Respondents broken down by age and gender

In the 18-30 age range, women mostly responded that they had encountered the term "cognitive technology". There were more positive answers in the 31-60 age range, with 171 women declaring that they had come across the term "cognitive technology". In contrast, most men (222) stated that they had never encountered this term. Only in the 61+ age range did fewer women declare that they were familiar with this term; however, this was not a statistically significant sample, as this respondent group included only 30 people. The results regarding familiarity with the term cognitive technologies are quite surprising

and to some extent challenge the established stereotypes that tend to attribute knowledge of modern technologies and technological innovations to men.

Attempts by respondents to define this concept were unsuccessful. The conclusion is that although respondents have encountered the term, they do not know what it means. This applies to both men and women.

The results in terms of encountering the term "artificial intelligence" are quite different. Most respondents claimed that they had encountered this term, which is hardly surprising given the enormous popularity of science fiction films that have brought it into the mainstream. Across every age group surveyed, respondents mostly stated that they knew this term. Figure 4 shows the response results.

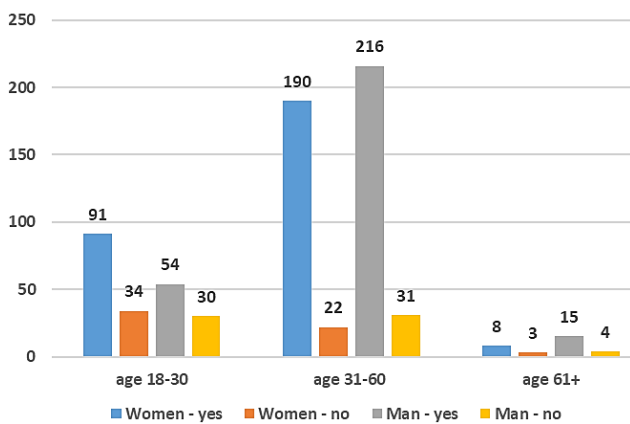


Fig. 4 Question: Have you ever come across the term "artificial intelligence"?

Nonetheless, there were few attempts to define the term "artificial intelligence", with as many as 657 people failing to answer. Examples of definitions of this term provided by the respondents are as follows: "the use of computers to understand human intelligence and perform human functions"; "the ability of intelligent systems to perform creative functions that have traditionally been considered the prerogative of humans"; "intelligence is created using software and computer code"; "machines with mental abilities close to those of a human"; "a computer system or working with the ability to think like a person"; "intelligence is created by a human but is capable of functioning independently"; "a written program with a grid of instructions for dealing with various conditions"; "a program that contains instructions for dealing with certain situations"; "robots that can act like humans". Although the interpretations provided by the respondents are imprecise, they are somewhat reflective of the primary characteristics of artificial intelligence.

When asked "Would you like to have an artificial intelligence-equipped robot at home?", respondents answered in the affirmative. They could select more than one from among the multiple-choice answers (results do not add up to 100%). Table 1 shows the responses.

Table 1
Answers to the question "Would you like to have an artificial intelligence-equipped robot with the characteristics defined below at home?"

A robot that can	F 18-30	F 31-60	F 61+	M 18-30	M 31-60	M 61+	Total quantity/percentage
1. Read your mood	34	184	-	11	167	1	397/56.7%
2. Read your thoughts	22	55	1	11	98	6	193/27.6%
3. Read your non-verbal cues (e.g. facial expressions, gestures)	36	168	2	17	172	4	399/57%
4. Read and analyse your biomedical parameters (e.g. body temperature, blood pressure, pulse)	52	112	6	29	168	9	376/53.7%
5. Read and analyse your biomedical parameters and call for medical assistance if necessary	48	112	4	28	132	4	328/46.9%
6. Respond to and follow your verbal commands	39	96	6	30	198	6	375/53.6%
7. Recognise and meet your emotional needs	30	179	4	14	98	4	329/47%
8. Recognise and meet your intimate (sexual) needs	21	66	1	27	132	4	251/35.9%
9. Balance and supervise your diet	35	103	-	24	86	7	255/36.4%

Of the proposed multiple-choice answers, the reading of thoughts proved the least popular (2), with fewer than 30% of respondents choosing this answer. For answers 1, 3, 4 and 6, the results show more than 50% positive responses. Further, the positive response rate oscillated around 47% in the case of the answer concerning the reading and analysing of biomedical parameters and summoning medical assistance. This also applied to the function enabling the recognition and meeting of emotional needs. For other answers, the positive response rates were slightly above 35% (8, 9). To some extent, the research makes it possible to conclude about the respondents' needs and emotional state. Nonetheless, no clear answer can be given whether the interest of humans in interacting with intelligent robots is meant to compensate for the lack of such interactions with other humans. It is worth conducting research on a representative sample in this respect. The pilot study conducted sets out further interesting research lines.

CONCLUSION

Analysis of the research conducted revealed that the term "cognitive technology" was not widely known among respondents (research question 1). There were also significant differences by gender in the 31-60 age range (cf. Fig. 2). The development of cognitive technologies and their various functionalities is bound to require more and more specialists, capable of skillfully handling the functionalities offered by such technologies. Yet this fact alone does not make it possible to deduce whether the term itself will become widespread and comprehensible to the public. The evolving labour market driven by the development of cognitive technologies will require proper education programmes in this field, combining technical and IT issues with social sciences and humanities. Such education should take into account ethical contexts [45, 46] and stimulate innovation [47, 48] by using innovative educational methods. Ethical issues are particularly important the inappropriate use of modern technologies can have certain negative consequences for society. Therefore, there is a need to disseminate models of proper responsible behavior and the use of these technologies for the benefit of people and increasing their quality of life. In the process of ethical education, character traits such as prudence (prudence), caution and responsibility should be shaped as well-established human inclinations to act following the ethical good [46].

The study population found the term "artificial intelligence" more recognisable (research question 1). There were no statistically significant differences by gender in the responses.

The research revealed a strong interest in using the capabilities (functionality) of artificial intelligence and cognitive technologies (research question 2) among respondents. The most frequently selected answers were 1, 3, 4 and 6 (see Table 1). Responses in respect to items 7 and 8 may prove an interesting area for further research (see Table 1). As of today, interactions between humans and intelligent machines (robots equipped with artificial intelligence solutions) arouse the interest of researchers in various scientific disciplines, including philosophy, psychology, sociological sciences, linguistics, social communication and media sciences, management and quality sciences, legal sciences, economics and finance, as well as computer science. Interdisciplinary approaches are bound to enable better recognition of the complexity of such interactions. There is no doubt that the distance between humans and intelligent robots is narrowing. Research show that man is willing to let intelligent robots enter even the most intimate spheres of his life.

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