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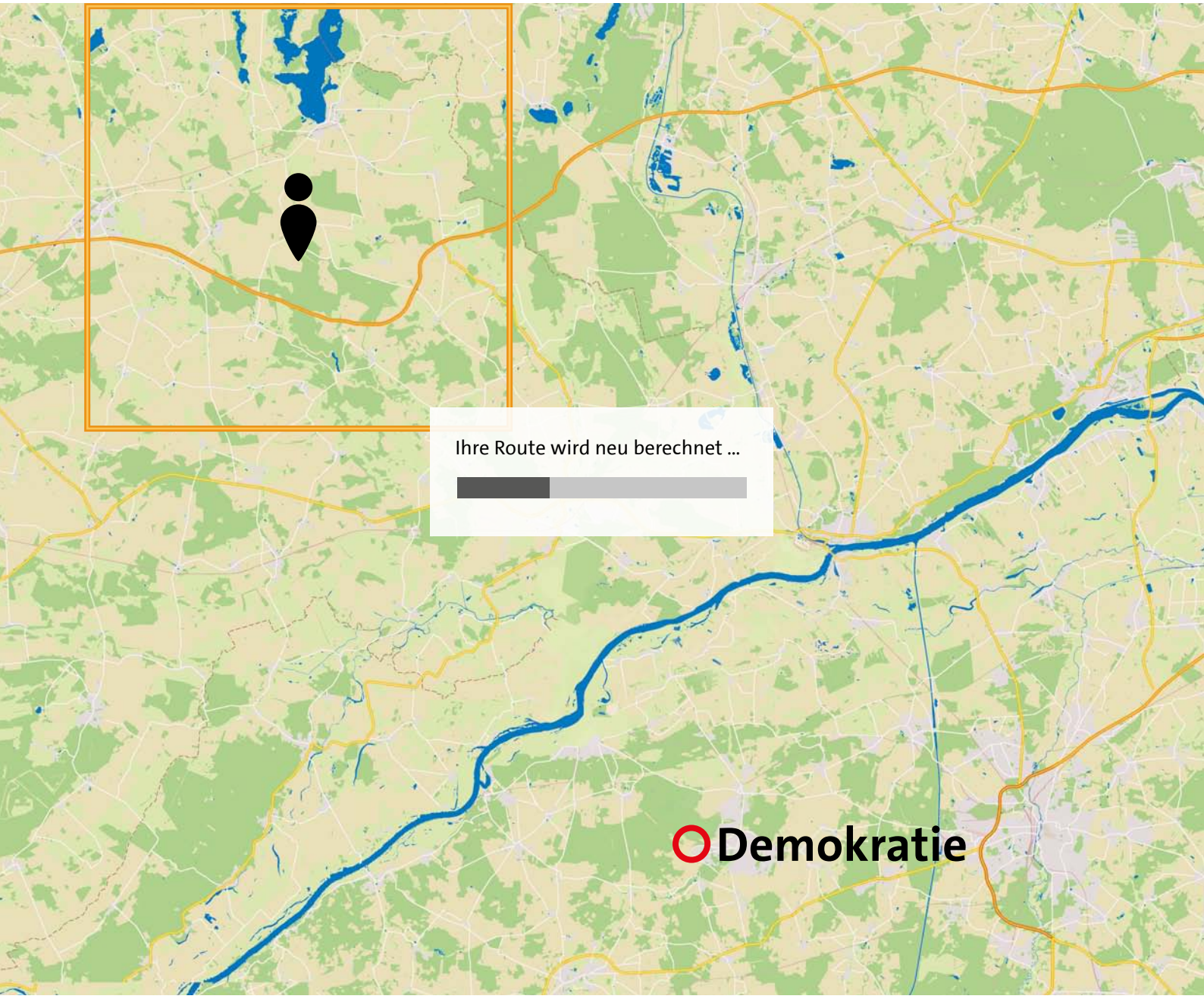
FACHMAGAZIN FÜR DIGITALISIERUNG IN DER LEHRE | **#05**



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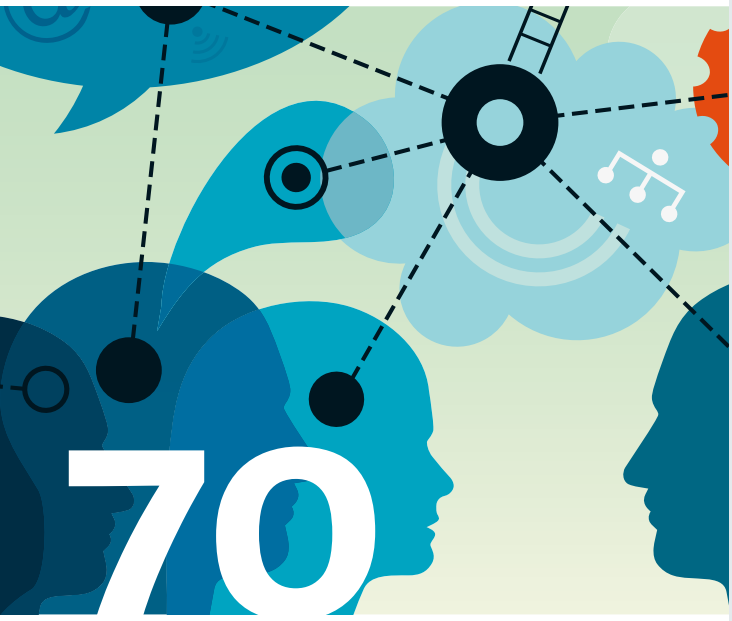
DEMOKRATIE
Digitalisierung, Demokratie und Transparenz

OER
OER Forschung

DEMOKRATIE

Politische Medienkompetenz als Zielvorstellung digitalisierter Hochschullehre

Welchen Beitrag können Hochschulen heute leisten, um ihre Studierenden auf eine emanzipierte Teilhabe an unserer digitalisierten Gesellschaft vorzubereiten?



OER

OER-Forschung – Warum es sie bisher nicht gab und wie sich das ändern kann

Die Entwicklung einer Forschung zu Open Educational Resources (OER) steht noch ganz am Anfang. Ein Überblick über aktuelle Erklärungs- und Lösungsansätze.

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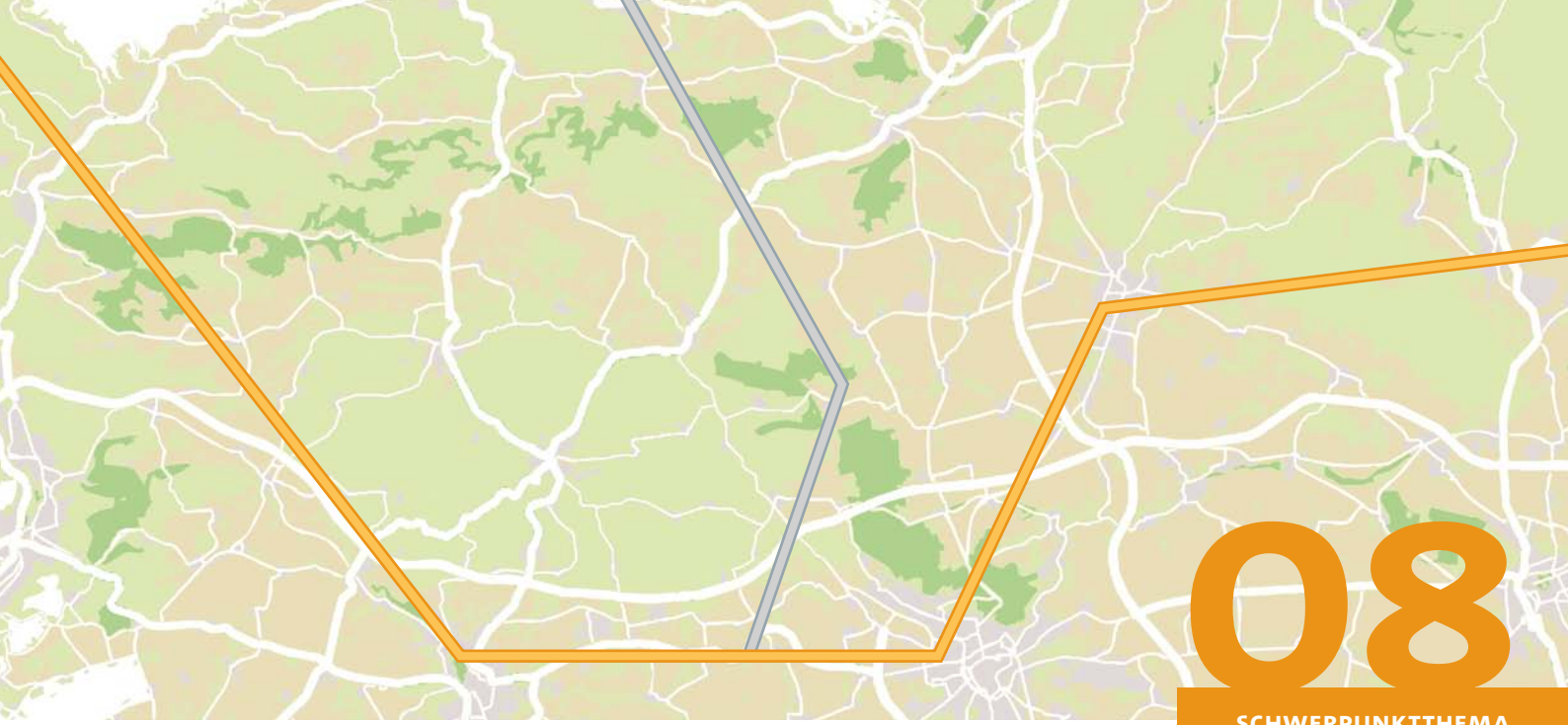

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DEMOKRATIE

Herausforderungen der Digitalität jenseits der Technologie

Die Entwicklung der modernen Gesellschaft macht Digitalität auch zu einem sozialen Thema. Im Zuge neuer Möglichkeiten wollen alle Stimmen gehört werden. Drei Formen der Digitalität spielen eine zentrale Rolle – Referenzialität, Gemeinschaftlichkeit und Algorithmizität.

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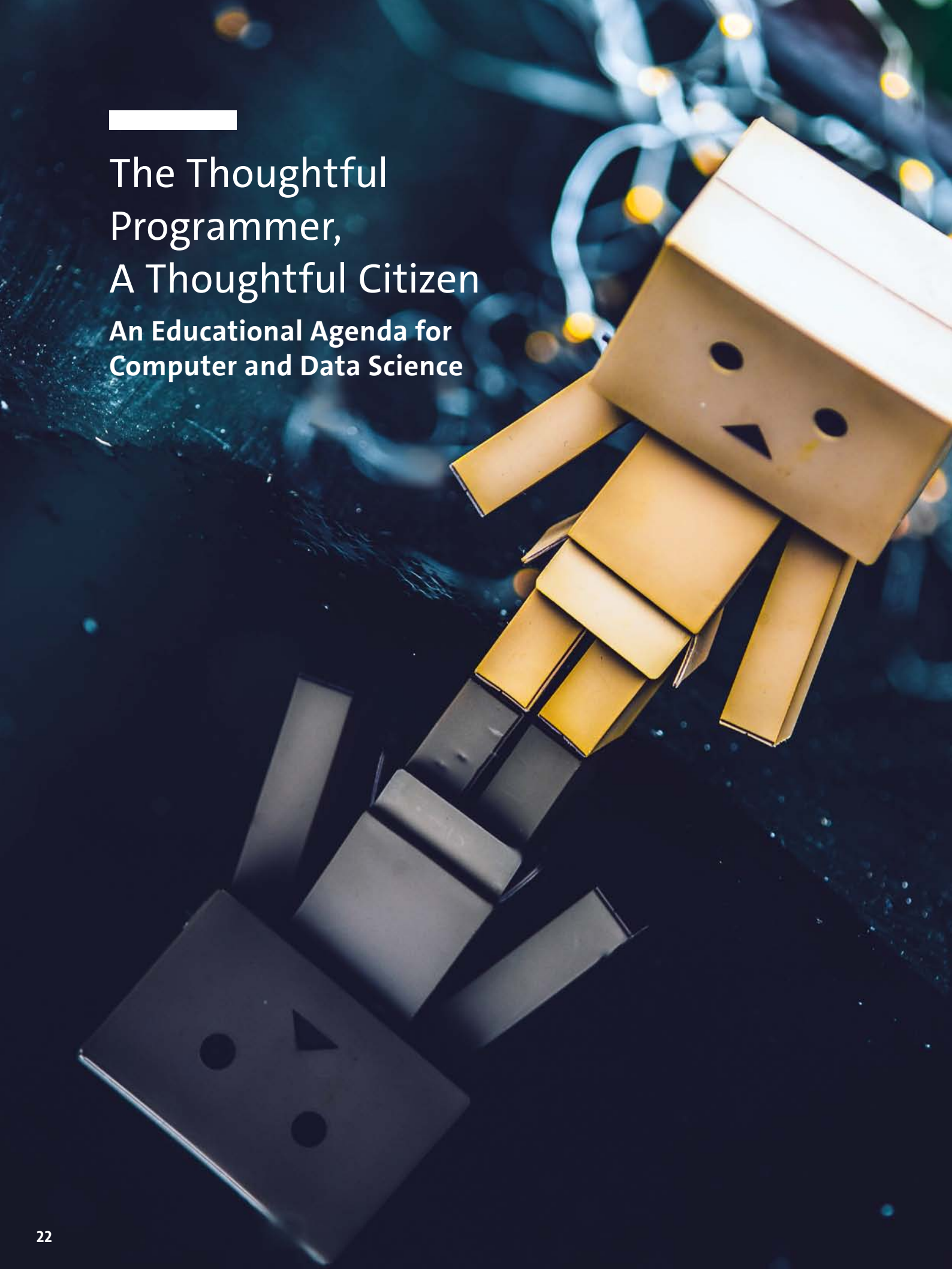

The Thoughtful Programmer, A Thoughtful Citizen

An Educational Agenda for Computer and Data Science

MATTHEW BRAHAM

Progress

Artificial intelligence (AI) is the science and technology of the construction of intelligent agents. Roughly, these are technologies that behave in an environment in such a way that if performed by humans we would call it "intelligent". In this sense "intelligence" basically refers to instrumental conceptions of rational decision-making as found in economics and statistics. It is about the ability to make instrumentally optimal decisions by following certain kinds of plans and inferences. In the last two decades, the combination of machine learning, statistics, control theory, and computational neuroscience with the availability of vast amounts of data and computer processing power has yielded huge advances in AI. This shows up in a wide variety of domains such as in speech recognition and machine translation, autonomous vehicles and aircraft, bipedal movement, computer vision, question and answer systems, and ranking systems.

It is now widely accepted that AI research is making rapid advances and that its societal impacts will steadily increase. One needs only consider the scale of investment: according to some estimates, the leading technology giants spent up to USD 30 Billion on AI in 2016, with 90 % of this spent on R&D and deployment, and 10 % on AI acquisitions (Columbus 2017). And in the UK, the government has started offering salaries of well over 100 000 Euro per year to computer scientists to develop machine learning to help the unemployed in their job search, predict pension fund performance, and find patterns in and sort customs and revenue documents (Buranyi 2017). It is more or less received wisdom that the potential benefits are enormous not only economically but for human civilization itself. In his freshly published *Enlightenment Now*, the Harvard cognitivist psychologist Steven Pinker (2018) expounds the optimistic view that digital- and nano-technologies combined with AI will make it possible for the planet to sustainably maintain a population of nine billion humans leading flourishing lives according to some basic universal humanist tenets.

Concerns

Yet, there is mounting concern among academics, policy-makers, and the public about the social impacts and dangers of the uncontrolled proliferation of AI. There is increasing evidence that computerized decision-making can be highly opaque, unfair, and even unaccountable. In *The Blackbox Society*, University of Maryland law professor Frank Pasquale (2014) argues that financial market algorithms may have been one of the causal factors in the 2007 financial crisis and ensuing Great Recession (see also O'Neil 2017). More specifically, there is clear evidence that algorithmic policing, judicial decision-making, and financial screening can be highly biased and discriminatory, reinforcing and amplifying structural inequalities. For instance, in a 2016 research paper, Kristin Lum and William Isaac (2016) of the San Francisco-based Human Rights Data Analysis Group demonstrated that PredPol, a predictive policing program, predicts a higher rate of crime in black and brown Bay Area

The existential threat is an "AI take-over scenario", where quite literally superintelligent systems take over the governance of the planet with unknown and probably disastrous consequences.

neighbourhoods even though empirically the crime is more evenly spread. If police follows the advice of PredPol they would potentially overpolice these neighbourhoods, with the knock-on effect of reinforcing prejudices and structural inequalities.

A graver scenario has been carefully unfolded by the Oxford philosopher and director of the Future of Humanity Institute at the University of Oxford, Nick Bostrom. In his highly acclaimed study of AI, *Superintelligence: Paths, Dangers and Strategies*, Bostrom (2014) argues that AI actually poses an existential risk to humanity itself. The risk lies with what he denotes as the "control problem" (chp. 9). This will arise in a not too distant future when we have created superintelligent AIs that "greatly exceed the cognitive performance of humans in virtually all domains of interest" (Bostrom 2014, p. 26). This, according to Bostrom, will unleash a yet unknown technological power. The existential threat is an "AI take-over scenario", where quite literally superintelligent systems take over the governance of the planet with unknown and probably disastrous consequences. A scenario known as "technological singularity" (see also Shanahan 2015). In a nutshell, the control problem is one in which the principals (we the creators) lose control over our agents (the AI). Bostrom is not alone in his belief. Stuart Russell, a leading AI researcher at the University of California, Berkeley, has also gone on record to state that unlimited AI may be as dangerous as unlimited energy and uncontrolled AI may be as dangerous as nuclear weapons (Alpaydin 2016, p. 165).

Choosing the "Artificial"

Regardless of whether we are moved by the apocalyptic scenario of superintelligence or the more immediate and down-to-earth problems of unjustified discrimination and entrenchment and amplification of social inequality due to the use of AI technologies, the fundamental issue at stake is the same. The AIs that we have and will have, are a product of human choices: how we program it and the data we feed it. It is not simply something purely "out there"—yet. An AI is, after all, "artificial". In the *Sciences of the Artificial*, the Nobel laureate in economics, Herbert A. Simon (1996, p. 5) defined this as something that (a) is synthesized by human beings, (b) imitates something natural while lacking the reality of being natural, (c) is characterized in terms of functions, goals, and adaptation, and (d) is designed in terms of imperatives as well as descriptives.

Thus, we need to keep in mind the quality of all artificial phenomena—AI included—is but a reflection of our state of knowledge and our goals. If we believe that a particular AI is morally problematic, it will be so because either we did not know how to program a morally good one, or we did not choose to do so. In the first case this might be because we simply lack knowledge of what a morally good AI actually is or what it means to engage in morally right AI programming (a theoretically thorny issue for philosophers), or we do not as yet possess the technical capacity to program morally good AI. In the second case, even if we actually have the moral and technical knowledge, we may have overriding reasons not to program it in this way. One reason is that we may believe in "value free science" (research of the natural and artificial world should not, as far as possible, be restricted by moral values). Another reason is that we believe the morally bad AI are mere imperfections that need to be improved, and science and technology progresses piecemeal by trial and error. We deal with the problems as they crop up and create other artificial systems, such as legal and regulatory and educational frameworks to manage them.

As it happens, institutional responses to the concerns about uncontrolled AI proliferation have started to emerge. There is now support both within the AI industry and science communities to impose regulation of AI in the same way we regulate morally sensitive biotechnologies (e. g. codes of ethics, legal and regulatory frameworks, watchdogs, etc.). And, as foreseen by Bostrom (2016), we are witnessing the establishment across the globe of institutions that are concerned with studying the long-term impacts of the development of AI, in much the same way we have institutions specializing on predicting and guiding global impacts of climate change, economic development, biodiversity, and population growth.

Epistemic Opacity and Capacity Building

Given these developments, there is indeed good reason to be optimistic about our ability to meet the moral challenges of AI. We are going through an adaptation process. As part of this adaptation process, there is, I believe, a crucial area that calls for far more attention than has previously been given: the training of those who will work in the core of AI.

What is the issue? Boiled down, there is a significant feature of AI that requires a particular educational approach. Some AIs are epistemically opaque systems (black boxes). AIs can make use of such complex processes that even their developers admit that they are unable to explain how answers are generated (Alpaydin 2016, chp. 7). Apparently, this is the very nature of deep-learning AI: such AIs learn from data and are "trained" and the outputs are not "pre-programmed". In turn, this implies that deep-learning AI contains an inexplicable random element, making it less predictable than a fully pre-programmed one. As a result, in critical cases in which an AI

affects the interests and wellbeing of people, we could see the emergence of moral and legal "responsibility gaps" in which no natural or legal person can be held to account. This is anything but a trivial development as accountability is a primary regulative structure of a well-ordered liberal democracy. (This problem already emerged in the recent case of Lufthansa ticket pricing after the collapse of Air Berlin (see Busse 2018)).

Here lies the kernel of the problem. Epistemic opacity cannot fully be regulated from the "outside" alone. Hence, any attempt to impose excessive legal requirements for transparency on AI would probably strangle the life out of the discipline. The nature of AI is complexity, which by definition has this opacity problem.

So, is there an apt strategy to at least reduce the risk of morally troublesome AIs or Bostrom's "control problem" if throwing the book will only be of limited efficacy? In the closing chapter of *Superintelligence*, Nick Bostrom sets out the need for "building good capacity" to address this goal. This, he says, requires us to focus on recruiting the "right kinds of people into the field" and a crucial consideration here is the "social epistemology" of the AI field. What is meant is that attitudes and beliefs about the problems of AI have to be constructed within the discipline by engaging the right kind of people. Obviously, this can only be the future programmers who promote and commit to, best AI practices and disseminate these norms and practices in the discipline and industry.

Our future computer and data scientists should have a reflective understanding of the nature of the technology they are creating and its consequences for society.

Nevertheless, how to go about building this good capacity and social epistemology? Bostrom does not offer much in terms of concrete suggestions, although he is very aware that pious words are insufficient. An answer, however, is fairly easy to state, although probably institutionally difficult to implement. It lies with the education and training of AI scientists and the AI itself. We need computer and data scientists who are sensitive to the problems of AI and are able and willing to train AI in the appropriate ways to minimize morally bad AI. In sum: we need "thoughtful programmers" who are also "thoughtful citizens". That is, our future computer and data scientists should have a reflective understanding of the nature of the technology they are creating (the "thoughtful programmer") and its consequences for society (the "thoughtful citizen").

Integrative Thinking and Value Alignment

What, then, are the concrete steps? For sure, I am not going to suggest an expanded mandatory curriculum in ethics, moral and political philosophy, and epistemology for computer and data scientists. Many universities already require students to take courses on the fundamentals of data privacy and security and on the general ethical and legal implications of digital technologies as well as in the philosophy of science.

Rather, the task is to integrate the pressing philosophical problems directly into particular curricular tasks in computer and data science. This requires that we approach the philosophical problems from the perspective of AI problems. This is not a reduced-form applied philosophy, but instead—to lift a phrase from Philip Kitcher (2012, chp. 9), a philosopher of science at Columbia University in New York—to do "philosophy inside out".

To do philosophy this way is to reverse the order of teaching it. Instead of starting with a general theory, say utilitarianism, and then examining its inner workings and a range of applications, we start with a felt difficulty in a practical problem, experiment with different solutions, and find justifications and explanations for these solutions. That is, we work from a significant practical problem outwards to a general theoretical level that indicates the scope of applicability of the solution.

Courses in contemporary moral and political philosophy have a standard stock of quandaries that students have to tackle. For instance, should we secretly harvest the organs of some unsuspecting conscripts in order to save the lives of many more (utilitarianism)? Should we lie to the mad axeman who asks us where his victim is (deontology)? By in large, the standard philosophy course treats these questions as abstract test cases for the theory in question. Alternatively, they are discussed in particular practical contexts, such as medical ethics, Just War Theory, or Corporate Whistleblowing, all of which are generally far from the experience of the student. But to reverse the order is to start with a felt difficulty in a particular situation in which people find themselves. In the case of an AI student, this would be: how should we program our AI for an autonomous vehicle in the case of an emergency? Should it be programmed with a utilitarian calculus when faced with a potential collision? Should it kill the one, to save the many, even if the many are in its carry? Or to put it broadly: the designer of the AI that drives an autonomous vehicle has to decide whether the AI should be programmed in this respect or allow it learn the societal norm. This is known as "the problem of value alignment". Achieving value alignment will require very close interaction among computer and data scientists, philosophers, and legal scholars in the lab, lecture halls, and seminar rooms. Integrative thinking requires integrative teaching.

If we want to avoid the computer scientist shifting the responsibility to the philosopher, it is precisely here where the philosophical discussion has to begin. Moreover, it will go deeper, to ultimately deal with virtue ethics, the metaphysics of agency, causation, and consciousness, once more fundamental issues are encountered, such as the AI takeover scenario (technological singularity). This will require discussion and reflection on, to use Bostrom's (2014, p. 262) words, "humanity's cosmic endowment". Students would have to actively experiment with programming an ideal moral AI, for example, Adam Smith's "well-informed and impartial spectator"; or they may have to try and find a way to implement a principle that Bostrom briefly discusses: "Keep humankind ultimately in charge of its own destiny" (p. 264). The value alignment problem is clearly an educational process for both programmers and AI technologies.

Thus, my suggestion is that we integrate these moral problems into the act of creating AI; that is, as a constitutive of doing computer and data science itself. This is very natural to the discipline because it is a design activity. Design, to draw on the thoughts of Herbert A. Simon (1996, p. 114) again, "is concerned with how things ought to be, with devising artefacts to attain certain goals."

"The Thoughtful Programmer, A Thoughtful Citizen" is not an educational model that will emerge on its own. It will take university leaders to set the agenda and create the institutional structures for its implementation.

It is to be emphasized that what I propose is not at all new to AI. There are now many research programmes working on integrating ethical perspectives into AI. It is also not new to the natural, medical, and engineering sciences in general as there has long been efforts to bring philosophy to bear on certain areas of these disciplines (many applied ethicists are employed outside philosophy departments). What is "new" is the way in which this is to be done. As I have set out above, this is not to be "philosophy from the outside", but from the "inside"—an idea that has a heritage in American Pragmatism and especially the works of John Dewey (Kitcher 2012, chp. 9). The philosophical problems that students of AI need to reflect upon and work out solutions to have to be those that they encounter as part of their experience of learning and designing AI. The learning has to be inextricably linked to the presence of difficulties to be overcome in order to make progress in AI. From this, the needed social epistemology will come into being.

Implementation

"The Thoughtful Programmer, A Thoughtful Citizen" is not an educational model that will emerge on its own. It will take university leaders to set the agenda and create the institutional structures for its implementation.

This will not be easy; no matter how necessary it is, for it calls for a shift in teaching practices, most significantly in and of philosophy. In addition, in all probability it will demand a different kind of philosopher to the one we generally have. We need philosophers who understand that philosophical problems arise out of felt difficulties in real social, scientific, and technological practice and who are prepared to work in those contexts to find solutions to these problems. We require philosophers who are literally willing to move to where the problems are and not isolate themselves in a separate text-bound and historical discipline. Clearly, this is the philosopher who will be at home in both the AI and philosophy communities.

"Interdisciplinary" is obviously the buzzword, but "disciplinary border-crosser" is probably better as it signals a "dual citizenship". There are many successful models of this approach in other branches of science (medical ethicists who are doctors, physicists who are philosophers of science, economists who are political philosophers etc.). Some philosophers call this "integrative pluralism" (Mitchell 2009).

In the process of implementing this educational agenda and bringing philosophy and AI closer together, there will be many disciplinary path-dependencies that will have to be disrupted. At the end of the day, this simply calls for a spirit of intellectual openness and cooperation. Admittedly, this is hard to establish given the incentives of our highly specialized division labour in modern academia. However, we do have at least recourse to one means, which is the rational appeal. In the words that Nick Bostrom (2016, p. 319) closes his book with: "Will the best in human nature please stand up."

All things considered, the ideal of "The Thoughtful Programmer" is, I believe, the educational and programmatic substance of the widely flaunted concept of "digital sovereignty". A nation that has thoughtful programmers will have such sovereignty. These future AI programmers will help to maintain our human sovereignty over the technology by keeping in view the very foundational values of a healthy and functioning liberal democracy: human moral autonomy combined with a mature and reflective responsibility.*

Comments

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PODCAST

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SYNERGIE #06
Shaping the Digital Turn

Liebe Leserinnen und Leser,
die sechste Ausgabe von Synergie, Fachmagazin für Digitalisierung in der Lehre, erscheint im September 2018 im Rahmen der Themenwoche „Shaping the Digital Turn“ (21. bis 28. September 2018 in Berlin). Gemeinsam mit dem HFD ausgewählte Autorinnen und Autoren ergänzen mit vielfältigen Fachbeiträgen zur Hochschulbildung die Veranstaltung im Fachmagazin.

Die Ausgabe wird ab dem **21. September 2018** für Sie auf den verschiedenen Veranstaltungen der Themenwoche und darüber hinaus bei der Gemeinschaftskonferenz von Campus Innovation und Konferenztag Jahrestagung Universitätskolleg am 22. und 23. November 2018 ausliegen.

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