

DEUS EX MACHINA OR E-SLAVE? PUBLIC PERCEPTION OF HEALTHCARE ROBOTICS IN THE GERMAN PRINT MEDIA

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Objectives: The news media plays a central role in providing information regarding new medical technologies and exerts an influence on their social perception, understanding, and assessments. This study, therefore, analyzes how healthcare robotics are portrayed in the German print news media. It examines whether the risks and opportunities of new medical technologies are presented in a balanced manner and investigates whether or not print media coverage of these technologies is affected by science-fiction discourse, in which robots appear mostly as a threat to humans.

Methods: Ten years of German print media coverage (2000–2010) have been studied by means of systematic, standardized content analysis.

Results: Reporting focuses predominantly on beneficial advancements in medical practice and the advantages of robotics for patients, medical staff, and society. The results show that the dominant relationship between robots and humans that is transmitted in print media in medical contexts is positive, with robots mostly portrayed as assistants, colleagues, or even friends. Only a small number of articles report ethical questions and risks.

Conclusions: In contrast to science-fiction discourse, the German print media provides a positive picture of robotics to the lay public.

Keywords: Healthcare robotics, New medical technology, German print media

Western culture tends to have an ambivalent attitude toward robots. On the one hand, there exists a fascination with their potential physical and technological superiority; on the other hand, there exists the fear of a “dehumanizing menace” (24). Owing to the complexity of this relationship, robots have been a consistent theme in science-fiction films and literature for decades (12). There, they often appear as machines of destruction, threatening the very fiber of human civilization (4) and providing the basis for an entire subgenre of “man vs. machine” narratives.

In reality, however, robots have proved immensely useful in industry, science, and particularly medicine. In the healthcare domain, owing to rapid advances in robotics technologies, robots have been increasingly used for surgery, diagnosis, prosthetics, and elderly assistance. However, the use of robotics in a high-risk arena such as medicine has raised considerable social, legal, and ethical concerns (22), which have led to a struggle for public acceptance (6).

An oft-mentioned ethical issue is the dehumanization of medicine, particularly the fear that the patient-doctor relationship will be negatively influenced or even replaced by human-machine interaction. This point is especially sensitive in relation to assisting the elderly, who could be excluded from society and suffer from social isolation due to reduced human contact (20). The appropriate relationship between technology and humanity is debated, which leads to the question of whether robots should

be more anthropomorphic or machine-like. In addition, there are concerns of a philosophical nature about defining human beings in view of robotic prosthetics, which cross the border between natural and artificial, becoming more and more pervasive in the human body. Further ethical issues concern fair access to healthcare technologies and their impact on the global distribution of resources owing to the high cost of robotic technologies.

Robots are not only popular topics in science-fiction discourse; they are also gaining attention in print media. The news media plays a central role in providing information regarding new medical technologies (17) and thus shaping peoples’ attitudes toward, understanding of, and assessments of such technologies (25). Furthermore, mass media is one of the powerful stakeholders in the healthcare system (9) which have a considerable impact on policy-decision making (7). Therefore, the meanings attributed by print media to medical technologies are a very important factor that influence the ultimate development and implementation of a technology, as well as its assessment. The constant monitoring of media discourse provides an essential contribution to the better understanding of the “embedding” of new technologies into society and can have a strategically important early warning function for healthcare technology assessment (HTA).

Often, public perception of technological issues is influenced by what is written or shown by the mass media (15). Many studies have discussed how print media coverage influences people’s perceptions of new technologies and have shown how powerful this influence is (19). In Germany, as

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in many other countries, newspapers and magazines are second only to television in their influence on public opinion (23). The print media can be a primary basis for shaping public conceptions, particularly in the early stages of the development and implementation of new medical technology, and may be considered an arbiter of public acceptance. Therefore, the media representation of any new medical technology merits analysis.

Against this background, this study aims to analyze the German press coverage of healthcare robotics. Its central research question is as follows: How is healthcare robotics conceptualized and represented in German print media coverage? From this question, we derived the following research questions: What is the prevailing tone of the coverage? How does the reporting change over time? What are the frames and strategies of portrayal in the reporting of robotics?

Are the risks and opportunities of new medical technologies presented in a balanced manner?

The media should provide the public with risk information (11), but the legal situation of a given country can negatively influence critical reporting, thus restricting open discussion about scientific research. For example, the UK's strict libel laws tend to favor plaintiffs and have been strongly criticized for repressing scientific debate. U.S. libel laws favor media organizations because they demand proof that information published was not only harmful and false but also that it was published with malicious purpose (10). Studies in the abovementioned countries that focus on the print media coverage for "emerging technologies" such as neurotechnology (18) or nanotechnology (1;21;25) show that reporting, instead of highlighting the potential risks of these technologies, hypes up their medical and economic benefits, and is predominantly positive and sensation-oriented. In Germany, while libel laws protect individuals and corporations, they tend to favor news organizations if the information published was proved to be from a reliable source and the subject is one of legitimate interest to the public (10). Against this background, the question arises of whether media coverage of healthcare robotics in Germany differs from that of neuro- and nanotechnologies in the United Kingdom and United States.

In addition, in Western science-fiction discourse, narrative confrontation is based on the relationship between robots and humans; consequently, robots have a negative reputation.

This study, therefore, examines whether or not German print media coverage follows science-fiction discourse in its representation of healthcare robotics.

METHODS

Content analysis was used to investigate media coverage. Only the general popular press was selected for the sample, which comprised eight leading national German print publications: the daily newspapers *Die Welt* and *Frankfurter Allgemeine Zeitung*

(FAZ), the weekly newspaper *Die Zeit*, weekly news magazines *Der Spiegel* and *Focus*, the monthly popular science magazine *Bild der Wissenschaft*, the daily business newspaper *Handelsblatt*, and the tabloid newspaper *Bild*. All of these publications have a wide circulation and are commonly perceived as high-quality and opinion-leading.

The chosen media were searched using the following keywords in German, which appeal to different application fields of robotics in healthcare: "Medizinroboter," "Medizinrobotik," "Roboter in der Medizin," "Nanoroboter," "Nano-Roboter," "Nanobot," "Mikroroboter," "Rehab-Roboter," "Assistenzroboter," "Pflegerroboter," "Care-o-bot," "Operationsroboter," "OP-Roboter," "Telerobotik," "Teleroboter," "Robodoc," "Roboterarm," and "Neurorobotik." These terms were sought in articles written between the years 2000 and 2010. Only full text articles that were directly related to robots in healthcare were included in the analysis.

We performed a qualitative analysis with the help of MAXQDA 2007, using a category system based on existing research in U.S., UK, and Canadian print media (8;18). Two researchers (K.L. and D.G.) analyzed all articles independently according to the following aspects: the tone of the article ("critical," meaning the article covers mostly risks connected with robotics technology; "positive," meaning the article covers mostly positive aspects and benefits; "balanced," meaning both the risks and benefits of robotics are represented; and "neutral," meaning neither risks nor benefits are mentioned); time focus (past, present, near future, or distant future/futuristic), thematic focus, mention of ethical and legal issues, and rhetoric level (argumentation strategy, style, and vocabulary).

RESULTS

Tone of Coverage and Time Distribution

We found 345 relevant articles, of which 287 (84 percent) dealt with robotics in healthcare as a primary topic. The articles' distribution over time is shown in Figure 1.

A remarkably high number of reports are from the year 2000. A possible reason for this disproportion is that in that year, the *feuilleton* (a supplementary arts section in German newspapers) of FAZ published an article with high media resonance because of the horrifying picture it presented of new technologies. This was an article by the U.S. computer scientist Bill Joy entitled "Why the future doesn't need us: Our most powerful 21st-century technologies—robotics, genetic engineering, and nanotech—are threatening to make humans an endangered species." Its message was very provocative: humanity was approaching a state in which it would substitute and essentially replace itself. Joy advocated the renunciation of further development of new technologies in these fields, emphasizing the uncertainty of imminent results. At this time, many articles appeared in the media arguing with Joy's assumptions and opinions (13).

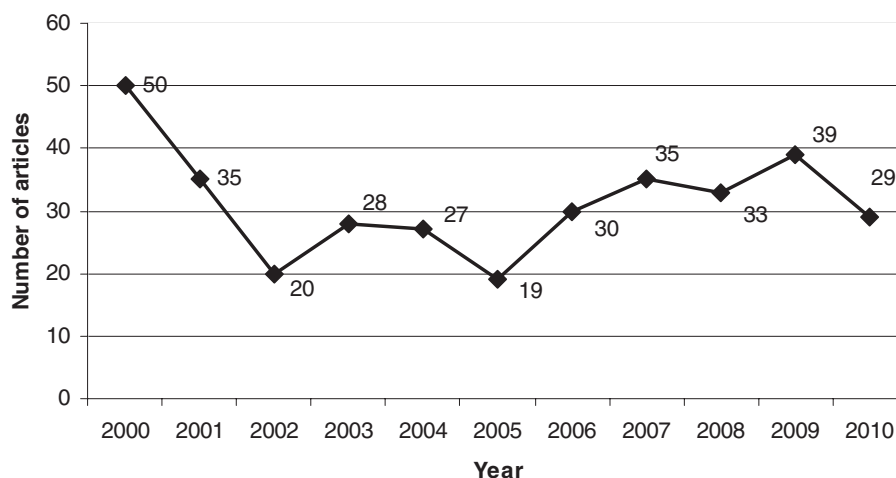


Figure 1. Frequency of articles over the course of time.

The majority of the articles examined ($n = 201$; 58.3 percent) contained positive connotations (Figure 2); that is, the articles showed exclusively positive aspects of robotics in medicine.

The second-largest group of articles ($n = 55$; 15.9 percent) were more well-balanced: they showed the advantages as well as the risks of robotics technology. The third-largest group was pure event-reportage and, therefore, qualitatively neutral. Only thirty articles (8.7 percent) looked at the use of new technologies critically, emphasizing possible risks and disadvantages.

Positive reporting ceased in 2004, while critical reporting peaked in this year (Figure 2). The 2004 spike in negative coverage can be explained by the so-called Robodoc scandal in Germany. An American-made medical robot (called *Robodoc*) for the computer-assisted implantation of hip-joint prostheses had been used, mainly in Frankfurt Hospital, between 1994 and 2004, and was ultimately found to have harmed many patients. A

wave of complaints ensued. The reports at this time are, therefore, marked by increased attention to the risks and negative outcomes of medicinal robotics.

Thematic Fields and Time Focus

Many articles deal with surgical robotics, followed by geriatric assistance robotics and neuroprosthetics. Figure 3 shows the distribution of subjects.

The majority of the articles ($n = 169$; 52.3 percent) refer either to the present or the near future ($n = 99$; 30.7 percent) and report successful attempts to implement robotics in the healthcare sector, new results of research, or rapidly developing trends. Other frequently mentioned issues include economic ones, such as the high immediate cost of robotics, as well as long-term financing issues (15 percent) and questions of the social acceptance of robotics among both medical staff and patients (3.3 percent).

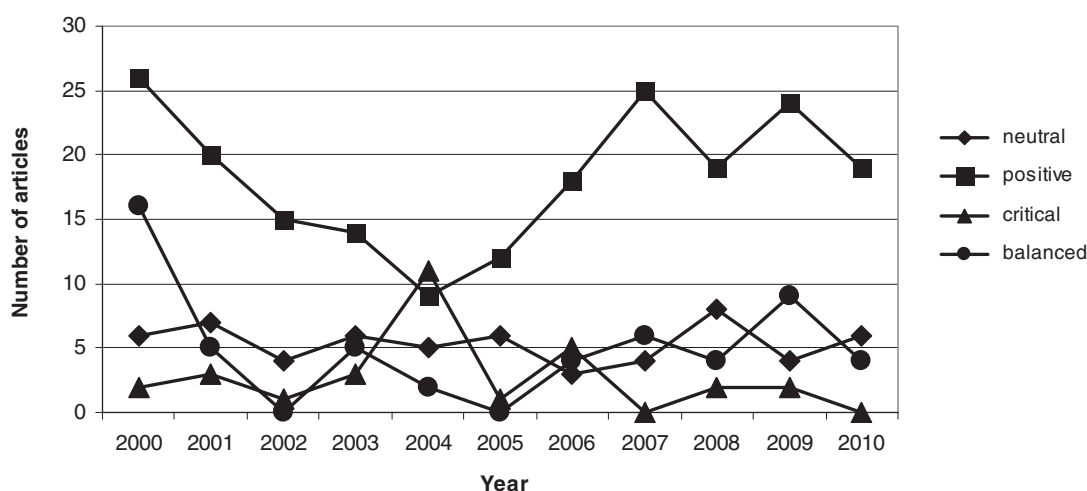


Figure 2. Tone of the articles over the course of time.

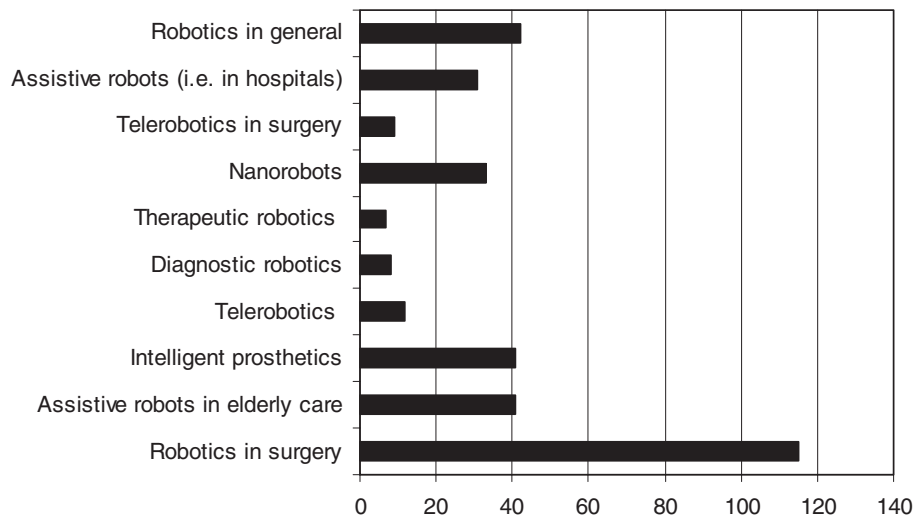


Figure 3. Fields of application.

Ethical and Legal Issues

A few articles ($n = 55$; 15.5 percent) discuss ethical and legal issues, but not in detail. They deal primarily with the ethics of the risks—technical, social, and medical—associated with the application of new technology and are usually in the form of *feuilleton* essays, editorial comments, or letters to the editor.

Another noteworthy problem is related to anthropological aspects, such as the changing physician–patient relationship because of the increasing technologization of medicine. The articles also mention economic problems such as the high costs of robotics and their long-term financing, which lead to questions on the allocation of resources and on fair access.

The legal issues related to robotics do not seem to be extensively discussed in the German print media. Only 4.5 percent of the studied articles address a central question in the application of robotics technologies in telemedicine: “Who is responsible if something fails during a remote operation?” (2) Reporting that includes ethical aspects peaked in 2004, a phenomenon that can again be attributed to the Robodoc scandal.

Human–Robot Relationships

Media representations convey some uncertainty with regard to the relationship between humans and robots. This relationship clearly is quite new and not easily definable. The following three kinds of human–robot relationships were identified in our research.

In the first relationship, person and machine fuse with each other, as in the growing medical field of neuroprosthetics. Media reports discuss “liaisons between man and machine” (14), that is, Robocop-style stories of symbiotic connections creating a new mixed-breed creature. The media portrays such technology as engendering feelings of ambiguity. On the one hand, it gives hope for disabled people whose lost or damaged body parts or functions could be restored with the help of neuro-implants. In

this context, the mechanization of humanity is perceived not as a danger, but as potentially healing or even improving human abilities. “Through these developments, people will become a mixed being of humans and machines. We will possess the best of what machines can offer us, and we will use our biological inheritance to improve what we develop in robotics technology. In this manner, we (the robot-people) will always be one step ahead of them (the pure robots). We will not have to fear the possibility of them taking control” (5). On the other hand, the media conveys the overarching fear of the loss of free will: that self-determination and bodily control could be usurped by robots.

In the second relationship, either robots and humans cooperate or robots become the servants or slaves of humans. This kind of relationship is predominant in current media coverage. The media describes robots as toys, friends, colleagues, and assistants, often referring to science-fiction discourse when comparing robots in healthcare with those in science fiction. In doing so, the media always emphasizes the idea that contemporary robots differ greatly from those in films: “The voice does not sound like the robots in science-fiction films at all. It sounds human, polite” (16). Robots can support humans in many ways, such as assisting doctors with routine duties in hospitals or in all kinds of surgery, including neurosurgery, orthopedic procedures, or spinal surgery, which requires great precision. However, the media always emphasizes that robots can by no means act as substitutes for humans with real skills, experience, creativity, and so on. In this context, robotics is seen as a neutral technology, the actions and consequences of which depend on human practice.

In the third relationship, robots are superior to people, masterful and masterly, and both admired and respected by humanity: “Trembling hands, bad mood – such inadequacies do not curtail the brilliance of the operation robot da Vinci”

Table 1. Benefits of Healthcare Robotics Mentioned in the Press

Beneficiaries	<i>n</i> (%)	Benefits described
Benefits for patients	145 (59%)	Lower operation duration, minimally invasive surgery, lower operation risk, greater safety, less pain, smaller scars, shorter hospital stays, quicker rehabilitation and return to independent life, improved quality of life for disabled and elderly people
Benefits for medical staff	17 (7%)	Support for nursing staff in routine tasks, support for doctors in hospitals in planning and performing operations, raised quality of medical education because of the use of robotic patients
Benefits for medicine	43 (18%)	Quick and specific interventions; greater precision and safety of medical interventions; enhanced quality control before, during, and after operations
Benefits for society	39 (16%)	Closing care gaps in ageing society; introduction of reliable work force; more reliable medical care in war zones and in remote towns (tele-surgery)
Economic benefits	2 (1%)	Reduction of healthcare costs (e.g., through the use of assistance robotics residential care facilities)

(3). The media portrays such a relationship with ambivalence. Some fears stem from the possible superiority of a “new super-species” that could become a competitor with humanity and a substitute for many human jobs and functions in which it might possess vastly greater abilities.

Media Frames

We identified two issue-specific frames in this study. The first—medical and societal utility—is dominant in media coverage and deals with the value of healthcare robotics in terms of health, societal, and economic benefits. Robotics appears as a promise for the eventual provision of quality healthcare. Table 1 presents the most often cited benefits for different fields.

Expert opinions and results from clinical studies are used to support claims within this frame. In fact, the majority of the articles studied ($n = 185$; 58 percent) are supported by the opinions of leading experts in the robotics field. Their statements and the results of their research publications in such leading scientific magazines as *New Scientist*, *Neuroscience Letters*, *Neurosurgery*, and *Nature* are frequently cited.

The second frame—innovation and technological progress—involves over-optimistic, uncritical assessments of the results of research in the robotics field. The main actors are scientists and researchers, who tend to maintain a positive outlook toward the technology. The primary topic in this frame is the immense potential of robotics for future application in medicine and healthcare. Often, these highly sensationalized articles announce the birth of a new epoch of robotics technologies, with such titles as “The Future Has Begun” and “The Future Has Become a Reality.”

CONCLUSION

This study shows that the German print media, in comparison with science-fiction discourse, transmits an overwhelmingly positive image of robotics to the lay public. Reporting tends to portray healthcare technology positively and focuses predominantly on its present-day capabilities or probable ad-

vancements in the near future; articles tend to show the advantages of robotics technologies for both medicine and society.

The print media rarely refers to ethical and legal issues and covers mostly the technical, social, and medical risks that accompany the application of new technology. Articles related to robotics most frequently discuss this technology’s economic benefits and risks, as well as the question of societal acceptance. The majority of the articles that do mention the risks of healthcare robotics appeared in 2004 in connection with the Robodoc scandal, a phenomenon that demonstrates the media’s lack of attention to or engagement with the technology in the absence of outright and dangerous failures. These results demonstrate that despite differences in libel laws, healthcare robotics reports in the German media resemble the over-optimistic, benefits-hyping reports on neurotechnology and nanotechnology in the UK and U.S. media, which pay less attention to risks and ethical issues. However, further international comparative studies in this field are needed to better understand this issue.

This study has identified two dominant frames in news media communication regarding healthcare robotics: medical and societal utility and development, and technological progress. The reporting follows certain representation strategies, including the solicitation of expert opinions from the areas of research and clinical study, comparisons with science fiction, and announcements of a new era of human life/technology.

The media transmits uncertainty regarding possible future relationships between robots and humans. Three kinds of relationships were identified in the articles, ranging from complete fusion of the human body with new technology to cooperation to machine superiority. However, the most common relationship portrayed is connotatively positive, showing robots predominantly as assistants, colleagues, and even friends.

The monitoring of media coverage of robotics in the context of HTA can add important dimensions to the evaluation of health technologies. It can improve the understanding of future scenarios in the development and implementation of medical technologies, as well as help analyze and identify emerging

issues of public concern and measure public acceptance of these technologies. Additionally, close dialogue and responsible cooperation between journalists on the one side and scientists and healthcare professionals on the other is important for the judicious handling of the results of HTA in the media, which provides a knowledge base for decision makers as well as the general public.

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CONFLICT OF INTEREST

Both authors report they have no potential conflicts of interest.

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