THE IMPORTANCE OF A FREE, OPEN, ONLINE TECHNOLOGY IMPACT CYCLE TOOL

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Abstract

In a world where technology is playing an increasingly dominant role, it is crucial that we teach our students to think about the impact of technology. After all, we train our students for leading positions in business and government. In those positions they will have to make decisions about the design, use, or application of technology. That is why it is crucial for them to understand the issues that determine the impact of technology.

Technology in our world is also becoming more and more intimate and intensive. We can do more and more with technology, so our decisions about the use of technology are also becoming increasingly important. **We strongly believe that the use, application and design of technology is the practice of ethics, but with different means.**

At Fontys University, we conducted two years of research into concrete tooling that could help with this. The result is the **Technology Impact Cycle Tool (TICT).** A free, open, online tool to help estimate the impact of a particular technology.

The Technology Impact Cycle Tool was created by a multidisciplinary team and was launched in January 2021. The tool, which is already used by thousands of students, consists of crash courses and smart scans in ten different categories that together provide a complete picture of the impact of a technology.

The tool is suitable for anyone designing, programming, considering whether to use or deciding on a technology. The tool is for techies and non-techies. The tool is not normative, but designed to make people think.

And best of all, the tool is open, online, free and available to everyone at **www.tict.io**

1 Introduction

Since 2016, we have become really serious about teaching digital ethics at Fontys University of Applied Science. During those lessons we learned our students to think about the impact of technology. In the beginning, the lessons were mainly interesting for programmers, designers and other techies, but we soon noticed that more and more students were doing projects in which they looked for technological solutions for a better society. This involved students of journalism, health care, business economics, agriculture, real estate, pedagogy and so on.

At the same time, we noticed that there was a strong need for concrete tools that could contribute to better and more structured thinking about the impact of technology.

These two reasons (everyone must be able to think about the impact of technology and the need for concrete tools) made us decide at the beginning of 2019 to start a research project into a concrete tool that could be used by thousands of students from all fields of study.

We launched this Technology Impact Cycle Tool in January 2021. In this paper we discuss this tool.

First, we will explain why it is so important to be able to think carefully about the impact of technology (section 2). Then we discuss the creation, features, use and experiences with the tool (3) and we conclude with the community that built the tool and our plans for the future (4).

2 Why we need to think harder on the impact of technology

As teachers in ICT and Media Design at Fontys University of Applied Sciences we know but all too well what many of our students want. They are part of a makers community. Most of them just want to build cool stuff with whatever (new) technology may be relevant. Our students are by grosso modo millennials or even post-millennials: a synthetic generation for whom the concept of digital 'transformation' is alien (van Doorn, Duivestein, & Pepping, 2019). So most of our students are digitals natives: they use ICT as a tool to make a positive impact on society. **But does that mean they use their (ICT) skills to build the right things?** Or more specifically: do they automatically build things in a right manner? We don't think so and we will share our reflective thoughts about this later on in this section.

2.1 The impact of technology on humans from a philosophical viewpoint

As more and more engineers who leave Silicon Valley hit the news because of their tech regrets, the impact of technology on society can no longer be ignored. The influence can be positive (utopian) as well as negative (dystopian). But, to really get a grip on this, we have to understand where the relationship between people and technology started and where we are today:

In times of upcoming industrialization, Karl Jaspers (1883–1969) was one of the first philosophers who had to deal with upcoming technologies. To support this industrial system, people had to perform with the help of technology which, according to Jaspers, alienated them from their natural human environment. Jaspers statement at that time was that technology is neutral, but in current times, this statement might not be tenable (Verbeek, 2000, p. 47).

German philosopher Martin Heidegger (1889–1976) opposes the image of technology as a neutral means. Heidegger calls that image "instrumental". He agrees with the analysis of technology as instrumental, but says that we need to look deeper: he investigated technology more as a social and cultural phenomenon. Heidegger's theory can be defined as determinism: he sees technology as an unstoppable force of nature.

Heidegger's determinism has the pitfall of getting stuck in extreme utopian or dystopian scenarios from which passivity arises. Just as with Jaspers' theory this one can be helpful, but it might not be helpful enough when answering the more complex questions of our era.

Current philosophers of technology like Peter-Paul Verbeek (1970-present) and Don Ihde (1934-present) stress the importance to look at the intertwined relationship between humans and things. As things are shaping the user and vice versa, we should focus more on the embodied relationships. Ihde states that both people and technology are constantly changing in interaction with each other. Technologies are multistable: the same artefact can have different meanings or identities in different contexts (Verbeek & Jong, de, 2017).

Leaning on the work of Ihde Verbeek describes multiple ways in which technology, people and the world mediate (Verbeek 2000, p. 141–44). He calls this the theory of technological mediation: its central idea is that technologies, when they are used, help us to shape the relations between human beings and the world. Rather than approaching technologies as material objects opposed to human subjects, or as mere extensions of human beings, he sees them as mediators of human-world relations.

2.2 A common misunderstanding: technology is only for techies.

Judging by the name 'philosophy of technology' you might be fooled that thinking about the influence of technology on our human world is something for techies or tech-nerds only. But, as technology is influencing our lives in many ways (for instance: who does not have an internet connected, data collecting mobile phone nowadays?) more and more people are involved in this kind of mediations (with or without knowing about it, see the student case example above).

Engineers are involved because they are creators, but non-technical persons are involved as well because they can be users or decision makers for others, politicians are involved because they make the rules in which technological companies can operate and journalist should be involved because they can function as smart thorns in our digital world by asking critical questions.

But there is a difference. "One of the main differences between science and engineering is that engineering is not just about better understanding the world but also about changing it. Many engineers believe that such change improves, or at least should improve, the world. In this sense engineering is an inherently morally motivated activity" (van de Poel & Royakkers, 2011).

2.3 Translating theory into action

Back to our students. What does all of the above mean in a practical sense? In our opinion it is crucial to let students (and others!) be aware of the possible (un)intended social (side) effects their design choices might have. Therefore a lot of questions have to be asked (about stakeholders, human values, impact on society, data, fairness, privacy, transparency, sustainability, and so on).

In our opinion, the implementation of technology into our society, in what form whatsoever, can no longer be done without taking any form of responsibility and without questioning the choices we make.

Verbeek's mediation theory can help us to think critically about the entangled relationship we have with technology. His theory is important, because if we keep on discussing things from an utopian or dystopian perspective it will not get us any further. His theory sketches a field in which people and technology both appear as actors — intimately connected — sometimes even without distinction, but both with their own dynamics. From this viewpoint technology can no longer be seen as neutral or passive: it does something to the world just as we do something to technology. There is continuous interaction and it is not entirely predictable in which direction these interactions will take us.

Technology has not only made decision-making more difficult but also more complex. The difficulty to predict interactions requires designers that take their responsibility during all stages in the design process and who can arrange their designs in such a way that policymakers, citizens, media, politicians (especially at municipal level) or even other engineers or designers can easily understand the choices made and intervene when necessary.

There are so many processes that we do not have grip upon, that we might have to accept that we will never be able to control everything. But we have to keep on trying. And we must come to action.
But, based on what should we go on? What should be our guiding lights? Here are our suggestions:

Technology should be multidisciplinary. Thinking about the impact of technology is important for both tech and non-tech students as well as for professionals. Multidisciplinary teams with different backgrounds should be encouraged, because the people you make your products for might be diverse and possibly not represented by your team elsewise. Discussions from different viewpoints should be encouraged and if you disagree on things, it might just be an indication to dive deeper.

Ethics as a driving force for innovation. An important thing we should avoid is to use ethics as a criterium for what not to make or what not to do. The case should be how to make or do things in a better sense. So, the question we have to ask here is not: "Are we pro or contra"? but "How are we going to design or redesign human-technology interactions in favor of our well-being?"

Non-normative. Peter-Paul Verbeek argues not to judge but to guide technological development. We can add here that our role as a university is not to decide what our students should think or what the moral just answer should be to an ethical dilemma, but to let our students make up their own minds. The questions we ask should therefore be non-normative: there may not be such thing as an absolute wrong or right, there are just a lot of options and choices to make.

Part of the (design cycle) process. Consciousness and discussion are important factors: recognizing human values, wondering whether your values are central or at stake. And, as most design and development processes are cycles, asking questions should be a part of each stadium of the process. So, we have to apply ethics "from the inside out", and not "from the outside in" or only at the end, as is often the case in ethical discussions (Lancee, Prüst, & Kamp, yet to be published).

Context is king. There are no 'one size fits all' solutions here, as every case has a different context. From the vision of Mediation Theory ethics should not be limited to whether or not a technology is acceptable (a yes/no question), but should be concerned with how a new technology could get a place in society and how that affects our human values, considering the impact of this specific technology within its applied context.

So, to avoid possible future tech regrets we should ask ourselves a lot of questions and start discussions in each stage of the design process (called ethics from within). Doing so we can design, invent or use technology with positive impact on society!

The most important thing to realize these ambitions is a concrete tool that helps with this. The Technology Impact Cycle Tool.

3 The Technology Impact Cycle Toolkit

In this section we present the creation (design proces), features and evidence based use and results of the technology impact cycle toolkit.

3.1 Creation process

The education team involved in developing and implementing the educational innovation which is aimed at the impact of technology started had two important goals:

1. A widely supported realization that in education it is of great importance to get all students from all study programs, the teachers and the surrounding professional field to think better about the impact of technology;
2. A concrete, free, open, online toolkit (www.tict.io) that can be used in all kinds of ways, and by thousands of students, to think in a concrete way about the impact of technology.

For point 1, the education team has developed and deployed a range of products that boost the importance of thinking about the impact of technology. Think of publications, essays, events guest lectures, inspiration workshops, teaching materials, teacher workshops and well-attended master classes for the professional field. All these products are openly accessible where possible and suitable for the widest possible target group.

During all our communication with students, teachers, researchers and the professional field it became clear that there was a need for a **concrete tool** to think about the impact of technology. A number of starting points also emerged from the many conversations. We already listed some of these in the previous section.

A tool should be:

• Multidisciplinary (for tech and non-tech students and professionals);
• Not normative (the tool does not provide answers, but asks questions);
• Open (for everyone to use, online);
• Usable in a design (cycle) process;
• Context sensitive.
• And above all fun and inviting.

This has inspired us to realize the heart of educational innovation, namely a concrete, free, open online toolkit, the features of which we describe in section 3.2.

Design-based research. The ambition of our educational initiative is to provide students, teachers, professional field and other interested parties with the means to think better, more fun and more structured about the impact of technology. We have strived for this through various research processes,

always starting from research-by-trying. From the first moment, prototypes of teaching materials & tools have been built, which have been adapted step by step based on input from the various stakeholders.

Literature research was also carried out and existing tools and frameworks looked at. Where existing tools and frameworks often look at one aspect of the impact of technology (ethics or privacy) or one type of technology (data or AI), the strength of our toolkit is that it helps to look at the total impact of each technology on an accessible way.

A graduate of Applied Psychology also conducted research into the effectiveness of the tool and how it is perceived by students and teachers. The tool has been adapted based on that information and the student has graduated from it.

Finally, the tool was launched in January 2021. We continually collect feedback and will adapt the tool accordingly.

3.2 Features

The technology impact cycle tool can be found and used at **www.tict.io**

Figure 3. Short introduction TICT

The technology impact cycle tool consists of five major components.

Smart scans. The heart of the tool is formed by the questions that are asked to determine the impact of technology. Because we think it is very important that students learn to look at the total impact of technology, the questions are divided into 10 categories. We have linked a specialist from the education team (the ambassador) to each category, who keeps the material up-to-date. keeps improving and is the point of contact for anyone with questions and comments. The challenge was to formulate the questions in such a way that they are relevant to as many users as possible and not normative. This has been tested by constantly testing them, collecting and adjusting feedback and, together with students, the professional field, teachers and lecturers, by further refining the questions (a process that is never finished).

To make the tool accessible, it also offers the option of answering only one question per category (Quick Scan) or answering the questions that concern the improvement of a particular technology (Improvement Scan). Reports can be printed after completion. Progress can be saved, shared and collaborated on.

Open, free, online courses. The second important component is the open, online courses that are offered in each of the 10 categories. To be able to think carefully about the impact of technology, you need to be inspired and have the means to think carefully. These are offered in ten open courses of exactly 1 hour. These courses have been developed in teaching situations, in master classes with the professional field and together with the team of teachers.

Best practices. The third component is the best practices. We have built the tool so that it can be used in any kind of education and in any way. From briefly, fragmentary, to complete and extensive. We do think there are a number of ways in which the tool works best. We have drawn up best practices for this. These are divided into specific roles that users can assume (such as The Designer, The Teacher and The Critic). All best practices come from our practice and range from a teacher who organizes a one-hour workshop as awareness to a designer who improves his product by using the tool for six months, to a journalist who wants to write a critical article.

Additional teaching material. The fourth component is extra teaching material. The TICT offers inspiration material, exercises and links to other frameworks and publications. The tool also offers a number of completed cycles (such as that of a mourning robot) for inspiration and as an example. This also makes it a real gathering place for anyone who wants help to think about the future of technology. Or for anyone who likes it!

Community building. As the fifth important component, the tool facilitates a community. All users can make their own answers (in the TICT we call them cycles) available to the community, so that users can inspire each other and you can respond to each other's analysis.

3.3   Use

Below we give an idea of the impact of the TICT on the basis of a number of concrete practical examples:

First, the tool has been used in the Netherlands in the discussion about the effectiveness of the corona contact tracing app. The versatility of the tool provided a complete picture, which contributed greatly to the quality of the discussion. Second, the tool is already widely used by thousands of students within Fontys University of Applied Science in diverse ways.

For example: EdTech minor students use the tool to improve their EdTech solution. Movement designers from the Sports College use the toolkit for the same applications as above, but in their own field. Smart Mobile students quickly test their intended apps with a Quick Scan, so that they make the choices with the most impact from the start. Marketing Management students use the courses offered to gain a general impression of the impact of technology. They take the exam using the tool. The new Master DTE will use the tool as a quality tool for the "solutions to be delivered. Journalism students use the toolkit to ask or prepare critical questions. And these are just a few examples.

We haven't widely promoted the tool yet, but we already see more than a thousand users using the toolkit to assess their technology. And that with all kinds of education!

It is a conscious choice to offer the toolkit openly and for free. Because everyone has unlimited use of everything, the toolkit can have more impact, even in surprising places that are unknown to us.

3.4   First Evaluation & Future plans

The Technology Impact Cycle Tool is intensively used in education. At Fontys University of Applied Sciences we are already seeing the first results. They are listed below:

- Graduate students from the school of ICT substantiate their graduation work with a technology impact document. This document is a product of the tool and gives the student the opportunity to show that he has thought in a thorough way about the impact of his solution;
- Teachers from the school of Engineering created their own best practices (with different cycles) which helps students to create more (positive) impactful technologies;
- Journalism students indicate that they are much better able to interview policymakers, supported by the tool. Articles have become demonstrably better;

We have deliberately designed the Technology Impact Cycle Tool in such a way that it can be used in all kinds of ways and by all kinds of people. The tool can be used to perform a one-off quick scan or to carefully compile a technology impact document for six months. The tool can be used as a basis for a comprehensive course on the ethics of technology or as optional material to deepen your knowledge. The tool can be used by students from all kinds of different courses within Fontys, but also by professionals, policymakers, IT staff, managers and all other interested parties.

That is why we believe that one of the most important indicators is usage at the moment. How many people assess technology with our tool? How many people do the crash courses? The more people are working on this, the greater the chance of impact.

After the summer of 2021 we will start a large evaluation (based on a scholarship) in which we will structurally research the best ways to use the tool from an impact perspective.

4   Community

The names and role descriptions of all persons involved form are proof of the multidisciplinary nature of the teaching team.

All contact details can be found at: https://www.tict.io/contact

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6 Author biographies

Rens van der Vorst (1971) is Head of IT Innovation & Technophilosopher at Fontys University of Applied Science. He teaches, writes, and does research. Does technology make our lives better? And, what is exactly meant by better? Can we combine humor and technology and still communicate our important message?

Rens is author of "Waarom je altijd wilt winnen van je navigatiesysteem (2020)" a book with the 100 most important technological questions of today. Rens also wrote Smartphones are the New Smoking (Appen is het Nieuwe Roken in 2017) and writes columns for bron.fontys.nl / emerce / cio.nl and other outlets. He gives a lot of talks on our relationship with technology. These talks are funny, confronting and interactive and for everyone.

Rens is leading a research - project into a free online tool that helps people think about the impact of technology (www.tict.io). He is also owner of www.quantifiedstudent.nl. A project to create a RunKeeper App for studying.

Rens lives in Breda (The Netherlands) with his beautifull wife and kids, is great at squash and has a NAC Breda season ticket.

Jo-An Kamp is Lecturer, researcher and coordinator at Fontys University of Applied Sciences. She coaches ICT students in the fields of UX, research, (interactive) media, communication, (interaction) design, ethics and innovation.

She does research on the impact of technology on humans and society. Jo-An lives in Vught, The Netherlands.