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The Future Is Ours. How Dutch People Think about Technology and the Future

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Abstract

Experts play an important role in foresight. However, their expertise can also limit their view on potential new developments and thereby reduce the predictive as well as the explorative quality of foresight. This is why involving citizens or laypeople is potentially a welcome addition when studying the future. In this paper, we present the results of a study in the Netherlands about how Dutch citizens think about the future in general, and about the future course of specific technologies in particular. The survey shows that Dutch citizens tend to display a form of social pessimism for the long-term future, although they are optimistic about their own futures. In terms of technology outlooks, people are optimistic about the development and impact of technology on society as well as on their personal lives in general terms, although they are anxious about specific developments in the fields of robotics, digitization, biotechnology and energy technology. The paper argues that taking the opinions of a broad group of citizens in the development of technology and policies related to technology is key to a better future for all.

Keywords: Expert, Foresight, the Netherlands, Laymen, Technology

Introduction

The opinions, hopes, and expectations of experts provide a popular and major input to studies of the future. People who specialize in certain areas are expected to hold relevant and innovative views about how those areas are likely to develop in the future. In the case of studies about the future, a subject characterized by high levels of uncertainty, expert opinions are often pooled, to create future projections that can be translated to policy. If experts have the power to influence decision-makers, the role of experts in thinking about and shaping the future is rather difficult to overestimate. Most research tools used in foresight studies, for example the Delphi

method, have been designed specifically to (anonymously) tap the knowledge of experts and arrive at a well-informed consensus or dissensus about the (possible) future course of a particular topic (Linstone et al., 1975; Okoli & Pawlowski, 2004). Although expert-focuses methodology such as the Delphi method are considered to be serious and well-functioning methods, their outcomes have been often disputed (Powell, 2003; Woudenberg, 1991), with critics raising the broader question whether and to what extent experts can be considered a viable and reliable source of information in a foresight study. In addition, they pose the question whether only experts should be consulted, pointing out, for instance, that expert pools lack diversity in opinions, are prone to be affected by group-think, miss wild cards, and do not have an interdisciplinary character, the overall conclusion being that by only consulting acknowledged experts, we run the risk of overlooking many voices.

In response to these criticisms, in researching the future of technology and its impact on Dutch society, we decided to adopt a different approach. Since our democratic society requires as many citizens as possible to be involved in decisions concerning concern our common future, we propose a method that actively involves citizens in thinking about the future and present the results of a survey that was inspired by the notion that politicians need to politicize technology development and involve the opinions of citizens in that process. Relevant questions include: How fast will technological developments go? Should we be optimistic or pessimistic about the future? Which technologies may impact our daily lives? How will we live in the future?

We conducted a survey among over 1000 Dutch citizens and asked them to comment on the future of technology and its possible social consequences in the Netherlands. The research sample was based on a population that aimed to be representative of the Dutch demographics on the basis of different characteristics, and in particular age, gender, political preference, education, religion and region. In this paper, we discuss the results and analysis of this survey, after addressing some remarks on the use of experts in a literature review involving the role of experts and laymen in foresight studies, and discussing the methods used in our research set-up.

The Expert and the Layman

Recently, Tetlock and Gardner (2016) have demonstrated that people with a specific expertise are outperformed in forecasting by people who are less specialized, who have a broader interest in and knowledge of developments, and who are willing to adjust their ideas in favor of updated information and new insights.

Indeed, a number of studies have emphasized that a firm's ability to move beyond contextually localized information is an important source of innovation (Heil & Enkel, 2015). As such, it is not surprisingly that futures studies are increasingly considered to be a multidisciplinary, transdisciplinary and interdisciplinary scientific area where it is vital to combine insights and developments from different perspectives, given that they provide essential input to innovation processes and policy (Van der Duin, 2006).

The decline of experts, or at least of their status, is also illustrated by many bottom-up developments and changes in society. For instance, we are witnessing the rise of civic journalism: you are no longer required to study journalism or own a large printing press to express your opinion or report on important issues on a worldwide scale. Nowadays, it is relatively easy to start your own blog on the Internet and attract a loyal crowd of readers ('followers'). In addition, in many European countries, we see an increasing number of political referendums about all kinds of issues, especially in relation to the governance of Europe, which many citizens consider to be a textbook example of a top-down project.

Overall, we see a development which we call 'citizen empowerment', by which we mean that, due to the increasing availability of information and knowledge, everybody can acquire knowledge quickly and reduce knowledge gap with experts significantly. Although it may not be possible to

bridge that gap completely, partly due to the role played by the tacit knowledge that experts build up over time, but non-experts are becoming increasingly critical and are diminishing the *status aparte* of many experts, on many issues. For instance, physicians are getting more and more questions from prepared patients about their diagnosis and more and more patients ask for a second opinion, because the information they get from their physician does not match the information they have found online. Also, lawyers and solicitors are being challenged by citizens (customers) who are critical when it comes to the supposed added value of these two professions, while, in the field of encyclopedias, non-expert volunteers continue to create, collect and manage knowledge platforms which are estimated to be on a par, or arguably even more up-to-date and elaborate, as expert encyclopedias. Nature, for example, published a peer reviewed study comparing 42 science articles from Encyclopædia Britannica and Wikipedia, and found that Wikipedia's level of accuracy approached that of Encyclopædia Britannica (Giles, 2005).

In organizations, the successful use of 'remarkable people' by energy giant Shell in its scenario building process is an example that illustrates the limitations of experts (Bradfield, Wright, Burt, Cairns, & Van Der Heijden, 2005). Remarkable people are people who 'who have some knowledge of the industry and are acute observers of the environment' (Bradfield et al., 2005, p.809). It is their lack of expertise that makes them interesting and valuable to the scenario-building process, because they have a less biased standpoint towards the business and its possible futures. Outsiders see things from a different perspective and can make the organization aware of developments of which it was unaware or which it did not consider relevant, even though they might be crucial to the growth path of the business.

However, if the input provided by experts to studies of the future is not without limitations, what other sources can we use when thinking about possible futures? Based on the trend described above and based on the trend of 'responsible innovation', which means that more value is assigned to the input of societal and human values in technology development (Von Schomberg, 2013), we directed our attention toward citizens. After all, our democratic society requires as many citizens as possible to be involved in decisions that concern our common future, so it makes sense to ask citizens what they think about the future. Merely depending on experts for the political decision-making process would not do justice to the complex co-existence of experts and liberal democracy (Turner, 2001). In particular, in the Netherlands, we have witnessed the implementation of certain technologies that were not aligned with ethical principles and legal considerations. For instance, what do we think about the use of new technologies, like using a 3D-printer to manufacture a pistol, and why are there no laws yet that prohibit the use of drones close to airports? Or: what do we think about sharing data as a tacit payment for digital services and entertainment? Apparently, technology evolves more rapidly than other societal developments, which means that the answer to the question 'what can we do?' arrives at the scene before we have the discussion 'what do we want?'. Indeed, policy discussions are seriously lagging behind technological developments. Whereas, in the past (say, the 1950s, 1960s and 1970s), the question was if we would ever accomplish what we would like to have, nowadays, a more alarming question is being posed: do we really want to have what technology enables us to do? Moreover, Dutch politics lacks the interest and with it the vision on how to deal with these differences in societal developments. Although opinions and policies involving science and innovation are being discussed, the political debate on how to cope with new technologies (the output of science and innovation) from a societal, ethical and legal point of view is minimal.

Research Structure

To examine what Dutch citizens think about technological developments in particular and the future in general, we teamed up with GfK (www.gfk.com), a market research agency, to set up a

project called the National Future Monitor. The ambition is to conduct this survey every two years, to monitor possible changes in how Dutch citizens think about the course of the future and future technologies. We developed an online questionnaire and sent it out to 1004 respondents in June 2016. The research sample is based on a population that is representative on the basis of different characteristics of Dutch citizens, in particular age, gender, political preference, education, religion and region. The respondents provided these characteristics themselves and were all inhabitants of the Netherlands, 18 years or older and selected from a panel that is managed and maintained by GfK consisting of 85,000 Dutch citizens. The reponse rate of this panel is relatively high, at 67%, and automated software was used to screen the answers of respondents for possible deceitful or irrational behaviour (such as filling out the questionnaire without taking time to read the questions).

Table 1. *Most relevant characteristics of the sample*

Group	Number
Male	494
Female	510
Age: 18-34	266
Age: 35-49	267
Age: 50-64	259
Age: 65+	212
Education: low	317
Education: middle	436
Education: high	251
West	459
North	103
East	204
South	239
Christian	375
Other religion	23
No religion	587
Political left wing	170
Political centre-left wing	224
Political centre-right wing	282
Right wing	131
Total:	1004

We began by asking the respondents general questions about how they think about the future. Will the future be better or worse than the present? And how will technology contribute to society in the future? These questions were categorized using the STEEP-framework: divided into Society, Technology and Science, Economy, Ecology and Politics (Bradfield et al., 2005).

Results

The Future in General

For most Dutch people, thinking about the future is not a daily activity. This research shows that only one in seven respondents think about the long-term future (more than twenty years ahead) on a regular basis. What is noteworthy is that these people are generally speaking more optimistic about the future, as well as about the impact of technology on their lives. More than half of the respondents hardly think about the long-term future. Nevertheless, the survey shows that people are well-suited to answer questions about the long-term future and to outline future scenarios and emerging ethical dilemmas.

More people are pessimistic (42%) than optimistic (16%) about the future of the Dutch society. The same applies to the future of our environment (39% negative and 27% positive) and politics (29% negative and 16% positive). It is interesting to see that the response category 'neutral' scores high in all domains, especially in economics and politics. Maybe the expected benefits and disadvantages are perceived to be equal here, but perhaps this indicates the inherent uncertainty of questions about the future.

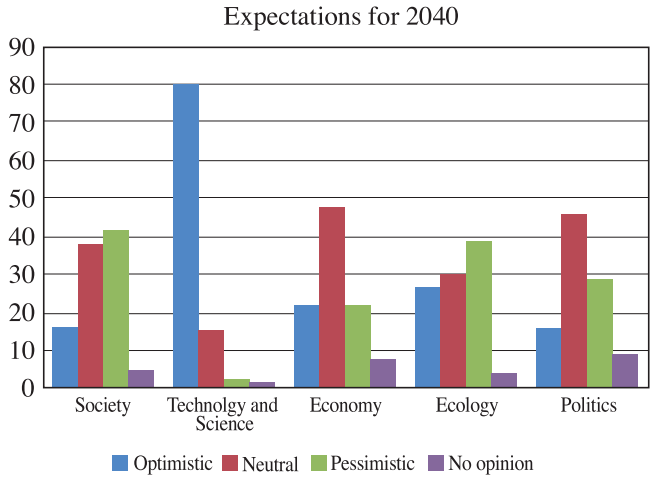

Figure 1. STEEP-expectations for 2040

With regard to geopolitical relations and conflicts, the respondents tended to be pessimistic about the future: only 8% expect there to be less turmoil and conflict in the future, while 62% expect that things will be worse. The open answers show that the increase of drones, robots and automated warfare contributed to this negative perception.

Against these predominantly pessimistic visions of the future, people are optimistic with regards to technology. More than 80% of the respondents expect science and technology to make great strides forward over the next 25 years, and 46% of them expect technology in particular to have a positive impact on society. Among the respondents who regularly think about the long-term future, optimism about technology is higher (58%). Of those who are optimistic about the future in general, this is even 70%. When asked about the impact of technology on their lives, we see similar figures: 42% think that technology will have a positive impact, while 7% expect it to have a negative impact. A higher percentage of optimism is found among people who are professionally involved in technology (61%) and people who regularly think about the long-term future (64%).

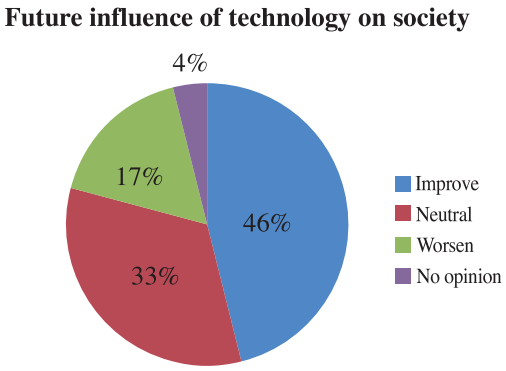

Figure 2. Opinions on the future influence of technology on society

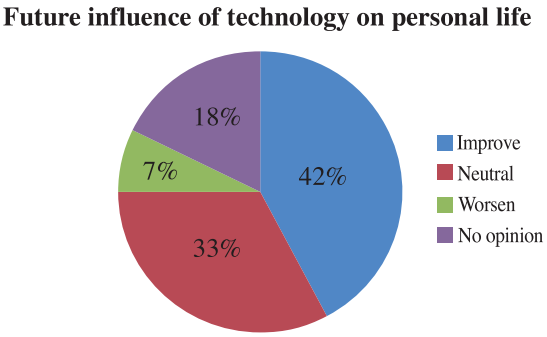

Figure 3. Opinions on the future influence of technology on personal life

By asking open-ended questions, we examine this optimism more closely. One of the respondents summed it up by saying that the future is "faster, better, cheaper, and more sustainable". Many of the optimists expect technological developments to lead to an increase in wealth in a scenario that someone called "omnipresent abundance", while some cherish the hope that technological development will lead to unlimited access to (and perhaps free) energy, as well as a reduction in food shortages and poverty. This reasoning applies to prosperity for the respondents themselves, but is also paired with hope of a better distribution of wealth in the Netherlands and in the world. In addition to material prosperity, some optimists also expect greater non-material well-being. "We will be disconnected from earnings or possession in the future," one respondent wrote. Others wrote that a happier life can be obtained by "uploading the soul" or "living our dreams in virtual worlds."

When we asked about the major positive changes that are expected in 2040 as a result of technological developments, the solutions to medical problems were mentioned most often. Many respondents hope that technology will eradicate diseases like Alzheimer, cancer and diabetes, as well as provide new types of treatments, like "medical interventions that do not impact the body," "artificial kidneys and other artificial organs" or "personalized medication". In addition, they expect technology to be able to lead to a better knowledge base and a smarter society. Many existing jobs, in particular heavy, routine or boring jobs, are expected to become superfluous, and "the five-day working week can be abolished!"

Table 2. *hopes and fears for the future of technology*

Hopes	Fears
1. Medical breakthroughs	1. Technological unemployment
2. Sustainability	2. Deterioriation environment
3. Less (tough) work, more leisure time	3. Weakening of social fabric
4. Economic growth	4. Increase of wars and conflicts
5. Better communication	5. Privacy violations
6. Faster and better transport	6. Widening gap poor-rich
7. A smarter society	7. Technology superior to humans

Techno-Pessimism

One in every six of the respondents fear that technological change may lead to a future in which they are worse off than they are now. Unemployment, due to automation, is mentioned most often, both in the personal and social sphere: what is the place of people in the job market in a technology-driven future? Several participants mention the need to establish a new economic model, such as a basic income. In the social sphere, the reduction of human contact is seen as a big problem. Respondents fear this will increase and which is already being felt: "Look what the smart phone did to human contact; in trains or buses, where you could have conversations with strangers ten years ago, now everyone turns away in their own world, which creates more distance between people".

One respondent referred to this as the arrival of the "stand-alone society", in which technology may provide more independence, but also erodes community spirit and solidarity. Another concern, which is characteristic of our information society, is the fear of privacy violations. It is feared that personal information, for instance medical or financial information, will not be safe in the future. The answers to the open-ended questions reveal a distrust of information-gathering parties, such as technology companies and governments. In a broader sense, there is a fear that people will lose control over their own lives. Respondents expressed the fear that they 'will be lived' in the future, implying a breakdown of personal choice and autonomy. As one of them stated, "systems will think for you, all automatically, even without pressing a button." Some suggest that technology will take over more human tasks, with the fear that there is little or nothing we humans do better than machines. As a result, the future role of people in society is unclear and some even fear that "we will be ruled by technology." Others downplay the role of technology and wonder if we should be so concerned about it: "nice stuff, all those gadgets, but not necessary at all for having a happy life."

The Future of Specific Technologies

The next part of the questionnaire focused on four technological themes: robotics, digitization, biotechnology and sustainability. For each category, we asked the respondents how fast they believed technological developments might go, how plausible and desirable certain technological applications are, and to what extent these technologies could improve the personal lives of the respondents and of society in general. To close the questionnaire we built a technology calendar by presenting the respondents with specific images of the future (technologies in particular) and asked them when they expected certain technologies to be implemented and how they evaluated those technologies. The monitor's time horizon is the long-term future, although we choose the year 2040 as a marker for various questions since it is far enough to give people sufficient room to think outside current constraints, and at the same time it is sufficiently near to allow them to think about it at all.

Robotics

The survey shows that the Dutch are predominantly optimistic about the social impact robotics will have in the next 25 years. 43% thinks that robotics will improve society, as opposed to 25% who believes it will have a negative effect. Among men and more highly educated people, the level of optimism is even higher, around 50%. People are especially positive about the use of robots in the care domain (51% positive against 26% negative). A large group (47%) is in favor of medical operations being conducted independently by robots, although there appear to be limits as well. Most people (63%) are negative about robots making decisions about human lives, for instance in legal cases or (rescue) operations. An even larger majority (74%) is against the idea that robots will look after their children or parents in the future, while 81% are less than happy about the idea that we could have intimate relationships with robots in the future. In fact, none of the respondents over 65 has a positive response to the idea.

Table 3. *Opinions on the future of robotizations*

Future scenario	Positive	Neutral	Negative
Robots making decisions about human lives.	14%	23%	63%
Medical operation by an independently operating robot.	47%	25%	27%
Robots taking over administrative tasks at the office.	33%	27%	40%
A robot looking after your children or parents.	8%	18%	74%
An intimate relationship with a robot.	4%	15%	81%

Different age groups respond significantly differently when asked about the effect robotics will have on the labor market. Most people give a negative response, in particular the middle-aged respondents (35-64).

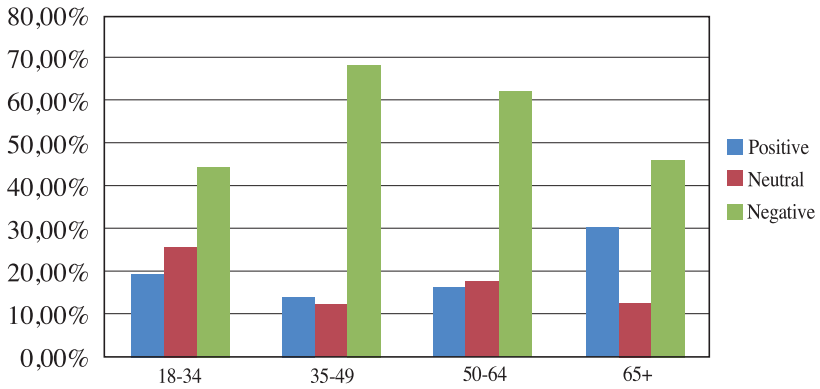

Figure 4. Influence of robotics on the labor market

However, the answers to the open-ended questions show that the respondents also see the economic benefits of robotics. According to one of the respondents, robotics improves "the quality, production and continuity of companies". Others argue that robots do not call in sick, always do what they are told, are consistent and, in addition, can save a lot of money. According to some, robotics also contributes to the environment, for instance "because more production will take place at home (by robots) as opposed to low-wage countries (by people)".

On the other hand, the fact that robots are becoming ever smarter is seen as a threat, either as a physical threat, in that they may actually be able to fight people, or because they take over too many human activities. “People will start feeling useless and become depressed. Eventually, people will feel like machines, and machines will feel like people”. The dependence on robots and the reduction in human contact, because robots will become more and more important in our lives, are seen as cause for concern. According to one of the respondents: “In 2040, I will be very old; a robot will bring the groceries to my door, a robot will cook for me, a robot throws me from my lounge chair onto my dining chair and a robot talks to me when I want to talk to another human being”.

Digitization

In the last 50 years, the digital domain has grown immensely, and that is certainly true in the Netherlands; according to the Central Bureau for Statistics, only 6% of Dutch households have no access to the Internet (2016). Closely related to the rise of the Internet is a technological development that we call digitization: the process whereby physical things, like text, sound of images, are converted to electronic information. In this monitor, the concept of digitization refers above all to the increasingly influence of computers and the use of digital systems, which allow information to be shared more quickly and easily, but which also affect the way we interact.

This study shows that more Dutch people are positive than negative when it comes to the future consequences of digitization in their own lives, although there are significant variations between the various subgroups. For instance, while about 50% of more highly educated people are positive about the consequences of digitization in their own lives, only 29% of less highly educated people share that sentiment. In the age group 18-34, 46% is positive, as opposed to only 31% of people over 65.

On the plus side, people expect administrative tasks to be easier and they expect to have access to information all the time and everywhere. There will be more transparency, which is “a good thing, provided our privacy is safeguarded, because the government and business do not to know everything”. The access, or open data development, saves time, increases transparency and has a positive impact on democratic processes. On a personal level, one of the respondents states: “I don’t know how the world will improve, but I do owe my life to an electronic patient system....”. Several respondents indicate that we have more insight into the world and our own actions, which contributes to a smarter society. Other positive qualities that are assigned to digitization are speed, user-friendliness, efficiency and cost-saving. However, the answers also reveal a certain paradox: on the one hand, people say that technology helps create a world that is easier and simpler, but on the other hand they indicate that the technology-driven society is harder and harder to understand.

What is also striking is that, although people are generally speaking positive about digitization, a majority has a negative response to the technological changes we outline.

Table 4. *Opinions on the future of digitization*

Future scenario	Positive	Neutral	Negative
Communication in virtual reality	27%	32%	41%
A personal digital assistant	31%	32%	36%
Smart chat bots to replace humans	11%	21%	68%
Software producing art	11%	22%	67%
Systems that predict what you want and purchase it for you	9%	25%	65%

Most people do not look forward to software that is able to create paintings, music or literature as well as humans can, to smart chat bots that replace human contact, or to predictive systems that buy new things for customers based on their shopping history. One worried respondent uses these elements to paint a critical picture of the future: "A GP in the form of an online database that refers you to the cheapest hospital or pharmacy, after which the medication is delivered quickly via a drone, while the payment is deducted automatically from your bank account without your say-so. Humans beings become subordinate to the economy and automation processes".

A decrease in personal contact and people becoming lonely as a result of digitization are frequently voiced fears; respondents indicate that human "values become blurred by digital communication". Some respondents explicitly indicate that they feel that digitization can lead to the exclusion of groups of citizens with less highly developed digital skills. Unless we help these people, the fear is that they face an uncertain future.

Biotechnology

The discovery of the DNA structure in 1953 led to a new chapter in biotechnology. A chapter that has raised many questions and does not seem to have an end. Synthetically manufactured insulin, DNA forensics, organs on demand; modern biotechnology keeps opening up new possibilities. The blueprints of plants, animals and human beings can be scrutinized and it is expected that, in the future, we can adjust and use them, if we want to. However, in a time when biotechnology makes the impossible possible, the question is whether or not that is what we want as a society.

The survey shows that Dutch people are more positive than negative about the future consequences of biotechnology. At the same time, they find it hard to tell if it will affect their own lives and in what way. At a macro-level, they see that biotechnology especially has a positive impact on the agricultural sector, fishery, healthcare and the environment. "If we want to feed everyone, we need biotechnology", as one respondent put it. A longer and healthier life, higher quality food and resistance to certain diseases were listed as positive effects.

Table 5. *Opinions on the future of biotechnology*

Future scenario	Positive	Neutral	Negative
Pets that are genetically modified so people are no longer allergic to them.	18%	28%	53%
Organs that are no longer donated but custom-made in a lab.	63%	24%	13%
Genetic modification of your body to cure or prevent hereditary diseases.	52%	26%	22%
Modifying the DNA of unborn children to guarantee their health.	28%	29%	42%

People are relatively optimistic about the possibilities of biotechnology in the medical sector: 63% of the respondents are positive about custom-made organs, while 52% are positive about genetic modifications for health reasons. However, genetic tinkering with unborn children is considered less acceptable; only 28% are positive about that, while 42% are negative.

People fear that biotechnology will above all be used to make a profit. Some fear that large companies are insufficiently alert to the potential consequences of this technology for our health and in particular for the natural balance: "I am afraid that there are unscrupulous people behind these developments and that they fail to ask themselves whether it provides a positive contribution to mankind and, instead, only care about the money". And: "Tinkering with nature is extremely

dangerous. Nobody knows what the unwanted side-effects can be. In addition, it provides a false solution to the problem of overpopulation: it's prosperity at the expense of well-being".

One of the fears is that biotechnology will go too far and create "less versatile food", the "soil is exhausted", "breeding practices will overshoot the mark", "diseases will emerge" and "well-being comes under threat". Furthermore, it is indicated that nature should be left alone and we should not try to be or play God. When we cross-reference the answers in this section with people's religious convictions, we see a variety of results.

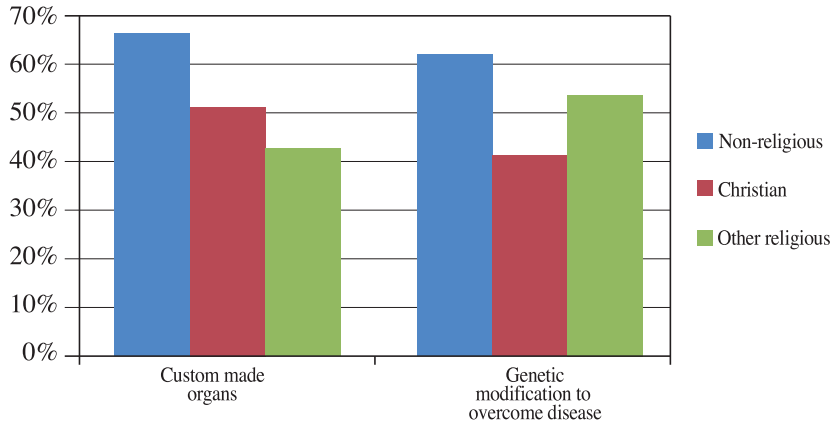

Figure 5. Positive attitude towards biotechnology

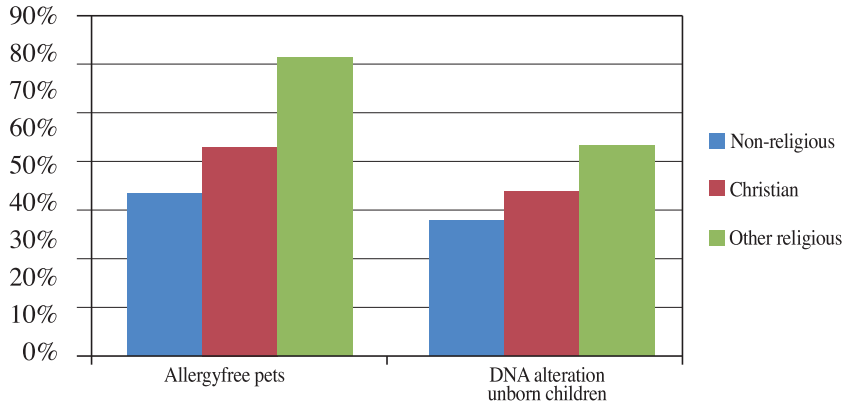

Figure 6. Negative attitude towards biotechnology

Sustainable Technologies

In the past year, the state of The Netherlands was taken to court several times to enforce sustainability; an organization called Environmental Defense (Milieudefensie), for instance, demanded that the air quality would be improved, while another citizen group, called Urgenda, was successful in getting the courts to order the state to better counter climate change. The question here is what role technology will play to accomplish a more sustainable future world?

The survey shows that sustainability through technology – like the use of solar energy, but also different ways of producing materials – encounters little resistance in the Netherlands. Men and women, young and old, highly educated or less highly educated, Dutch people embrace

sustainability as the way forward. Almost 70% of Dutch people see the advancement of technology to reach sustainability as a positive development, as opposed to 4% who expect negative effects. With regard to their own lives, people are less certain about the positive consequences; a large group (38%) expects the impact to be limited.

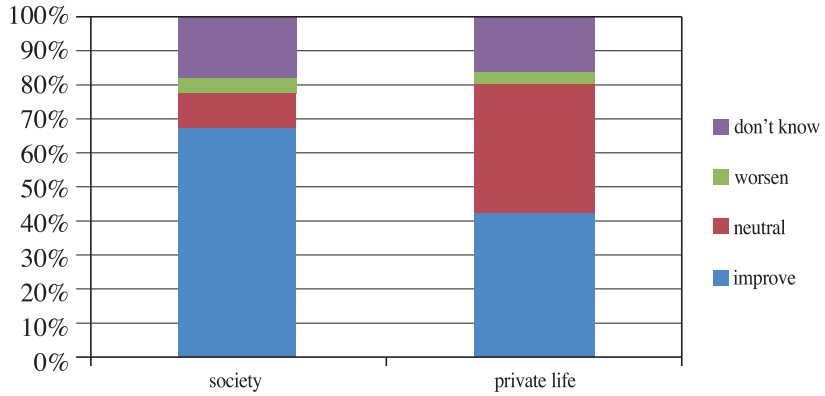

*Figure 7. I*mpact of sustainable technology on society and people's own lives

The answers to the open-ended questions show that, although the critics consider the trend towards sustainability to be positive, they believe that either it is too late ("the environment cannot be saved") or that people are so stubborn that there is no real point. Other critics argue that sustainability is little more than a buzzword with little meaning, or that it is used to make money, while "as much or more rubbish" is being produced. Some point to the gap between the rich and the poor that keeps growing because this new technology could entail considerable costs to users.

"Less pollution", "reduction of CO2 emissions", "cost reductions", "a better world": as mentioned earlier, a majority of Dutch people sees above all the positive influence of sustainable technology, although there are gradations, and there are two groups in particular who are positive about sustainability: people who vote 'left' and people who are highly educated. The question how people feels about a government ban on cars that run on fossil fuels illustrates this with a clear trend: the more to the left respondents are, the less negative they are.

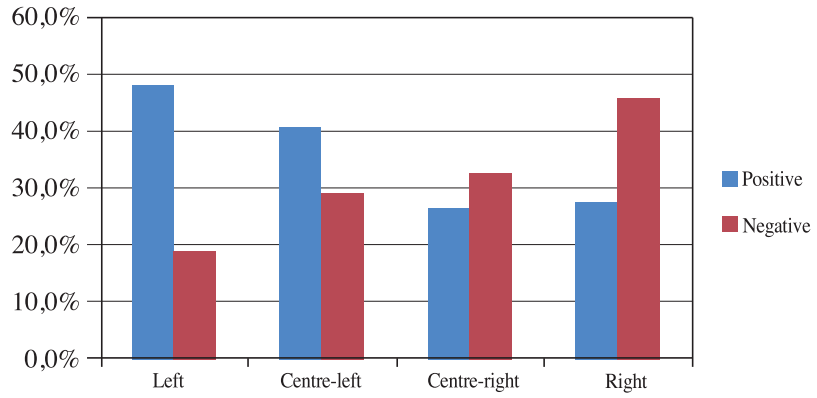

Figure 8. Political stance towards 'Government ban on personal vehicles on fossil fuels'

Of all Dutch people, 56% are positive about smart meters in the house to determine when to use energy, and 62% have no trouble at all replacing sockets and plugs with a new wireless standard.

Table 6. *Opinions on the future of energy*

Future scenario (n=1004)	Positive	Neutral	Negative
The use of new nuclear power plants that produce less waste than existing plants.	44%	28%	28%
Smart meters at home that determine when energy can be used.	56%	28%	16%
Wireless energy as standard for electrical appliances. Plugs and sockets become obsolete.	62%	26%	12%
A government ban on personal vehicles that run on fossil fuels.	34%	34%	32%

Perhaps it is difficult to envisage the drawbacks of the statements, or perhaps the benefits outweigh the drawbacks. But are we not worried about privacy when we think about smart meters? And does everyone have access to transportation when fossil fuels are banned? These are questions that are interesting to monitor over time.

The Technology Calendar

In addition to asking our respondents what they think about the future and new technological developments, we also asked them more specific questions about when they expect certain technologies to be implemented and how desirable that is. This results in a kind of technology calendar showing different images of the future for the next decades.

If we look, for instance, to the 2040's, we see that seven out of ten Dutch people think that we will have communication technology that will enable lifelike holograms (three-dimensional projected images) of other people. Eight out of ten respondents expects we will be able to use websites like Google Maps to see when goes on in public spaces live and real-time. Two-thirds of Dutch people expect supermarkets to sell meat that was created in a lab, and as many people expect that, by that time, many of us will have electronic chip implants to monitor our health.

A smaller, albeit still substantial, group expects technology to be a lot more disruptive by 2040. For instance, about 30% think that we will colonize another planet by that time, while 25% of the respondents expect that there will be medication that virtually stops aging, and 23% expect that we will be able to teleport things (moving objects from one location to another, without physically moving the objects through space).

According to one respondent, technology will "make giant strides" and we can see this on the time scale. A majority of the public expects major technological changes before the year 2050. It is striking that, according to the respondents, not a whole lot will change in the short term. Most developments are expected between 2040 and 2050. Only our ability to influence the weather on a direct and daily basis, according to 68% of the respondents, will never materialize. Over a third of the respondents checked 'never' when asked about the colonization of other planets, food printers at home and teleportation.

We also asked people about the desirability of the various technological developments. What is striking is that, although people indicate that they expect technological changes to happen, they also indicate that most future scenarios are undesirable or even very undesirable. Most people are not interested in eternal life, care robots, lab meat in the supermarkets or food printers at home:

- 64% of the respondents are negative about a future in which software produces art as well as people do (for instance paintings, music and literature).
- 68% of the respondents considers it undesirable for the weather to be influenced by people, for instance during public holidays, using technology.

- 54% of the respondents think that selling meat in supermarkets that was created in labs has a negative influence on society.

People appear to be most positive about developments related to sustainability, like electronic cars and self-regulating homes; and they hope that self-regulating homes will be built in the foreseeable future.

Other Results

In section 2, we mentioned that our sample of respondents is based on various characteristics, such as age, gender and religion. Based on these characteristics, different groups can be distinguished who all have a different attitude towards and a different opinion about the (possible) future and about technological developments.

Over 65's:

- ... of all the respondents, this group is the most optimistic about the contribution of technology in the future.
- Although they work and study less, the over 65's are very positive about the link between technology and the labor market, education and the economy.
- An exception when it comes to optimism involves intimate relations with robots, about which none of the over 65's are optimistic.

Atheists

- ... of all the groups, atheists are the most optimistic about technological and scientific progress in the future.
- ... compared to people with a different outlook on life, they spend the least amount of time thinking about the long term.
- ... are considerably more positive than others about issues in relation to technology and the body, like genetic modification or computer chip implants.

Dutch women

- Nuanced or modest? Women check 'no opinion' more often than men.
- ... compared to men, are less optimistic about technology and its contribution to society on virtually all issues.
- ... are especially more negative about the role of robots, for instance in healthcare or administrative tasks.

Highly educated people

- ... of all the groups, highly educated people are the most optimistic about the future and about the contribution of technology to their personal lives.
- ... generally speaking are more optimistic about specific technologies, like robots in the household.
- ... are the most actively engaged in new technological developments.

Political stance: left-inclined people

- ... think about the long-term future more than other Dutch people.
- ... are in particular optimistic when it comes to issues regarding sustainability.

- ... compared to other groups, are more optimistic about self-regulating homes and self-driving or electrical cars.

Concluding Remarks

In June 2016, as we launched this monitor, the prominent futurist Alvin Toffler died. In 1965, he wrote about the term "future shock", which refers to the feeling that more and more people cannot keep up or understand the technological changes in an increasingly complex society (Toffler, 1970). Our survey shows that this phenomenon also plays out with a group of Dutch people. Some find themselves "too old to comprehend it all", while others stated that "there is so much happening" or that "technology is accelerating beyond control." On the news, we see more and more reports about cyber security, about complex systems that are shut down by unknown hackers, with even more unknown abilities. There is talk about robots taking on human tasks or even taking over jobs, and more and more people are hooked on games and virtual reality. The general feeling is that we are living in a technology-driven era. While, for some people, this is exciting, for others, it is a 'future shock' with ever-increasing intensity.

When we assess the various opinions, it would appear that technology is not distributed evenly across the population. While some see technology as something that can strengthen their position in society and will benefit them, for others, it can create new barriers and exclusion. Those who are actively involved in technological developments, according to Marina Gorbis, are also "actively and consciously shaping their own desired future" (2016). But is the future only for those who invent new technology? We think not. The debate on the future must not be confined to the tech-savvy; it is a discussion that needs to include all of us. That is why we decided to consult a large, nationally representative group of Dutch people, to give them a voice, but also to get everyone involved in a broad discussion about the future. However, this is not only a commendable goal in itself. Given the limitations of experts, as outlined out above, involving 'ordinary people' in foresight studies will increase their quality and hence their potential use in decision-making, resulting in a better future for everybody, both expert and layman.

This study is not the only Dutch study to examine how Dutch people think about the future. An important monitor in the Netherlands, the Citizens Outlook [COB] of the Social and Cultural Planning Office [SCP], also asks a large group of Dutch citizens how they think about society and the future. Our approach differs from the SCP, because we have a long-term focus and elaborate on the role of technology, but it is good to explain the study results together. The COB paints a picture of respondents who are optimistic about their own future, but pessimistic about the future of society. "I'm doing well, but we are in a bad state", as Dutch sociologist and former director Paul Schnabel calls this aptly. Remarkably, this social pessimism is not related necessarily to the situation of our country. "At the height of the recession, in the spring of 2009, two out of three Dutch people were convinced that the country was going down the drain, while hardly anyone thought it would improve. That seems logical, but at the height of the boom, in the beginning of 2008, the judgment was exactly the same" (Dekker et al., 2011).

The survey shows that this social pessimism is also projected on a time that is yet to come, the long-term future. People are more optimistic about the future of their own lives than they are about society. Moreover, our study shows that people's opinions about the future of technology and science differ strongly from their opinions about the future of other domains. They are optimistic about the development and impact of technology on society as well as on their personal lives. This techno-optimism is not just a Dutch phenomenon, it reinforces the findings of the 'Deep Shift report from the World Economic Forum (Espinel et al., 2015) and the Eurobarometer (European Commission, 2015), in which small focus groups from 16 EU Member States (including the Netherlands) were interviewed about the role of technology in the future. All focus groups were

overwhelmingly positive about technological innovations and sketched, as this report does, a future full of technology. The American Pew Research conducted a survey that produced similar results. Americans appear to be slightly more optimistic than the Dutch: "Some 59% are optimistic that upcoming technological and scientific changes will make life in the future better, while 30% think these changes will lead to a future in-which people are worse off than they are today" (Smith, 2015).

As in the United States, we seem to be living in a techno-optimistic time. For citizens, it is difficult to imagine that technology will become less important or that its usage will decline. A clear outcome of the survey is that the larger Dutch public expects a future teeming with technological change. Technologies such as holograms, smart robots and internal chips are expected to be commonplace, and respondents believe they will have major implications for the way we interact with each other and organize our society. A side note here is that people are more positive about technology in general than they are about specific instances. While the Dutch are predominantly positive about the future impact of robots, digitization and biotechnology, specific technological developments within these domains are often defined as undesirable. It is only technology that helps create a more sustainable world that is perceived to be positive on both a general and specific level. Interestingly enough, more people expect technology to contribute to a more sustainable world than to do harm (for instance through global warming). Time will tell if this trend continues and whether it is something that we will consider 'typically 2016' in the future. In addition, respondents generally relate technology to major societal challenges, such as poverty, conflict, disease and environmental problems. Care-related applications are mentioned most frequently, for example "a DNA corrector which restores organs and eliminates any pain", "a techno-buddy for the blind, frightened or disturbed behavior", as well as different types of solutions for existing diseases.

Finally, it is striking that utopian and dystopian ideas about the future are based on the same technologies: respondents think that specific technological trends, such as digitization, can either improve or deteriorate communication and social connections. Biotechnology could lead to food scarcity or an abundance of resources, and especially robots star in both utopias and dystopias. On the one hand, they can take over burdensome or boring work and provide people with more free time. On the other hand, a large group expects that robots will actually lead to unemployment, reduced human contact and isolation. With this, this survey appears to underline that it is not so much the technology that will create a better world, but the way people implement and use technology.

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